# Appendix 5
# **Air Quality**

**5.1 CEQA Air Quality, Greenhouse Gas and Health Risk Assessment Technical Report**

**5.2 Additional Information Regarding Potential Health Effects or Criteria Air Pollutant Emission Impacts**

**5.3 Air Quality, Greenhouse Gas, and Energy Analysis of the Willow Village Project Variants**

Appendix 5.1

# CEQA Air Quality, Greenhouse Gas and Health Risk Assessment Technical Report

Prepared for
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Project Number
**1690010687**

Date
**June 2022**

# CEQA AIR QUALITY, GREENHOUSE GAS AND HEALTH RISK ASSESSMENT TECHNICAL REPORT

## WILLOW VILLAGE

## MENLO PARK, CALIFORNIA

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# Acronyms and Abbreviations

| | |
|---|---|
| AB32 | Assembly Bill 32 |
| ACC | Advanced Clean Cars |
| AERMET | American Meteorological Society/Environmental Protection Agency Regulatory Model Meteorological Processor |
| AERMOD | USEPA's atmospheric dispersion modeling system |
| APCO | Air Pollution Control Officer |
| ARB | (California) Air Resources Board |
| ASF | Age Sensitivity Factor |
| BAAQMD | Bay Area Air Quality Management District |
| BMP | Best Management Practice |
| Cal/EPA | California Environmental Protection Agency |
| CalEEMod | California Emissions Estimator Model |
| CAP | Criteria Air Pollutant |
| CEQA | California Environmental Quality Act |
| $CH_4$ | methane |
| City | City of Menlo Park, California |
| CO | carbon monoxide |
| $CO_2e$ | carbon dioxide equivalents |
| cREL | chronic reference exposure level |
| CPF | Cancer Potency Factor |
| DPF | Diesel Particulate Filter |
| DPM | Diesel Particulate Matter |
| EIR | Environmental Impact Report |
| EV | electric vehicle |
| EMFAC | EMission FACtor model |
| eVMTs | Electric Vehicle Miles Traveled |
| GHG | Greenhouse Gas |
| g/trip | grams per trip |
| g/s | gram per second |
| HRA | Health Risk Assessment |
| HQ | hazard quotient |
| KPAO | Palo Alto Airport |
| KSQL | San Carlos Airport |
| kWh | kilowatt-hour |
| Lbs | pounds |
| m | meter |
| MAF | modeling adjustment factor |
| MSS | Mobile Source Strategy |
| MEISR | Maximally Exposed Individual Sensitive Receptor |
| NED | National Elevation Dataset |
| NMHC | non-methane hydrocarbon |
| $N_2O$ | nitrous oxide |
| NOx | oxides of nitrogen |
| OEHHA | Office of Environmental Health Hazard Assessment |
| OFFROAD2011 | (ARB) In-Use Off-Road Equipment model |

| | |
|---|---|
| OPR | Office of Planning and Research |
| PCE | Peninsula Clean Energy |
| PG&E | Pacific Gas & Electric |
| PHEV | plug-in hybrid vehicles |
| PM | Fine Particulate Matter |
| $PM_{2.5}$ | Fine Particulate Matter Less than 2.5 Micrometers in Aerodynamic Diameter |
| $PM_{10}$ | Particulate Matter Less than 10 Micrometers in Aerodynamic Diameter |
| Ramboll | Ramboll US Corporation |
| ROG | reactive organic gases |
| RPS | Renewables Portfolio Standard |
| SB | Senate Bill |
| SCAQMD | South Coast Air Quality Management District |
| TAC | Toxic Air Contaminant |
| TDM | Transportation Demand Management |
| TOG | total organic gases |
| tpy | tons per year |
| $\mu g/m^3$ | microgram per cubic meter |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| VMT | vehicle miles traveled |
| VOC | volatile organic compound |
| ZEV | zero-emissions vehicles |

# 1. INTRODUCTION

Ramboll US Consulting Inc. conducted an air quality and greenhouse gas (GHG) assessment for the construction and operation of the proposed mixed-use development at Willow Village in Menlo Park, California (referred to hereafter as the "Proposed Project" or "Project") for Peninsula Innovation Partners, LLC. The scope and methods used in this assessment are consistent with recommended analyses for projects requiring review under California Environmental Quality Act (CEQA). The CEQA analysis in this report addresses criteria air pollutants (CAP) and CAP precursors, GHGs, toxic air contaminants (TACs) and local air quality and health impacts associated with the Project construction and operation at off-site sensitive receptors. For informational purposes, this report also includes analysis of the health impacts associated with Project construction and operation at on-site sensitive receptors. The analysis in this report will be independently reviewed by the City of Menlo Park, California (referred to as the "City") and peer reviewed by ICF, the City's environmental consultant for possible incorporation into the Environmental Impact Report (EIR) for the Project.

This emissions and Health Risk Assessment (HRA) methodology document describes the scope and methodology for evaluation of air quality, GHG, and health impacts from Project construction and operational emissions, and cumulative impacts at on-site and adjacent off-site sensitive receptors. This document also describes the thresholds of significance that were used, which were consistent with the 2017 Bay Area Air Quality Management District (BAAQMD) CEQA Air Quality Guidelines where appropriate.

## 1.1 Project Description

### 1.1.1 Existing Conditions

The main Project site is a 59-acre plot adjacent to Willow Road between the Dumbarton Corridor and O'Brien Avenue. The Project site also includes three parcels west of Willow Road on both sides of Hamilton Avenue, referred to as the Hamilton Avenue Parcels North and South. The main Project site includes 20 existing office, commercial, industrial and warehouse buildings totalling approximately 1,000,000 square feet, along with associated parking. One emergency diesel generator is currently on-site. The area in the general vicinity of the Project consists primarily of residential, mixed-use, commercial, industrial, and educational/institutional uses. The educational/institutional buildings of Mid-Peninsula High School's campus are adjacent to the Project site to the southwest. To the west is a residential neighborhood. South of the main Project site are mixed-use commercial, industrial, and residential buildings. Though there are commercial operations in the general vicinity of the Project site, there is a lack of amenities in the site vicinity such as grocery stores, pharmacies, and public gathering spaces. **Figure 1** shows the location and boundary of the Proposed Project in Menlo Park and **Figure 2** shows sensitive receptor locations.

### 1.1.2 Proposed Project

The Proposed Project on the main Project Site would be a mixed-use development that would include up to 1,730 residential units, up to 200,000 square feet of retail uses, a 193-room hotel, up to 1,600,000 square feet of space for office and accessory uses consisting of up to 1.25 million square feet of office uses and the balance (350,000 square feet of office use is maximized) of accessory uses, a publicly accessible park, a dog park, a town square, and associated parking spaces.[1] The proposed land use summary is shown in **Table 1**. The main Project Site would consist of three planning districts: The Town Square District, the Residential/Shopping District, and the Campus District. The Town Square District would allow space for a range of activities and events from recreation to seasonal markets. The Residential/Shopping District would provide multifamily rental residences and parking, retail, grocery, and park space. The Campus District is planned to consist of office space organized around a pedestrian promenade as well as accessory space and public-serving retail amenities. The Project also would include the re-alignment of Hamilton Avenue, relocation of the existing services station and addition of retail area on the Hamilton Avenue Parcels North and South. The Project Applicant has committed to powering all buildings entirely by electricity. Natural gas may be used for commercial culinary uses only, as allowed under Menlo Park building code.

Project construction would include demolition of all existing structures (including existing buildings, parking spaces, and other features on the main Project Site) and removal of the generator on-site. It is assumed that the earliest-constructed residential buildings would be occupied during the construction activities associated with the subsequent construction activities and, even though not required by CEQA, future residents are considered as on-site receptors for purposes of this air quality analysis.

The Project would also include off-site improvements. To serve the Project's requested electrical demand, four 12 kilovolt feeders need to be installed from Ravenswood Substation. This includes work at the substation itself, which is northeast of the Project site along Bayfront Expressway, and installing the underground feeders from the substation to the Project. The Project would also include intersection improvements in the form of signal changes, lane stripping, and sidewalk improvements.

Land uses for the existing conditions to be demolished and the Proposed Project are shown in **Table 1**.

## 1.2 Objective and Methodology

The purpose of the air quality and GHG analysis is to assess potential criteria air pollutant and GHG emissions, as well as health risks and hazards that would result from the construction and operation of the Proposed Project consistent with guidelines and methodologies from air quality regulatory agencies, specifically, the BAAQMD, the California Air Resources Board (ARB), the California Office of Environmental Health Hazard Assessment (OEHHA), and the US Environmental Protection Agency (USEPA). The analysis in this report followed the BAAQMD 2017 CEQA Guidelines where appropriate. In addition to the evaluation of an individual project, the CEQA Guidelines recommend an analysis of cumulative impacts when the project's incremental effect is cumulatively considerable. (14 Cal. Code Regs., § 15130, subd. (a).) For an air quality HRA, the cumulative analysis is performed when a project is in an area that includes other air emissions sources within a "zone of influence" of 1,000 feet surrounding the project. This report evaluates the risks and hazards associated with Project construction and operational activities on on-site receptors,

[1] Only actively programmed open space, such as parks, were evaluated in this analysis. The remainder of the open space would not generate new emissions outside emissions covered in other land uses.

off-site receptors and the cumulative impact to both on-site and off-site sensitive receptors from Project construction and surrounding sources.

### 1.2.1 Resources

Ramboll directly or indirectly relied on emissions estimation guidance from government sponsored organizations, government-commissioned studies of energy use patterns, Project-specific studies, and emissions estimation software as described below. In cases noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above. Where Project-specific data estimates were available, they were used preferentially instead of model defaults. The methodology used to calculate this emissions inventory is described in detail in the following sections, including citations to information used in this inventory.

#### 1.2.1.1 CalEEMod

Ramboll primarily utilized the methodology from the California Emissions Estimator Model (CalEEMod) version 2020.4.0 to assist in quantifying the criteria pollutant emissions in the inventories presented in this report for the Project. CalEEMod is a statewide program designed to calculate both criteria and GHG emissions from development projects in California. This model was developed under the auspices of the South Coast Air Quality Management District (SCAQMD) and received input from other California air districts. It is currently supported by numerous lead agencies for use in quantifying the emissions associated with development projects undergoing environmental review. CalEEMod utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available.

CalEEMod provides a platform to calculate annual operational criteria pollutant emissions from a land use development project. Specifically, the model aids the user in estimating operational emissions associated with a fully built out land use development. This includes emissions from on-road mobile vehicle traffic associated with the land uses, emissions from landscaping equipment and other off-road mobile sources, emissions from natural gas usage in the buildings, emissions associated with electricity usage in the buildings and electricity usage associated with water usage. This also includes emissions associated with solid waste disposal.

CalEEMod uses sources such as the USEPA AP-42 emission factors,[2] ARB's approved on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and In-Use Off-Road Equipment model (OFFROAD), and studies commissioned by California agencies such as the California Energy Commission and CalRecycle. OFFROAD is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment) (CARB 2011a). The off-road diesel equipment emission factors used by CalEEMod are based on the ARB OFFROAD2011 program. ARB has released an updated OFFROAD version, OFFROAD2017, that includes updates to population information and emission factors. OFFROAD2017 was used in this analysis. EMFAC is an emission factor model used to calculate emissions rates from on-road

[2] The USEPA maintains a compilation of Air Pollutant Emission Factors and process information for several air pollution source categories. The data is based on source test data, material balance studies, and engineering estimates. Available at: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors. Accessed: October 2021.

vehicles (e.g. passenger vehicles) (CARB 2011b). The emission factors used by CalEEMod for on-road vehicles are based on the ARB EMFAC2017 program. ARB recently released EMFAC2021, an update to EMFAC2017, that includes various changes, notably the incorporation of USEPA and ARB regulations and standards (e.g., Advanced Clean Trucks and the Heavy Duty Omnibus). EMFAC2021 was incorporated into this analysis.

In addition, CalEEMod contains default values and existing regulatory methodologies to use in each specific local air district or county. Appropriate state-wide default values can be utilized if regional default values are not defined. Ramboll used default factors for San Mateo County for the emissions inventory, unless otherwise noted in the methodology descriptions below.

## 1.3 Thresholds for Evaluation

### 1.3.1 Criteria Pollutants and Precursors

Project construction and operation emissions of CAPs and precursors were evaluated and compared with the BAAQMD's 2017 CEQA Guidelines thresholds of significance. Project operational emissions at full buildout were compared to the annual and daily operational thresholds of 54 pounds (lbs) per day and 10 tons per year (tpy)of Reactive Organic Gases (ROG), oxides of nitrogen ($NO_X$), and $PM_{2.5}$ and 82 lbs per day and 15 tpy of fine particulate matter less than 10 micrometers in aerodynamic diameter ($PM_{10}$). Project construction emissions were compared to the average daily construction thresholds of 54 lbs per day of ROG, $NO_X$, and $PM_{2.5}$ and 82 lbs per day of $PM_{10}$. BAAQMD thresholds of significance for construction-related $PM_{10}$ and $PM_{2.5}$ mass emissions apply to exhaust emissions only and do not include fugitive dust emissions, which are addressed through BAAQMD's Best Management Practices (BMPs). Because construction would overlap with operations of other components of the Project, emissions during construction were combined with the operational emissions that are expected to occur during that calendar year and then compared to operational thresholds.

As noted above, the BAAQMD threshold for fugitive dust emissions during construction is compliance with its BMPs.

CEQA also requires evaluation of whether the Project would conflict with or obstruct implementation of the applicable air quality plan. Analysis of the Project's consistency with the applicable air quality plan is shown in Appendix A.

### 1.3.2 Greenhouse Gases

BAAQMD's 2017 CEQA Guidelines do not recommend a threshold for GHG emissions from construction. BAAQMD recommends quantifying and disclosing construction GHG emissions. Emissions from Project construction are estimated and disclosed.

BAAQMD's 2017 CEQA Guidelines include a recommendation for a GHG emissions threshold for operations for the year 2020. Since the project will be built out after 2020, this operational threshold is not appropriate for use. Due to lack of a recommended threshold from BAAQMD, the Project is evaluated against a two-tiered threshold that is based on guidance from expert agencies, including CARB and the Office of Planning and Research (OPR).

Building emissions, such as energy use, water use, area sources, and solid waste, are evaluated against a net zero threshold because a project that does not alter the existing environment has no impact on the environment.

GHG impacts from vehicles are evaluated using the City's VMT threshold. This threshold provides information on whether the project is consistent with applicable plans and goals to reduce GHG emissions by reducing VMT, including Plan Bay Area. In addition, using the same VMT threshold for both transportation and mobile-source GHG impacts ensures consistency throughout the EIR.

CEQA also requires evaluation of a project's consistency with an applicable plan, policy or regulation adopted for the purpose of reducing environmental impacts, including plans adopted to reduce the emissions of GHGs. The analysis of the Project's consistency with applicable plans to reduce GHG emissions is shown in Appendix B.

### 1.3.3 Health Risks and Hazards

The HRA evaluates the estimated cancer risk, non-cancer chronic and acute hazard index (HI), and fine particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) concentration associated with construction and operation of the Project. The cumulative analysis estimates the total excess lifetime cancer risks, non-cancer HI, and $PM_{2.5}$ concentrations that are attributable to off-site rail, mobile, and stationary sources within the 1,000-foot "zone of influence" in addition to effects from the construction and operation of the Project.

The HRA evaluates potential sensitive receptor locations including "people—children, adults, and seniors—occupying or residing in:

- Residential dwellings, including apartments, houses, condominiums;
- Schools;
- Daycare centers;
- Parks;
- Hospitals; and
- Senior-care facilities." (BAAQMD 2012a)

To meet these objectives, this HRA was conducted consistent with the following guidance:

- Air Toxics Hot Spots Program Risk Assessment Guidelines (Office of Environmental Health Hazard Assessment [OEHHA] 2015a);
- May 2017 BAAQMD CEQA Guidelines (BAAQMD 2017);
- BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (BAAQMD 2012a); and
- BAAQMD Health Risk Assessment Modeling Protocol (BAAQMD 2020c).

The results of the construction and operational health risk analyses are compared with the BAAQMD 2017 CEQA significance thresholds for single sources separately. Then the impacts from construction and operations combined, during the time that construction and operations would overlap, are compared to the single source thresholds. Finally, the maximum scenario for the combined construction and operational impacts are combined with the impacts of off-site sources of toxic air contaminants TACs and compared against the BAAQMD 2017 CEQA cumulative thresholds. The thresholds are:

Single Source Impacts:

- An excess lifetime cancer risk level of more than 10 in one million;
- Non-cancer chronic and acute HIs greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

Cumulative Impacts:

- An excess lifetime cancer risk level of more than 100 in one million;
- A chronic non-cancer HI greater than 10.0; and
- An incremental increase in the annual average $PM_{2.5}$ concentration of greater than 0.8 $\mu g/m^3$.

As discussed in detail in **Section 3**, health impacts from the Project are based on emissions of TACs from diesel and gasoline combustion. Diesel particulate matter (DPM) does not have an acute non-cancer toxicity value, so an acute HI from diesel exhaust is not estimated. BAAQMD does not estimate acute HI from roadways in its Roadway Screening Analysis Calculator (BAAQMD 2015) since impacts from all roadways were well below thresholds.[3] Therefore, acute HI from Project traffic also was not estimated.

We understand the City received guidance from BAAQMD that $PM_{2.5}$ from fugitive dust from earth movement activity during construction should be included in the comparison to the $PM_{2.5}$ concentration threshold, which contradicts previous guidance Ramboll received from BAAQMD. To be conservative, fugitive dust is included in this analysis. Additionally, resuspended road dust from Project traffic is included in this analysis.

### 1.3.4 Odor

To evaluate odor impacts, the ConnectMenlo EIR identifies a three-pronged approach "[r]eview of projects using BAAQMD's odor screening distances during future CEQA review, implementation of the [General Plan Policies], and compliance with BAAQMD Regulation 7 would ensure that odor impacts are minimized and are *less than significant*." (City of Menlo Park 2016)

The Project was evaluated against this three-prong approach in **Section 3**.

## 1.4 Document Organization

This scope of work is divided into seven sections as follows:

**Section 1.0 – Introduction:** describes the purpose and scope of the air quality analysis, the objectives and methodology used, and outlines the document organization.

**Section 2.0 – Criteria Air Pollutant and Greenhouse Gas Emission Estimates:** describes the methods used to estimate CAP, TAC, and GHG emissions from the Project, and includes the Project CAP and GHG emissions results and comparison to the applicable thresholds of significance.

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[3] A previous version of BAAQMD's tools for estimating health impacts from roadways stated that the maximum acute and chronic HI from all traffic on roadways was well below 0.1, so screening values were not provided by BAAQMD. In the current version of its tools, acute and chronic HI are not provided.

**Section 3.0 – Estimated Air Concentrations:** discusses the air dispersion modeling, the selection of the dispersion models, the data used in the dispersion models (*e.g.*, terrain, meteorology, source characterization), and identifies receptor locations evaluated in the HRA.

**Section 4.0 – Carbon Monoxide Analysis:** discusses evaluation of potential carbon monoxide impacts.

**Section 5.0 – Odor Analysis:** discusses potential odor sources and the evaluation of the Project against the three-pronged approach proposed in the ConnectMenlo EIR.

**Section 6.0 – Health Risk Assessment :** provides an overview of the methodology for conducting the HRA, and includes the Project HRA results and comparison to the BAAQMD threshold of significance.

**Section 7.0 – Cumulative Analysis:** summarizes the approach used in the HRA cumulative analysis. The analysis of criteria air pollutants and GHG emissions is inherently cumulative.

**Section 8.0 – References:** includes a listing of all references cited in this report.

# 2. CRITERIA AIR POLLUTANT, TOXIC AIR CONTAMINANT, AND GREENHOUSE GAS EMISSION ESTIMATES

Project and net incremental (Project minus Existing) CAP, TAC, and GHG emissions from Proposed Project construction and operational sources were estimated. Methodologies used to calculate CAP, TAC, and GHG emissions are summarized below.

## 2.1 Existing Conditions Calculation Methodology

All CAP, TAC and GHG emissions for existing operations on the Project site were calculated for year 2019 as data from 2020 and 2021 would not be representative of normal operations due to reduced activity resulting from the COVID-19 pandemic. Emissions estimates include activity in existing buildings slated for demolition, use of emergency generators, and traffic associated with these buildings. Existing land uses at the Project site include offices, warehouses, and parking lots, as well as retail at the Hamilton Avenue Parcels North and South. Emissions from existing offices, warehouses, and parking lots slated for demolition were estimated using CalEEMod with default data assumptions and data provided by the Project Applicant. The carbon intensity factor was adjusted for 2019 as described in **Section 2.3.4.1**. Existing retail, located at the Hamilton Parcels North and South, were not included in the existing emissions calculation, which is conservative because any retail that is replaced would likely be more efficient and less emissions intensive than the existing uses due to stricter building codes. Existing emergency generator information was provided by the Project Applicant. Existing operational traffic information was provided by the Transportation Engineer.[4]

## 2.2 Calculation Methodologies for Construction Emissions

A detailed construction equipment list was provided by the Project Applicant, which includes the type, quantity, construction schedule and hours of operation anticipated for each piece of equipment for each year of construction.[5] This data was used to estimate construction emissions using calculation methodologies consistent with CalEEMod2020.4.0. It was assumed that all construction off-road equipment is diesel powered except for those specified as electric powered by the Project Applicant. All diesel-fueled off-road equipment emissions of $PM_{10}$ were assumed to be DPM, which is a TAC.

The Proposed Project construction is assumed to start after project entitlements and last roughly five years.[6] A mix of construction equipment would operate over the course of any given day. **Table 2** shows a summary of the expected construction schedule provided by the Project Applicant. Construction of the Project includes construction on-site and at the off-

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4 The Transportation Engineer, Hexagon, provided daily Project VMT and trip rates on October 5, 2021.

5 This schedule and equipment list is subject to change as Project details evolve. A conservative construction start date and schedule was analyzed to identify maximum impacts of Project construction.

6 Construction is conservatively assumed to start December 15, 2021. The analysis uses a start date that is earlier than possible to be sure that the impact analysis is conservative. Emissions and impacts would decrease the later the actual construction start date is due to the incorporation of cleaner equipment into the construction fleet with time.

site improvements.[7] Construction emissions were calculated for off-road equipment, on-road vehicles, and off-gassing activities.

As discussed in **Section 1.3.1**, BAAQMD thresholds for fugitive dust are compliance with its Best Management Practices. However, as discussed in **Section 1.3.3**, emissions from fugitive dust are included in the estimation of $PM_{2.5}$ concentration.

### 2.2.1 Construction Phasing

The analysis described here does not rely on the default construction phasing schedule from CalEEMod, as a detailed schedule was provided by the Project Applicant. **Table 2**, provided by the Project Applicant, summarizes the expected construction schedule.

This analysis assumes that construction of buildings will overlap, that the complete build out would occur in roughly five years and that the buildings constructed would be occupied and fully operational as soon as construction of each building is completed. This is conservative because occupancy and operation of each building would likely ramp up over time, rather than immediately upon completion of construction. The analysis also assumes that operational emissions from completed buildings would overlap with construction emissions from buildings that are still being constructed.

The construction program would commence after existing uses have vacated from the Willow Village site.[8, 9] The preliminary construction schedule assumes that construction would begin after project entitlements and would last for roughly five years, as indicated in **Table 2**. Construction diesel equipment would be expected to operate between the hours of 7 AM to 6 PM, consistent with the Menlo Park noise ordinance,[10] with construction with heavy duty equipment exceeding 60 decibels (dBA) occurring Monday through Friday from 8 AM to 6 PM. However, equipment would not be expected to run its engine during this entire period. The equipment list for the construction of the Campus and Town Square Districts is shown in **Table 3**. The equipment list for the construction of the Residential/Shopping District is shown in **Table 4**.

Initial construction activities affecting the full site area include demolition of the existing buildings and parking lots, followed by grading and utilities.

### 2.2.2 Emissions from Diesel Construction Off-road Equipment

Emissions calculations associated with off-road construction equipment were based on the construction schedule and the type, size, fuel type, tier level, hours of operation and

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7 Off-site improvements considered are construction at the Ravenswood Substation, underground installation of the feeder lines, and intersection improvements that include diesel equipment operation.

8 The existing dialysis center may remain open for several months after demolition commences. If this were to occur, changes to the analysis would be negligible. The dialysis center would not be considered a sensitive receptor based on BAAQMD guidance, so the impacts of construction on the dialysis center do not need to be analyzed. The existing operational emissions associated with the dialysis center remaining and the shifting of emissions from the demolition of the dialysis center would not change conclusions as these would be minor changes.

9 The analysis only considers net new retail in the Hamilton Avenue Parcels North and South, so does not consider the existing retail in this area to be vacated.

10 Construction activity is assumed to start at 7 AM to conservatively consider more morning hours in the dispersion analysis, but no equipment will be operated that would violate the Menlo Park noise ordinance, which has low noise level thresholds for construction equipment prior to 8 AM.

utilization factor for each piece of equipment submitted by the Project Applicant. A Project-specific construction equipment list is presented in **Table 3** and **Table 4**.[11] For diesel-powered off-road construction equipment, methodologies consistent with CalEEMod are used to estimate emissions. Where Project-specific equipment information was not available, CalEEMod default horsepower were used. Load factors for each piece of equipment were based on the default load factor from CalEEMod.

The CalEEMod methodology for off-road construction equipment emissions relied on the ARB In-Use Off-Road Equipment model (OFFROAD2011) as well as specific emission factors by engine tier. However, ARB released a new version of its off-road emissions estimator model, OFFROAD2017, which was used to estimate emissions from the Project. Emission factors from OFFROAD2017 that are used in this analysis are shown in **Table 5**.

Emissions are calculated outside of CalEEMod using the same methodologies and emissions factors as CalEEMod. Emissions were calculated using the following formula, which is consistent with CalEEMod.

$$E_C = \sum (EF_C * HP * LF * Hr * Red * C)$$

Where:

$E_C$: off-road equipment exhaust emissions in pounds (lbs.)

$EF_C$: emission factor (g/bhp-hr) (CalEEMod defaults)

HP: equipment horsepower (CalEEMod defaults or Project-specific)

LF: equipment load factor (CalEEMod defaults)

Hr: equipment operating hours

Red: reduction from Diesel Particulate Filter (DPF), as applicable

C: unit conversion factor

Unmitigated emissions were based on fleetwide average emission factors from OFFROAD2017, as shown in **Table 5**. For mitigated emissions, emission factors from CalEEMod associated with Tier 4 final engines are used for 95 percent of the equipment operation before residents move on-site in Year 5 and 98 percent of the equipment after residents move on-site in Year 5. The other 5 percent and 2 percent of equipment (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Mitigated emission factors are based on the weighted average of 95 percent and 98 percent (before and after on-site residents, respectively) Tier 4 final emission factors and 5 percent and 2 percent (before and after on-site residents, respectively) Tier 2 emission factors, since all equipment may not be available as Tier 4 final. This equates to equipment with Tier 2 engines or better operating for up to 618,028 horsepower-hours before residents occupy the on-site buildings and up to 34,716 horsepower-hours after residents occupy the on-site buildings.

[11] Emissions are not estimated for intersection improvements without diesel equipment use. Emissions are assumed to be minor since the activity duration is short and trucks would not be idling at the intersection for long periods of time. Travel to the site is assumed to be included in the worker trip counts.

### 2.2.3 Emissions from Electric Construction Equipment

GHG emissions from the use of electrical off-road equipment were estimated based on type and usage of each equipment. The Project Applicant provided the equipment that will be electrically powered. Yearly electricity consumption by construction equipment was estimated to calculate emissions by multiplying the carbon dioxide equivalents ($CO_2e$) intensity factor with the electricity consumption for each year. Emissions from electric construction equipment are shown in **Table 6**.

### 2.2.4 On-road Construction Trips

Construction trip rates were provided by the Project Applicant for each general area. Construction trips by area are shown in **Table 7a**. Trip lengths are shown in **Table 7b**. For demolition and grading hauling trip generation rates, total haul truck trip counts were provided by Project Applicant.

Emission factors from EMFAC2021,[12] the ARB Emission Factors model for on-road emissions, were used for emissions of CAPs and GHGs. The emission factors used for on-road construction trips of the Proposed Project cover the anticipated years of construction. EMFAC2021 incorporates the Pavley Clean Car Standards and the Advanced Clean Cars (ACC) program.

Running exhaust, running loss, tire wear, and brake wear emission factors were estimated with a gram/mile factor. These emissions were calculated as shown below:

$$E_M = \sum (EF_M * VMT)$$

Where:

VMT or Vehicle Miles Traveled: Trip Length*Trip Number

$EF_M$: emission factor (g/mile) from EMFAC2021

Emissions from vehicle idling exhaust, starting exhaust, and evaporative emissions were estimated with a gram/trip emission factor. Idling emission factors were only estimated for heavy duty trucks as idling emissions occur during extended idling events while the truck is operating but not traveling any significant distance (e.g., during loading and unloading). In EMFAC2021, an extended idling event is defined as "a continuous segment of vehicle activity that meets three criteria: all instantaneous vehicle speeds being lower than 5 mph, the total distance of less than 1 mile, and the total duration of more than 5 minutes" (CARB, 2021). EMFAC takes account of idling emissions from light duty vehicles and other vehicle types in running emissions estimates. These emissions were estimated as shown below:

$$E_T = \sum (EF_T * Trip\ Number)$$

Where:

$EF_T$ = emissions factor (g/trip) from EMFAC2021.

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[12] ARB has published off-model adjustment factors to account for the "Safer Affordable Fuel-Efficient Vehicles Rule Part One: One National Program" (SAFE 1) adopted by the USEPA and the National Highway Traffic Safety Administration (NHTSA). These adjustment factors will not be incorporated into this analysis as this regulation is currently under litigation and the USEPA and NHTSA have proposed rulemakings to repeal SAFE 1.

Trip Number = trips provided by Project Applicant

Idling time is modeled to be consistent with California Airborne Toxics Control Measure (ATCM) to limit diesel-fueled commercial motor vehicle idling (California ARB 2016).

Road dust emissions are calculated using ARB methodology. The on-road entrained dust emission factor derivation is shown in **Table 8**.

### 2.2.5 Fugitive Dust

Fugitive dust contributes to $PM_{10}$ and $PM_{2.5}$ emissions and is generated by the various activities occurring at the Project site. The following subsections describe the methodology used to calculate fugitive dust emissions from Project activities.

Fugitive dust emissions are not included in the comparison to thresholds for mass emissions as these thresholds for construction are for exhaust only. However, to be conservative, fugitive dust emissions are included in the estimation of $PM_{2.5}$ concentration based on recent guidance provide to the City by the BAAQMD.

#### 2.2.5.1 Demolition

Fugitive dust emissions from mechanical dismemberment and debris loading during demolition were estimated using CalEEMod methodology and assumptions. The emission factor is calculated on a per-ton of building waste weight. Building waste weight was estimated based on the volume of building waste from demolition provided by the Project Applicant. Mitigated emissions assume a 55% reduction due to watering two times a day. Dust emissions from demolition are presented in **Table 9a.**

#### 2.2.5.2 Grading

Fugitive dust emissions from grading equipment (i.e., graders and scrapers) occur during the grading and utility phases. Grading emissions were estimated using CalEEMod methodology and assumptions. The emission factor for grading is calculated on a per-VMT basis. Equipment VMT was calculated using the maximum area disturbed per day, based on Project-specific data and CalEEMod default assumptions. Mitigated emissions assume a 55% reduction due to watering two times a day. Grading emissions are presented in **Table 9b.**

#### 2.2.5.3 Material Loading

Fugitive dust from material loading activities includes the unloading of materials construction and loading of soil onto the haul trucks during the grading and utilities excavation phases. Material loading fugitive dust emissions were estimated using CalEEMod methodology and assumptions. The emission factor for material loading is calculated on a per-ton basis. Material loaded in cubic yards is based on Project-specific data. Mitigated emissions assume a 55% reduction due to watering two times a day. Emissions from material loading are presented in **Table 9c.**

### 2.2.6 Watering for Dust Control

GHG emissions associated with the electricity consumed during watering for construction dust control were calculated based on the total water consumption, electricity used for watering, and the electricity carbon intensity for water supply, distribution and treatment over the construction period using CalEEMod equivalent methodologies. Total water consumption is from the Project Applicant. The electricity intensity used is Pacific Gas and

Electric's (PG&E) GHG emission factor.[13] Emissions from construction water use are presented in **Table 10**.

CAP and GHG emissions from water trucks operation were calculated using EMFAC2021 emission factors with other on-road construction trips as described in **Section 2.2.4**.

### 2.2.7 Architectural Coatings and Paving Off-Gas Emissions

Emissions from architectural coating and paving off-gas emissions were estimated using methodologies consistent with CalEEMod.

Paving emissions were based on the square footage of roadway and parking lots that need to be paved. This square footage was provided by the Project Applicant. The parking lot and the estimated square footage of roadways were summed together to determine the overall paved surface area assumed for the Project. This was used to calculate asphalt off-gassing emissions from the Project using default CalEEMod methodologies and factors, as shown in **Table 11**.

Architectural coating emissions were based on the square footage of different land uses as well as CalEEMod defaults regarding the amount of coated areas for the various land uses, as shown in **Table 12**. Unmitigated emissions from architectural coating during Project construction assumed compliance with BAAQMD paint volatile organic compound (VOC) regulations, while mitigated emissions assume that Project indoor painting during construction will utilize super-compliant coatings, which are paints that have been reformulated to exceed the SCAQMD's Rule 1113 (Architectural Coatings) requirements.

### 2.2.8 Construction CAP and GHG Emissions Summary

A summary of maximum annual average daily construction CAP emissions is shown in **Summary Table A**, below. More detail on unmitigated construction CAP emissions from the Project are summarized in **Table 13** and mitigated construction CAP emissions from the Project are summarized in **Table 14**. CAP emissions are reported in units of annual average daily emissions for each year of construction. For construction that will occur throughout the full year, annual emissions were averaged over 365 days of construction each year to give average daily emissions in lbs per day to get an average emission rate to compare against thresholds. [14] Construction will not occur throughout the full year during the first and last years of construction. In these scenarios, the annual construction emissions for the first and last years were averaged over the number of days construction will occur in the respective year. Mitigated emissions assume 95 percent of construction equipment before residents move on-site and 98 percent of construction equipment after residents move on-site has Tier 4 Final engines. The remaining equipment could have Tier 2 engines or better. Mitigated emissions also assume indoor painting during construction will utilize super-compliant coatings, which are paints that have been reformulated to exceed the SCAQMD's Rule 1113 (Architectural Coatings) requirements.

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[13] The Project would receive its power from Peninsula Clean Energy. However, the electricity to pump water from its source to the Project is not under control of the Project, so the carbon intensity of electricity from PG&E powered electricity will be used.

[14] Activity is expected on most Saturdays. Even if 6 days per week (312 days per year) were used to average emissions, conclusions would not change.

Total GHG emissions for construction are summarized in **Table 15**. GHG emissions are reported in total metric tons of carbon dioxide equivalents.

**Summary Table A. Summary of Maximum Annual Average Daily Construction CAP Emissions and Annual Construction GHG Emissions**

| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ |
|---|---|---|---|---|---|
| | lb/day | | | | MT/year |
| BAAQMD Threshold of Significance | 54 | 54 | 82 | 54 | N/A |
| Unmitigated Emissions | 63 | 124 | 5.8 | 5.4 | 23,050 |
| *Exceed Threshold?* | *Yes* | *Yes* | *No* | *No* | *N/A* |
| Mitigated Emissions | 28 | 47 | 0.78 | 0.77 | 23,050 |
| *Exceed Threshold?* | *No* | *No* | *No* | *No* | *N/A* |
| Source: Table 13, Table 14, and Table 15 | | | | | |

## 2.3 Calculation Methodologies for Operational Emissions

The net (Project minus Baseline) CAP, GHG and TAC operational emissions were evaluated. Sources of operational emissions from the existing site improvements (Baseline) and Project include operation of the buildings (area, energy, water, waste), emergency diesel generators, and on-road vehicles. The Baseline condition has one emergency diesel generator, and the Project would have thirteen emergency diesel generators.

Operational emissions that are concurrent with construction activities are presented by year in order to determine the combined construction and operational emissions for each year of construction, as discussed further in **Section 2.4**. Partial buildout emissions for both operational and mobile sources were scaled using the portion of each building area that becomes operational for each year of construction, as shown in **Table 16**.

Project and Baseline operational emissions were estimated using CalEEMod equivalent methodologies, as discussed below.

### 2.3.1 On-road Mobile Sources

Vehicles on the roadway emit CAPs, GHGs[15] and TACs in their exhaust and through evaporation, tire and brake wear, and fugitive dust from roadways. Mobile emissions were calculated using Project-specific trip generation and VMT by vehicle type and emission factors from EMFAC2021 for San Mateo County. To estimate annual emissions, trips and

15 GHG emissions from mobile sources are estimated for informational purposes. GHG impacts are evaluated based on VMT, as discussed in Section 1.3.2.

VMT were multiplied by the relevant emission factor of pollutants. More details on this calculation are provided below. The fleet mix and trip generation for the Project, and the Campus District in particular, are unique to the Project due to the Project's unique Transportation Demand Management (TDM) program, trip cap, and vehicle fleets. Therefore, using generalized approaches in CalEEMod would not appropriately estimate emissions for the Project. Project specific information was used to develop emissions calculations using EMFAC2021 directly.

#### 2.3.1.1 Vehicle Trips and VMT

Project traffic included residential and worker trips as well as service vehicle and vendor trips, and retail and commercial trips. The Transportation Engineer provided project-specific daily vehicle trips and vehicle miles travelled (VMT) for the Campus District and Baseline conditions at the Project site broken down by fleet category and the total daily vehicle trips and VMT in the Town Square and Residential/Shopping District broken down by land use. The trip rates and VMT of the Hamilton Avenue Parcels North and South were provided separately and combined with retail land use totals in the mobile emission calculations. These trip rates account for the Project-specific TDM program proposed for the Campus District, the Town Square District, and the Residential/Shopping District and the trip cap proposed for the Campus District.

We understand the Project's TDM program will reduce the amount of vehicle traffic generated by creating measures, strategies and incentives to encourage workers and residents to use alternate modes of transportation. The TDM measures include, but are not limited to the following measures:

- Improve Biking/Walking Network
- Provide Bicycle Amenities
- Improved public transit service (coordinated with San Mateo County Transit District)
- Car Share Program
- Tram Service
- Commuter Shuttles
- Parking Management
- Emergency Ride-Home Program
- Carpool and Vanpool Programs
- A Commute Assistance Center
- On-Site Housing

The Transportation Engineer provided weekday trip rates provided in Appendix C; therefore average daily trip rates for each land use and fleet category were estimated by scaling the Project specific trip rates with a ratio derived from CalEEMod weekday and weekend trip rates by land use. Average daily trip rates were calculated as a weighted average of the weekday and weekend trip rates. For partial buildout years, the trips and VMT were scaled by the proportion that each land use was operational during each year of construction, as shown in **Table 16.**

The weekday trip rates and daily VMT as provided by the Transportation Engineer are shown in **Table 17**. The trip rates and VMT are summarized in **Table 18** for baseline, full buildout and partial buildout.

Campus District. Trips and VMT for the Campus District were calculated using Project-specific fleet mixes and Project specific trip and VMT information from the Transportation Engineer.

The Project TDM program will employ several methods of reducing vehicle emissions including: commuter shuttles that take workers to and from work, a fleet of trams that move employees between campuses reducing the number of worker cars on the road, and on-demand vehicles that workers can summon for short trips around the campuses. These measures would reduce Campus District VMT. Specific trip rates and VMT were developed for each of these unique fleets and matched with fleet appropriate emission factors. Trams are proposed to operate at the same level of activity as the Baseline conditions; therefore, tram trips and VMTs are not considered in the emissions analysis because no net increase is proposed.

Campus District emissions were broken down into the following categories:

- Cars
- Trucks
- Shuttles
- On-Demand Vehicles

Cars, Trucks, Shuttles, and On-Demand Vehicle fleets are Project-specific fleets associated with the Campus District land use. It is anticipated that the shuttles, and on-demand vehicles will service all of Meta Platforms, Inc, ("Meta") campuses and often make multiple stops on one trip. Trip rates and VMT associated with the Campus District were provided by the Transportation Engineer.

Town Square District and Residential/Shopping District. Trips and VMT for the Town Square District and Residential/Shopping District were also provided by the Transportation Engineer and account for TDM reductions required by the City. These Mixed-Use trips and VMTs are assigned to the San Mateo County Mix fleet type, which includes all vehicle categories. The trips associated with the Hamilton Avenue Parcels North and South are added to the trips associated with the Town Square and Residential/Shopping Districts.

Existing site. Trips and VMT at the existing site were estimated by the Transportation Engineer for the same vehicle categories as the Campus District.

#### 2.3.1.2 Fleet Mixes

As mentioned above, the existing site has, and Campus District is anticipated to have, a unique fleet mix due to Meta's proposed trip cap and extensive TDM program. The vehicle fleets for the Town Square District, Residential/Shopping District, and Hamilton Avenue Parcels North and South are based on the default fleet mix for San Mateo County in EMFAC2021, consistent with the methodology used in CalEEMod. A summary of the fleet mix categories is shown in **Table 19**. Where a mix of EMFAC vehicle categories is used, the mix is based on the ratio of EMFAC2021 VMT for each vehicle type. The Shuttle fleet mix was assumed to be all diesel to conservatively estimate health risks.

#### 2.3.1.3 Emission Factors

Mobile emission factors from running, idling, and starting vehicle exhaust, as well as evaporative running loss, tire wear, and brake wear emissions were calculated using EMFAC2021 in San Mateo County for each of the fleet mix categories. Running exhaust, running loss evaporative, tire wear, and brake wear emissions were determined using factors with units of g/mile while idling and starting exhaust and other evaporative emissions were determined using factors with units of g/trip.

Total emissions from EMFAC2021 were converted to emission factors using the total VMT or trips for the relevant vehicle classes. The average emission factor for each fleet mix category was then calculated using the ratio of VMT or trips between vehicle classes.

Emission factors were calculated for each fleet mix category for the baseline year of 2019, full buildout, and each intermediate year where the Project would be operating concurrent with construction. For the purposes of this analysis, this is assumed to be 2024-2026, consistent with buildout of specific buildings in the construction analysis. The fleet-average mobile emission factors decrease over time due to fleet turnover and regulations such as ACC. For fleet mix categories associated with the Campus District, vehicles are assumed to be either gasoline or diesel, or natural gas in the case of certain vehicles in the fleet for trucks. Electric vehicles (EVs) were not included in the Campus District fleets because Project-specific reductions for vehicle charging were applied later, as discussed in **Section 2.3.2.1.** Emission factors for fleet mix categories associated with the Town Square District, Residential/Shopping District, and Hamilton Avenue Parcels North and South include gasoline, diesel, natural gas, and EVs based on default EV penetration for San Mateo County from EMFAC2021. EVs do not emit CAPs beyond PM from brake wear and tire wear. **Table 20a** and **Table 20b** show the CAP and GHG emission factors from EMFAC that were used in the analysis for Project and Baseline.

Vehicles driving on roadways would also emit $PM_{2.5}$ and $PM_{10}$ in the form of re-suspended road dust as described in **Section 2.2.5**. Road dust $PM_{2.5}$ and $PM_{10}$ emissions were added to exhaust $PM_{2.5}$ and $PM_{10}$ emissions for comparison against BAAQMD's total operational $PM_{2.5}$ and $PM_{10}$ mass emissions significance thresholds. The re-suspended road dust emission factors are summarized in **Table 8.**

#### 2.3.1.4 Emissions

Emission factors for each vehicle class were multiplied by the annual trips and VMT calculated as described above. For partial buildout years, the emissions were scaled by the proportion that each land use was operational during each year of construction, as shown in **Table 16**.

Mobile CAP and GHG emissions before reductions associated with the EV charging are summarized in **Table 21a** and **Table 21b**.

### 2.3.2 EV Charging Emissions Reductions

The Project will have a comprehensive EV charging network. Emissions reductions associated with the increase in EV miles traveled (eVMTs) due to the addition of EV charging at the Project are taken into account. EVs emit fine particulate matter (PM) brake wear and tire wear at the same rate as other vehicles (per EMFAC2021); therefore, these emissions are excluded from the emissions reductions taken for EVs.

The reductions associated with increased eVMT due to Project charging infrastructure are addressed differently for the Town Square and the Residential/Shopping District and the Campus District. The EV chargers in Town Square and the Residential/Shopping District would be utilized by the general public where there is less control over the use. The Campus District has a comprehensive program to for EV charging for its workers, as discussed below.

The reductions associated with EV charging are based on ARB's VISION program (California ARB 2020), which evaluates various scenarios regarding California's growth and adoption of technologies in the transportation sector. The program has developed and enhanced predictive traffic models since 2012. The VISION traffic models have been used by CARB to support transportation policy decisions and inform air quality and climate planners.

#### 2.3.2.1 EV Charging Emissions Reductions for Campus District

As discussed above, Meta offers an advanced EV charging program to its workers. Charging on campus is free and valets move cars into chargers to maximize charging time. Therefore, the Campus District would be expected to produce more EV penetration in its fleet than would be seen in the general public in the Town Square and the Residential/Shopping District. This is a further benefit to the community because workers can charge their EVs on campus using carbon free electricity instead of in their homes where electricity may not be carbon free.

The Project Applicant provided the annual electricity use for charging at Meta's existing campuses in 2019 in Menlo Park, including the existing charging at the Project site. The existing main Project site electricity use was used to estimate reductions associated with the baseline conditions, as shown in **Table 22**.

The anticipated amount of charging in the Campus District was calculated based on the historical charging in 2019, as shown in **Table 22**. The provided studies were used to calculate an average ratio of kilowatt-hours to square footage from the existing campuses. This ratio was applied to the projected square footage of the Campus District at full buildout to determine anticipated energy usage. To account for expected increases in fleet EV penetration by full buildout, the anticipated energy usage was scaled by the increase in eVMT 2026 in the Mobile Source Strategy (MSS) scenario of CARB's VISION program compared to the percentage of eVMT associated with the existing main Project site. The more aggressive MSS scenario was used to scale the Campus District eVMT because the EV incentives offered by Meta are expected to contribute to greater EV adoption by Meta workers when compared to the fleet average.

The electricity use for charging in baseline and full buildout was used to estimate the number of miles driven by EVs charged at the Campus District based on a fuel economy of 0.30 kilowatt-hours (kWhs) per mile.[16] The eVMT for the Campus District is shown in **Table 22.**

The electricity for EV charging at the Project would be supplied with 100% carbon-free energy, as discussed in more detail in **Section 2.3.2.2.** Mobile emissions for the Campus District were calculated assuming all VMT and trips were gasoline or diesel and then removing the equivalent gasoline or diesel emissions that are replaced by eVMT and EV trips, for both baseline and the Project. Therefore, the associated reductions in CAP and GHG

[16] The fuel economy is based on electric fleet data from fueleconomy.gov. Available at: https://www.fueleconomy.gov/.

emissions are calculated from the replacement of gasoline and diesel-powered vehicles with EVs for the same travel.

### 2.3.2.2 EV Charging Reductions for Town Square and the Residential/Shopping District

The EV chargers installed with the Project in the Town Square and the Residential/Shopping District contribute to emissions reductions due to increased eVMT charged by the Project chargers, similar to reductions associated with the Campus District. However, the Town Square and the Residential/Shopping District is not controlled by one employer, and vehicular travel associated with this area is largely from the general public. Therefore, reductions associated with eVMT were estimated using data derived from statewide trends in ARB's VISION program.

ARB is currently preparing the 2020 MSS model as part of the VISION program to anticipate fleet changes in accordance with the ambitious targets set by recent legislative actions. The new model incorporates the 2020 MSS scenario, which estimates eVMTs reflecting the target identified in EO N-79-20, assuming 100% of passenger vehicle sales in California are zero emissions vehicles (ZEV) or plug-in hybrid vehicles (PHEV), and GHG emissions assumed to have reduced by 2.0% per year from 2026 to 2035. The emissions reductions associated with this Project were determined to be the difference between the eVMT under the reference or "as-is" scenario and the MSS scenario, since the additional charging infrastructure associated with the Project will be an essential link towards reaching the targets set in the MSS.

As discussed in **Section 2.3.1.1**, the Town Square and the Residential/Shopping District fleet mix is based on EMFAC2021 and includes the default percentage of EV travel. To calculate the respective reductions from the Project chargers in the Town Square and the Residential/Shopping District, the percent of eVMT under the 2020 MSS model was determined for both the reference and MSS scenarios based on the model. The percentage of EV travel in the reference scenario is assumed to be similar to the EV travel in EMFAC2021. Because the 2020 MSS model only accounts for passenger vehicles, the percent of eVMT from the model was multiplied by the percentage of passenger vehicle VMT of the total fleet VMT from EMFAC2021. The resulting percentage, representing the vehicles within the fleet that could use the Project's chargers was then multiplied by the trip rates and VMT associated with the Town Square and the Residential/Shopping District by year. The eVMT offered by the Project chargers was then calculated based on usage assumptions for the charger of 10 hours per day and 365 days per year, where 1 hour of charging offers on average 25 miles of eVMT, as shown in **Table 23**. Charger usage was assumed based on typical operating time for retail charging. However, as shown in Table 23, emissions reductions are limited by projected demand of eVMT and EV trips, not charger availability.

The emissions reductions associated with the installation of the EV chargers in the Town Square and the Residential/Shopping District was calculated using the difference in charger eVMT between the reference and MSS scenarios. The reductions in CAP and GHG emissions were calculated using the emission factors and methodologies described in **Section 2.3.1.3** for the Town Square and the Residential/Shopping District.

The combined EV CAP and GHG emissions reductions from the Campus District and the Town Square and the Residential/Shopping District are shown in **Table 24a** and **Table 24b**. A summary of the total mobile CAP and GHG emissions with and without reductions associated with EV vehicles are in **Table 25a** and **Table25b**.

### 2.3.3 On-site Generators

The Project would include thirteen new emergency generators and the removal of the single existing emergency generator. Project and Baseline emissions for the emergency generators are based on the BAAQMD rule limiting the hours of non-emergency operation for emergency standby diesel engines to a maximum of 50 hours per year of testing and maintenance, which is consistent with the maximum allowed testing time from the ATCM for Stationary Compression Ignition Engines (CARB 2011). $PM_{2.5}$ and $PM_{10}$ emissions were calculated using emission factors based on ARB engine tier standards for diesel generator engines. NOx and ROG emissions were calculated by converting non-methane hydrocarbon (NMHC) emission factor values provided in ARB's Tier standards to the intended emission factors using EPA conversion factors (USEPA 2010) if explicit values are not provided for the specific tier level. When an emission factor was specified as a combined NMHC+NOx factor, the NMHC/NOx ratio of 5%/95% were taken from BAAQMD guidance (BAAQMD 2004). GHG emissions were calculated using CalEEMod default emission factors. All emission factors can be found in **Table 26**. Generator information, such as size of engine, quantity, and engine tier, was provided by the Project Applicant, as shown in **Table 27**. A summary of on-site generator emissions can be found in **Table 27**.

### 2.3.4 Energy

Energy emissions include indirect emissions from electricity used by buildings and direct natural gas combustion emissions. Indirect emissions are typically due to electricity generation from off-site power plant locations. Emissions from natural gas combustion can be generated from commercial usage (e.g., cooking and heating) and industrial usage (e.g., boilers).

CAP and GHG emissions from energy sources at the existing main Project site were evaluated based on energy use at the site in 2019, as shown in Appendix A. Existing land uses at the site include offices, a health center, industrial, commercial, and warehouse buildings, and parking lots. Emissions were estimated using CalEEMod equivalent methodologies with energy usage data provided by the Project Applicant. The carbon intensity factor for 2019 was used as described in **Section 2.3.4.1**.

Electricity usage rates for the Project were provided by the Project Applicant based on Project-specific estimates, as shown in Appendix A, which assume space heating and cooling, domestic hot water heating, and residential cooking equipment would be powered by electricity rather than natural gas. Natural gas would be used in supermarket and restaurant land uses for commercial cooking equipment only. Energy use associated with the net new retail at the Hamilton Avenue Parcels North and South are based on CalEEMod defaults. A portion of the retail in these parcels would be demolished and rebuilt. Evaluating only the net new area is conservative because newer, more energy efficient buildings will replace older buildings built under an older version of building energy code.

In an effort to reduce GHG emissions, the Project would be entirely electrically powered, with the exception of commercial culinary uses. The residential buildings would be entirely electrically powered. Therefore, energy use totals for the Project are based on Project-specific electricity and natural gas usage studies provided by the Project Applicant. A summary of energy use provided is shown in **Table 28**.

The Project also would include the installation of solar PV arrays that would generate about 3,900,000 kWh per year of electricity.

The buildings on the main Project Site also must comply with applicable Menlo Park Municipal Code requirements, stating:

*For all new construction, a project will meet 100 percent of energy demand (electricity and natural gas) through any combination of the following measures:*

(i) *Onsite energy generation,*

(ii) *Purchase of 100 percent renewable electricity through Peninsula Clean Energy or Pacific Gas and Electric Company (PG&E) in an amount equal to the annual energy demand of the project,*

(iii) *Purchase of local renewable energy generation in Menlo Park in an amount equal to the annual energy demand of the project, and*

(iv) *Purchase of certified renewable energy credits and/or certified renewable energy offsets annually in an amount equal to the annual energy demand of the project.*

The Campus District would meet this code requirement by eliminating the use of natural gas, except for culinary purposes (limited to the restaurant uses), and committing to purchasing 100 percent carbon free electricity from Peninsula Clean Energy (PCE).

Portions of the Town Square, Campus, and/or the Residential/Shopping District would include natural gas for cooking in the retail area. To meet this code requirement, the on-site solar would offset any emissions from the natural gas combustion for cooking and any electricity that may not be carbon free.

The compliance method is discussed further in the memorandum from Signature Development Group to the City of Menlo Park dated December 2, 2021 regarding Willow Village 100% Renewable Energy Memo.

The analysis accounts for state laws that require municipal utility providers, such as PG&E, to incrementally increase the percent of electricity it supplies from carbon free sources between now and 2045, when the electricity mix must be 100 percent carbon-free.

#### 2.3.4.1 Electricity

To estimate emissions, the estimated electricity usage of the Project was multiplied by the carbon intensity of the electrical grid. Carbon intensities of electricity are GHG emission rates from a given source in terms of the amount of GHG released in pounds per megawatt hour (MWh) of energy produced and are different depending on the source of electricity.

Electrical power is supplied to the study area by PCE, although the option to purchase electricity from PG&E is available. The carbon intensity from the PCE Standard plan, using the PCE power sources that supply energy under that plan, were used to estimate emissions from existing conditions and is shown in **Table 29**. The PCE Standard plan currently utilizes - and is committed to utilizing 86% renewable sources of energy through 2030.[17]

[17] Peninsula Clean Energy comes from 51% renewable sources, 35% hydroelectric sources and 14% unspecified sources. Unspecified sources were assumed to have the same carbon intensity as the non-renewable PG&E mix of power. Available at: https://www.peninsulacleanenergy.com/energy-sources/

As discussed above, as part of its sustainability strategy, the Project Applicant has committed to purchasing 100 percent carbon free energy from PCE for Campus District uses to reduce its GHG emissions, which is also consistent with the City zoning code. Any electricity in the Town Square, Campus and/or the Residential/Shopping District that is not carbon free would be offset with on-site solar. Therefore, a carbon intensity factor of zero was used for Project emissions.

As discussed above, the on-site solar would produce more electricity than would be needed to offset the non-carbon-free portion of electricity use and the natural gas use. Therefore, the additional electricity generated from the on-site solar PV would offset electricity that would have been generated by the utility, likely through non-renewable sources or peaker plants. The renewable energy generated onsite that is not consumed by the Project would thus be available for other projects, further reducing GHG emissions from electricity for the Project. However, to be conservative, this additional reduction in non-renewable energy was not taken into account in this analysis.

Indirect electricity emissions for the Project were estimated by combining the carbon intensity and projected usage for each year using methodologies consistent with CalEEMod as shown in **Table 30**.

#### 2.3.4.2 Natural Gas

Natural gas combustion emits GHGs and CAPs. Natural gas usage rates are based on Project-specific estimates provided by the Project Applicant and reflect the fact that all buildings would be primarily electric and would use natural gas only for culinary purposes in the supermarket and restaurant land uses. Residential units would be electric, including space heating and cooling, domestic hot water heating, and residential cooking equipment.

As discussed above, compliance with the City Municipal Code requires any natural gas usage to be offset by on-site renewable energy generation, off-site new renewable energy generation or offsets. However, to be conservative, GHG emissions from natural gas combustion are estimated for the Project since the carbon intensity of the reduction in grid electricity production due to the on-site solar is not known at this time.

For years before full buildout, the natural gas used at full buildout was multiplied by the percent of retail land uses that would be completed during each year.

CalEEMod default emission factors for natural gas combustion were used, as shown in **Table 29**. Direct emissions from the combustion of natural gas for both existing conditions and Project conditions can be found in **Table 30**.

### 2.3.5 Water and Wastewater

Water and wastewater use emits GHGs from the electricity used to convey, treat, and distribute water and wastewater and the release of methane ($CH_4$) and nitrous oxide ($N_2O$) directly from the wastewater.

The amount of electricity required to convey, treat, and distribute water depends on the volume of water as well as the sources of the water. Indirect emissions from electricity to supply, treat, and distribute water decrease over time as the average carbon intensity of electricity use decreases due to the California Renewables Portfolio Standard (RPS), a law designed to meet statewide GHG reduction targets. The electricity used to pump the water to the site is not under the control of the Project and therefore cannot be guaranteed to be generated with 100% renewable or carbon free energy from PCE. Therefore, GHG emissions from water transport are based on the carbon intensity of PG&E. The RPS required 33% of electricity supplied by utilities to come from renewable sources by 2020. The RPS was recently expanded with Senate Bill SB 100 to require 60% of electricity to be from renewable sources by 2030 and 100% of electricity to be from carbon neutral sources by 2045 (SB-100 2018). PG&E's estimated carbon intensity factor was adjusted for existing conditions, for each year of concurrent construction and operation and for full buildout based on the criteria established in the California RPS, as shown in **Table 29**.

GHG emissions from water and wastewater sources at the existing site were evaluated based on 2019 data. Existing land uses at the site include retail, offices, a health center, industrial manufacturing, research and development, and warehouse buildings, and parking lots. As discussed above, only net new square footage at the Hamilton Avenue Parcels North and South were included in the Project analysis because that represents the change from existing, baseline conditions.

Water use rates for the Project were provided by the Project Applicant, as shown in **Appendix C**. Water use at the Hamilton Avenue Parcels North and South were estimated using CalEEMod default rates. Summarized usage rates can be found in **Table 31**.

Emissions from water and wastewater use at existing offices, warehouses, and parking lots were estimated using CalEEMod equivalent methodologies with default data assumptions for San Mateo County, based on existing land use areas as listed in **Table 1**.

Water and wastewater emissions are summarized in **Table 32**.

### 2.3.6 Solid Waste Disposal

Indirect GHG emissions associated with waste disposal include $CH_4$ generation from the decomposition of waste and the $CO_2$ emissions associated with the combustion of $CH_4$, if applicable. GHG emissions associated with non-landfill diverted waste streams were not considered because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions. Waste diversion alternatives may result in differences in life-cycle emissions of GHGs, but it is not appropriate to combine life-cycle emissions for only one category of emissions.

Biogenic $CO_2$ emissions were not included when the ARB analyzed the GHG emissions inventory under Assembly Bill 32 (AB32). Therefore, they were not included in the emissions inventory.

Emissions from the disposal of solid waste were calculated using default solid waste generation rates from CalEEMod for San Mateo County. In order to reduce waste disposal, Meta diverts 82% of solid waste from landfill disposal.[18] The diverted waste would be composted or recycled. As a result, an 82% reduction was applied to the default solid waste generation rates for the Campus District, as shown in **Table 33**. In 2016, the City implemented zero waste management plan with the goal of diverting 90% of waste from Life Sciences, Office, and Mixed Use Residential zoning districts by 2035 (City of Menlo Park); however, these diversion rates were conservatively excluded from the analysis.

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[18] The 82% diversion rate was determined using waste disposal and diversion data for 2019 provided by the Project Applicant via email communication on August 2, 2021, as shown in **Appendix A**.

GHG emissions from solid waste disposal sources at the existing site were evaluated. Existing land uses at the site include offices, a health center, industrial, commercial, and warehouse buildings, and parking lots. Emissions from existing land uses that would be affected by the Project and Project emissions were estimated using CalEEMod equivalent methodologies with default data assumptions based on existing land use areas as listed in **Table 1.**. A diversion rate of 82% was also applied to the existing office building land use since the waste diversion program is currently in place.

Solid waste disposal emissions from both the existing site and the Project can be found in **Table 34**.

### 2.3.7 Area Sources

GHG and CAP emissions from area sources, such as landscaping equipment, consumer products, and architectural coating, were estimated using CalEEMod default values and equivalent methodologies based on the type and size of land uses associated with the Proposed Project. The residential units would not include any hearths, so emissions from hearths were not estimated.

GHG emissions from area sources at the existing site were evaluated for 2019.[19] Emissions were estimated using CalEEMod equivalent methodologies with default data assumptions based on existing land use areas as listed in **Table 1**.

#### 2.3.7.1 Architectural Coating

Operational architectural coatings include the reapplication of paint and coatings on interior and exterior surfaces, which result in emissions of ROGs. CalEEMod default assumptions were used to calculate the building surface area that would be coated, as well as the application rate and indoor and outdoor ROG emission factors based on BAAQMD Regulation 8 Rule 3 paint VOC regulations (BAAQMD 2009). The unmitigated architectural coating emissions are summarized in **Table 35**. Mitigated emissions assume that Project indoor painting will utilize super-compliant coatings, which are paints that have been reformulated to exceed the SCAQMD's Rule 1113 (Architectural Coatings) requirements,[20] as shown in **Table 36**Table 36.

#### 2.3.7.2 Consumer Products

Consumer product emissions come from various non-industrial solvents, including cleaning supplies, kitchen aerosols, cosmetics, and toiletries, which emit ROGs during their use.

CalEEMod provides a statewide consumer products emission factor based on the ARB 2008 emissions inventory. (CAPCOA 2020b) For this analysis, a San Mateo County specific emission factor was developed based on the emissions from consumer products from the ARB 2020 emissions inventory for San Mateo County and the building square footage in the county using the same methodologies utilized in CalEEMod, as shown in **Table 37.**Table 37

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[19] As discussed above, only net new square footage at the Hamilton Avenue Parcels North and South were included in the Project analysis because "net new" represents the change from baseline.

[20] Assumes "super compliant" architectural coatings for indoor building surfaces based on more stringent VOC limits from South Coast Air Quality Management District (SCAQMD) Rule 1113. South Coast Air Quality Management District. Super Compliant Architectural Coatings per Rule 1113. Available at: http://www.aqmd.gov/home/programs/business/business-detail?title=super-compliant-coatings&parent=other-low-voc-products.

The emission factor for the parking area and parks are the default values for the land uses from the CalEEMod User's Guide.

Consumer product emissions are summarized in **Table 38**.

#### 2.3.7.3 Landscaping Equipment

Emissions from landscaping equipment were calculated using CalEEMod and based on information regarding building square footage and acreage, as well as CalEEMod defaults. The recent law (Assembly Bill 1346) banning the sale of gasoline-powered landscaping equipment by 2024 was conservatively not accounted for, since it is unknown how the law will affect emissions due to non-electric equipment already in operation. These emissions are shown in **Table 39** and CalEEMod output files are shown in **Appendix D.**[21]

### 2.3.8 Net Operational CAP and GHG Emissions Summary

As discussed above, the Project would replace existing office, recreational, commercial, industrial and warehouse buildings, and surface parking facilities. Therefore, total operational emissions associated with the Proposed Project are the difference between emissions from the new land uses and emissions from existing land uses that would no longer be present. Existing emissions were subtracted from Proposed Project emissions for total net emissions from the Project. During Project operation, annual operational emissions were averaged over 365 days to give average daily operational emissions.

Net unmitigated and mitigated CAP emissions are summarized in **Table 40** and **Table 41**, respectively. Operational GHG emissions are summarized in **Table 42**. Mobile GHG emissions are 16,766 MT/yr. These emissions are not included in the estimate of net GHG emissions since GHG impacts from mobile sources are evaluated based on VMT, as discussed in Section 1.3.2.

Summary **Table B**, below, summarizes these emissions.

**Summary Table B. Summary of Maximum Annual Average Daily Net Operational CAP Emissions and Annual Net Operational GHG Emissions**

| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ |
|---|---|---|---|---|---|
| | lb/day | | | | MT/year |
| BAAQMD Threshold of Significance | 54 | 54 | 82 | 54 | N/A |
| Unmitigated Emissions | 88 | 21 | 37 | 7.0 | -1,056 |
| *Exceed Threshold?* | *Yes* | *No* | *No* | *No* | *N/A* |
| Mitigated Emissions | 80 | 21 | 37 | 7.0 | -1,056 |

[21] CalEEMod was only used to estimate landscape emissions only. Appendix D contains the non-default inputs to CalEEMod used to calculate these landscape emissions.

| | | | | | |
|---|---|---|---|---|---|
| *Exceed Threshold?* | *Yes* | *No* | *No* | *No* | *N/A* |
| Source: Table 40, Table 41, and Table 42. | | | | | |

## 2.4 Combined Construction and Operational Emissions Summary

This analysis conservatively assumed that the buildings constructed in each year of the construction program would be occupied and fully operational upon completion. This is conservative because occupancy and operation of each phase would likely ramp up over time.

Construction is expected to occur during Project operation because the Project will be constructed over a period of several years. In years when construction is scheduled to coincide with Project operation, construction emissions were combined with operational emissions. The combined construction and operational emissions were compared with average daily emissions thresholds, using the 365 days per year to average annual emissions for both construction and operations, as shown in **Table 43** and **Table 44**.[22]

**Summary Table C. Summary of Annual Average Daily Net Construction and Operational CAP Emissions for Maximum Year**

| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|
| | lb/day | | | |
| BAAQMD Threshold of Significance | 54 | 54 | 82 | 54 |
| Unmitigated Emissions | 97 | 72 | 37 | 7.0 |
| *Exceed Threshold?* | *Yes* | *Yes* | *No* | *No* |
| Mitigated Emissions | 80 | 21 | 37 | 7.0 |
| *Exceed Threshold?* | *Yes* | *No* | *No* | *No* |
| Source: Table 43 and Table 44 | | | | |

## 2.5 Proposed Mitigation Measures

As discussed, several mitigation measures were incorporated into the analysis. The measures are summarized below

[22] As discussed above, activity is expected on most Saturdays. Even if 6 days per week (312 days per year) were used to average emissions for construction, conclusions would not change.

**Architectural Coatings.** The applicant shall use super-compliant architectural coatings during construction and operation for all buildings, which shall have VOC content that meet SCAQMD Rule 1113 Architectural Coatings as revised on February 5, 2016.

**Tier 4 Construction Equipment.** To reduce construction emissions to below the 2017 BAAQMD CEQA Air Quality Guidelines, the Project Applicant shall either:

- Ensure all off-road construction equipment with greater than 25 hp and operating for more than 20 hours total over the entire duration of construction activities have engines that meet or exceed either USEPA or ARB Tier 4 Final offroad emission standards. The exception to this requirement is for a cumulative total 618,028 horsepower-hours over the duration of construction activities before residents move on-site in Year 5 and 34,716 horsepower-hours over the duration of construction activities after residents move on-site in Year 5 can be operated with off-road construction equipment that meets Tier 2 standards or better.

or

- Prior to commencing construction, provide supplemental analysis prepared by a qualified air quality specialist to the City for approval that shows that emissions of ROG and $NO_X$, excess lifetime cancer risk, and $PM_{2.5}$ concentration would not exceed the thresholds from the 2017 BAAQMD CEQA Air Quality Guidelines using the mix of equipment proposed by the applicant.

**Construction Fugitive Dust Emissions.** The following BAAQMD Best Management Practices (BMPs) for fugitive dust control shall be required for all construction activities within the project area. These measures would reduce fugitive dust emissions primarily during soil movement and grading, but also during vehicle and equipment movement on unpaved project sites.

Basic BMPs that Apply to All Construction Sites

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 streets, 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 five minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of 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. A publicly visible sign shall be posted with the telephone number and person to contact regarding dust complaints. This person shall respond and take corrective action, if necessary, within 48 hours. BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.

# 3. ESTIMATED AIR CONCENTRATIONS

To evaluate the health risks and concentration of air toxics upon the surrounding community, BAAQMD recommends estimating concentrations using air pollution dispersion modeling. The methodologies used to evaluate emissions for the Proposed Project and cumulative HRA impacts are based on the most recent BAAQMD CEQA Guidelines (BAAQMD 2017) and the most recent Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA 2015a).

## 3.1 Chemical Selection and Sources of Emissions

The Project would emit TACs from the combustion of gasoline and diesel fuels. The cancer risk and chronic non-cancer analyses in the HRA for the Project were based on DPM concentrations from diesel combustion and total organic gases (TOG) concentrations from gasoline combustion.

Diesel exhaust, a complex mixture that includes hundreds of individual constituents, is identified by the State of California as a known carcinogen (California Environmental Protection Agency [Cal/EPA], OEHHA 1998). Under California regulatory guidelines, DPM is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole. Cal/EPA and other proponents of using the surrogate approach to quantifying cancer risks and non-cancer chronic HI associated with the diesel mixture indicate that this method is preferable to use of a component-based approach. A component-based approach involves estimating risks for each of the individual components of a mixture. Critics of the component-based approach believe it will underestimate the risks and HI associated with diesel as a whole mixture because the identity of all chemicals in the mixture may not be known and/or exposure and health effects information for all chemicals identified within the mixture may not be available. Furthermore, Cal/EPA has concluded that "potential cancer risk from inhalation exposure to whole diesel exhaust will outweigh the multi-pathway cancer risk from the speciated components" (OEHHA 2015b). BAAQMD states "diesel exhaust particulate matter should be used as a surrogate for all TAC emissions from diesel-fueled compression-ignition internal combustion engines" (BAAQMD Rule 2-5).

The Cal/EPA-approved toxicity values for DPM were used to evaluate health impacts from construction and operational diesel fueled sources (Cal/EPA 2020).

Health effects from exhaust and evaporation from gasoline combustion were based on specific TAC emissions. Emissions of TOG from gasoline-fueled vehicles were speciated using organic chemical profiles from BAAQMD as shown in **Table 45** (BAAQMD 2012a).[23] The Cal/EPA-approved toxicity values for each TAC were used to evaluate health impacts from operational gasoline fueled sources (Cal/EPA 2020) as shown in **Table 46**.

There is currently no acute non-cancer toxicity value available for DPM and acute HI from roadways is expected to be minimal, as discussed in **Section 1.3**. Thus, an acute HI from the Project was not estimated.

[23] Speciation profile is from BAAQMD's Recommended Methods for Screening and Modeling Local Risks and Hazards (BAAQMD 2021a), Table 14, Toxic Speciation of TOG due to Tailpipe Emissions, and Table 15, Toxic Speciation of TOG due to Evaporative Losses.

### 3.1.1 Construction Phase

The cancer risk and chronic hazards in the HRA for the Project construction were based on TAC emissions from off-road diesel construction equipment, on-road vendor vehicles, and on-road diesel hauling trucks. Accordingly, the chemicals evaluated in the HRA for the construction phase were DPM emissions in diesel exhaust and $PM_{2.5}$ emissions from exhaust, tire wear and brake wear, and fugitive dust. DPM emissions are assumed to be equal to exhaust $PM_{10}$ from on- and off-road construction equipment.

Demolition of existing buildings has the potential to release additional TACs from the release of TACs in the buildings themselves. TACs that should be considered in building demolition include lead and asbestos. Before demolition, we understand the potential for lead paint or asbestos will be identified and all lead paint and asbestos will be removed in accordance with ARB and BAAQMD rules and regulations before demolition of the building occurs. Because the lead and asbestos remediation would occur before demolition and construction and would follow all regulations to reduce impacts to below a level of concern, these sources were not included in the HRA.

### 3.1.2 Operational Phase

The cancer risk and chronic non-cancer analysis for the Project operation are based on TAC emissions from on-road traffic and diesel-powered emergency generators. The chemicals evaluated in the HRA include $PM_{2.5}$ emissions (assumed to be engine exhaust from vehicles and generators, and brake wear, tire wear, and entrained dust from vehicles), DPM emissions (assumed to be exhaust $PM_{10}$ from combustion from diesel vehicles and on-site generators) and speciated evaporative and exhaust TOGs from on-road emissions from gasoline vehicles.

BAAQMD recommends evaluating impacts from all roadways with traffic of over 10,000 vehicles per day. Major roadways around the Project site include Bayfront Expressway, University Ave, and Willow Road. In addition, vehicles associated with the Project are also expected to use Adams Drive, Adams Court, and O'Brien Drive. Regardless of whether Project traffic exceeds 10,000 vehicles per day on these roadways, health impacts from Project traffic on these roadways were evaluated at on- and off-site receptors in the vicinity of these roadways.

Project traffic consists of on-site, off-site, and shuttle traffic. Onsite traffic is represented by the Cars fleet type and shuttle traffic is represented by the Shuttles fleet type. Offsite traffic for the Campus District is represented by a unique fleet mix, as described in **Section 2.3.1.1**, which combines Cars, Trucks, On-Demand, and Shuttles fleet types; however, shuttles are represented in its own fleet mix, as described above. Offsite traffic for the Town Square and Residential/Shopping District is represented by the default San Mateo County Mix. A summary of traffic volumes by roadway segment and fleet is summarized in **Table 47.**[24]

All fleet types except the Shuttle fleet mix are expected to contain vehicles that run on both diesel, whose health impacts are evaluated using DPM, and gasoline, whose health impacts are evaluated using evaporative and exhaust TOG. The Shuttle fleet mix is conservatively

[24] An on-site assessment of Hamilton Avenue Parcels North and South was not analyzed because volumes are minor and driving distance on-site are short.

assumed to be comprised of all diesel, as a result, all emissions from the Shuttle fleet mix contain only DPM emissions while emissions from all other fleet types contain both DPM emissions and evaporative and exhaust TOG. The DPM emission factor for Cars, On-Demand, Trucks, and the San Mateo Default Fleet vehicle types was determined from the $PM_{10}$ running and idling exhaust emission factors discussed above. These $PM_{10}$ emission factors account for emissions from both gasoline and diesel; however, DPM emissions are only attributable to diesel-run vehicles. Therefore, the portion of the total $PM_{10}$ that is actually DPM was calculated as the sum of $PM_{10}$ running and idling exhaust emissions from diesel vehicles divided by the sum of all $PM_{10}$ running and idling exhaust emissions for vehicles. A summary of traffic emission factors can be found in **Table 48**.

## 3.2 AERMOD Modeling

The most recent version of the American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD Version 21112) was used to evaluate ambient air concentrations of DPM, $PM_{2.5}$ and TOGs at on- and off-site receptors (USEPA 2021). For each receptor location, the model generates air concentrations that result from emissions from multiple sources. In this case, air dispersion factors as unit emissions were modeled and air concentrations were calculated in a subsequent post-processing step.

Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological data, topographical data, and receptor parameters. When site-specific information is unknown, default parameter sets that are designed to produce conservative (i.e., overestimates of) air concentrations were used (USEPA 2021).

### 3.2.1 Meteorological Data

Air dispersion modeling applications require the use of meteorological data that ideally are spatially and temporally representative of conditions in the immediate vicinity of the site under consideration. For this analysis, meteorological data collected from Palo Alto Airport (KPAO) and San Carlos Airport (KSQL) were used.

The Palo Alto Airport is located approximately 2.2 miles southeast of the Project site, making it a good candidate for representative meteorological data for dispersion modeling. The meteorological conditions shown in the data from Palo Alto Airport most closely matched on-site measurements observed adjacent to the Project site, which makes it the preferred station for representative data. Unfortunately, like many smaller Automated Surface Observing System (ASOS) stations, meteorological data are only collected during daylight hours. However, the San Carlos Airport collects data 24-hours per day. San Carlos Airport is 6 miles north west of the Project site and is the next closest meteorological station to the Project Site.

In an effort to develop a complete data set, in AERMET the Palo Alto Airport was selected as the "on-site" meteorological station and the San Carlos Airport, was selected as the "surface" station in AERMET. With these assumptions, data from the Palo Alto Airport will be used when available and data from the San Carlos Airport will be used when data is not available from Palo Alto Airport (i.e., non-daylight hours).

Meteorological data from 2012-2016 was used as these years were the most recent years with the most complete data set of meteorological data. A precipitation analysis was performed for both the on-site and surface stations using surface parameters obtained using the latest version of AERSURFACE, v20060. The data were processed using the Adjust U* option (ADJ_U*), a method that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u*).

### 3.2.2 Terrain and Land Use Considerations

Elevation and land use data were imported from the National Elevation Dataset (NED) maintained by the United States Geological Survey ([USGS] 2013) in NED 1/3 arc sec.

An important consideration in an air dispersion modeling analysis is whether or not to model an area as urban. Due to the proximity of the project to the San Francisco Bay and marshland, the default rural option was used in the modeling. The rural option tends to produce more conservative concentrations than the urban option due to the enhanced turbulence associated with urban environments due to the additional mixing associated with the heat island effect.

### 3.2.3 Building Downwash

Turbulent eddies can form on the downwind side of buildings and may cause a plume from a stack or point source located near the building to be drawn towards the ground to a greater degree than if the building were not present. This is referred to as the "building downwash" effect. The effect can increase the resulting ground-level pollutant concentrations downwind of a building. AERMOD takes this effect into account for sources modeled as point sources. The dimensions and locations of all on-site buildings were used, to allow AERMOD to incorporate algorithms to evaluate the downwash effect on dispersion of point sources. Building heights were obtained from the proposed Willow Village Master Plan Conditional Development Permit (Peninsula Innovation Partners 2021). The direction-specific building downwash dimensions were determined by the latest version (04274) of the Building Profile Input Program, PRIME (BPIP PRIME). As discussed in **Section 3.2.5**, point sources were used only to model the Project generators, so building downwash was only evaluated in the Project operational generator modeling.

### 3.2.4 Emission Rates

Emissions were modeled using the $\chi/Q$ ("chi over q") method, such that each source has a unit emission rate (i.e., 1 gram per second [g/s]), and the model estimates dispersion factors (with units of micrograms per cubic meter (([µg/m$^3$])/[g/s]). Actual emission rates were multiplied by the dispersion factors to obtain concentrations.

#### 3.2.4.1 Construction Emission Rates

For the construction phase, emitting activities were modeled to reflect the actual hours of the day that construction activity would occur. Emissions were modeled as occurring between 7 AM and 6 PM, consistent with the expected construction hours for the Project.[25] The AERMOD EMISFACT option was used to limit emissions to this time period.

For annual average ambient air concentrations over the construction phase, the estimated annual average dispersion factors were multiplied by the annual average emission rates. The emission rates would vary day to day, with some days having no emissions. To estimate an annual average, the model assumes a constant emission rate during the entire year. Thus,

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25 Construction activity is assumed to start at 7 AM to conservatively consider more morning hours in the dispersion analysis, but no equipment will be operated that will violate the Menlo Park noise ordinance, which has a lower construction noise threshold from 7 AM to 8 AM than from 8 AM to 6 PM.

the average emissions rates were calculated by taking the total mass of emissions and dividing by the hours considered in the model (11 hours per day, 365 days per year). The equipment would be expected to operate at most 8 hours per day, but this 8-hour period can occur anytime in the 11-hour window from 7 AM to 6 PM. Because the exact timing of when the equipment would operate is not known, the eight hours of emissions were averaged over these 11 hours of meteorology. While construction using heavy equipment is expected to generally occur Monday through Friday, the emissions were averaged over 365 days per year as meteorology conditions are not dependent upon day of the week. Weekends were not excluded from the meteorology data in order to generate more representative averages.

#### 3.2.4.2 Operational Emission Rates

Emergency generators were assumed to be tested at any hour of day; as a result, no variable emission rate factor was applied.

Traffic emission rates were calculated based on the actual fleet breakdown, as provided by the Project Applicant. The diurnal pattern of traffic volumes for operations (high volumes during rush hour and during the day, with low volumes overnight) was incorporated using the AERMOD EMISFACT option and percentage of traffic by hour. The traffic by hour was developed using ratios of hourly trip rates from EMFAC2021 in San Mateo County for all vehicle types, as shown in **Table 49**. Traffic by hour for the shuttles were developed using the shuttle schedule, as shown in **Table 49**.

### 3.2.5 Source Parameters

#### 3.2.5.1 Construction Sources

Source location and parameters are necessary to model the dispersion of air emissions. For construction, area sources were used to represent the on-site activity in AERMOD. The on-site construction exhaust sources were modeled with a release height of 5 meters (m) (SCAQMD 2008) and an initial vertical dimension of 1.16 m (USEPA 2019). Fugitive dust sources from grading, demolition, and truck hauling during construction were modeled with a release height of 0 meters and an initial vertical dimension of 1 m (SCAQMD 2008). Construction activity associated with off-site feeder lines were represented as adjacent volume sources. Construction area source group locations are presented in **Figures 3, 4a and 4b**.[26]

Exhaust and fugitive dust emissions from heavy-duty haul and vendor trucks on roadways were modeled using line sources. The line source width was the width of the road plus six meters, the modeled release height was 2.55 m, and the initial vertical dimension was 2.37 m, consistent with the USEPA haul road guidance (USEPA 2012). On-road construction worker trips would have negligible impact and therefore were not included in the HRA analysis for excess lifetime cancer risk and chronic HI. $PM_{2.5}$ emissions associated with on-road construction worker trips were included in the construction HRA analysis for $PM_{2.5}$ concentration modeling. Construction on-road source group locations are presented in **Figure 5**. **Table 50** summarizes the construction modeling parameters that were used in AERMOD.

[26] Since it is not known whether the feeder lines associated with the PG&E work for off-site improvements would be installed in University Avenue or Willow Road, emissions were conservatively applied to both routes, essentially doubling the emissions for the health risk assessment for this activity.

#### 3.2.5.2 Operational Sources

The Project generators were modeled as point sources. Project-specific stack heights, taken as the height of the building, were used in combination with default modeling parameters for generator sources, including stack diameter, temperature, and velocity, as reported by BAAQMD (STI 2011). The impact of the existing generator that will be removed was modeled using specifications provided by the Project Applicant and subtracted from the impact of the proposed new generators. The pump station associated with the Project may be located in one of two possible locations: 1) in the dog park (referred to as Location 1) or 2) in the parking lot of the park in the southwest portion of the site (referred to as Location 2). The pump station has an associated 755 horespower generator. Because the location of this generator has not been finalized, both locations were analyzed and the maximum health impact from either location is reported. Source parameters for the generators are summarized in **Table 51**. The location of the modeled generators is provided in **Figure 6a**.

On-road traffic sources were modeled as line sources following USEPA guidelines for this type of activity (USEPA 2012). Onsite passenger vehicles were modeled with a release height of 1.70 m, consistent with the San Francisco Community Risk Reduction Plan – HRA (SFDPH). Modeled on-site vehicle routes can be found in **Figure 6b**. Since passenger vehicles occupy the majority of off-site Project traffic, off-site traffic was modeled with a release height of 1.70 m, consistent with the San Francisco Community Risk Reduction Plan (SFDPH). Modeled off-site traffic routes can be found in **Figure 7**; as discussed, modeled roadways include Bayfront Expressway, Willow Road, University Avenue, and O'Brien Drive.

Intercampus shuttles were modeled separately, using a release height of 3.39 m, based on the actual vehicle type provided by the Project Applicant, as discussed in more detail in **Table 51.** Modeled shuttle routes can be found in **Figure 8**. The initial vertical dimensions for all pollutants were calculated consistent with USEPA Haul Road Guidance (i.e., plume height/2.15).

**Table 51** summarizes the operational phase modeling parameters that were used in AERMOD.

### 3.2.6 Receptors

TAC concentrations were estimated at both on-site and off-site sensitive receptor populations. As discussed in **Section 1.3.3**, sensitive receptors include areas with residents, schools, daycare centers, parks, hospitals and senior care facilities. Recreational areas near the Project site were also evaluated.

Residential and recreational receptors were identified using zoning maps for Menlo Park (City of Menlo Park 2019) and East Palo Alto (City of East Palo Alto 2017). Residential and recreational areas were modeled as a grid with 20 m (65.6 feet) spacing within 500 m of the Project site and 40 m spacing within 1,000 m of the project site.

Other sensitive receptor locations were identified using a report from Environmental Data Resources (EDR). The EDR report identified schools, daycare centers, nursing homes and hospitals near the Project site. These locations were modeled as discrete locations.

Off-site receptors were modeled at the breathing height of 1.8 m, consistent with the BAAQMD CEQA Air Quality Guidelines (BAAQMD 2017).

On-site receptors were modeled at the breathing height for each floor of the proposed buildings.

Maximum average annual dispersion factors were estimated for each receptor location.

**Figure 2** includes a map of both off-site and on-site sensitive receptor locations that were used in the HRA.

### 3.2.7 Modeling Adjustment Factor

OEHHA (2015a) recommends applying an adjustment factor to the annual average concentration modeled assuming continuous emissions (i.e., 24 hours per day, seven days per week), when the actual emissions are less than 24 hours per day and exposures are concurrent with activities occurring as part of the Project.

For construction activities, emissions only impact receptors during certain hours of the day when activities are occurring. However, the emissions modeled during those hours were annualized assuming 24 hour per day in the modeling outputs. Thus, a modeling adjustment factor (MAF) was applied to the annual average concentration used in the evaluation to account for an emissions schedule that is not occurring 24 hours per day, seven days per week, where the exposure takes place preferentially during construction hours.

Operational activities are expected to occur all day; therefore, the annual average concentration was not adjusted for concentrations from operational activities.

Resident children were assumed to be exposed to annual construction and operational emissions (averaged from actual operating hours) 24 hours per day, seven days per week. This assumption is consistent with the modeled annual average air concentration for construction (24 hours per day, seven days per week). Thus, the annual average concentration for construction was not adjusted for the residential population.

The MAF for the daycare center and school receptors assumes receptors are present only during the hours of the day emissions are occurring. Therefore, a MAF of 2.55 was applied to the annual average concentration for construction ([24 hours/11 hours] * [7 days/6 days]) for the daycare and school populations, since construction would occur seven days per week.[27]

The MAF for the recreational receptor assumes receptors may be present throughout the hours of the day emissions are occurring. A MAF of 2.55 was applied to the annual average concentration for construction ([24 hours/11 hours] * [7 days/6 days]) for the recreational population, since construction would occur seven days per week. The MAFs are presented in **Table 52**. [28]

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[27] Even if the MAF was based on a construction schedule of 5 days per week, conclusions would not change. The maximally exposed individual receptor is a resident, which is not affected by the MAF.

[28] Even if the MAF was based on a construction schedule of 5 days per week, conclusions would not change. The maximally exposed individual receptor is a resident, which is not affected by the MAF.

# 4. CARBON MONOXIDE ANALYSIS

Carbon Monoxide (CO) emissions from traffic are expected to be below significance levels if the following criteria is met:

1. Project is consistent with an applicable congestion management program established by the county congestion management agency for designated roads or highways, regional transportation plan, and local congestion management agency plans.
2. The project traffic would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour.
3. The project traffic would not increase traffic volumes at affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, below-grade roadway). (BAAQMD 2017)

The San Mateo County Congestion Management Program (CMP) requires new development projected to add 100 or more peak hour trips to the CMP roadway network to implement Transportation Demand Management (TDM) measures that would reduce project impacts. As discussed above, the Project has a comprehensive TDM program that reduces VMT consistent with City requirements and with the TDM program, the Project would not conflict with the CMP. As shown in **Table 47,** traffic at all roadways around the Project are expected to be lower than 44,000 vehicles per hour. The Willow Road Tunnel may be considered an intersection where vertical and/or horizontal mixing is limited. Traffic through the Willow Road Tunnel would be much below 24,000 vehicles per hour since this tunnel is only used by Project shuttles and trams, bicycles, and pedestrians. The Project is not projected to produce more than 24,000 trips per hour. Therefore, additional analysis is not needed. As such, operational traffic is expected to be a minor contributor to operational CO emissions.

Emergency generators would also emit CO. Emergency generators are subject to permitting with the BAAQMD and are subject to federal and state emissions standards that are designed to avoid impacts on the community and environment. Therefore, emergency generators are not expected to cause CO hotspots.

# 5. ODOR ANALYSIS

The Project is a mixed use commercial and residential development, and therefore is not anticipated to be a potential odor source. However, the Project was evaluated against the three-pronged approach proposed in the ConnectMenlo EIR.

First, the Project was evaluated against the land uses identified in BAAQMD's Odor Screening Distances (BAAQMD 2017). BAAQMD's Odor Screening Distances Table identifies land uses that could create objectional odors and distances where odors are not expected to be experienced. The Project may contain minor composting and recycling operations typical of a mixed-use development. Recycling and composting facilities are land uses listed in BAAQMD's Odor Screening Distances Table. However, these operations at the Project would not be considered similar in size to what would be considered a Composting Facility or Recycling Facility and therefore should not be considered.

The Project would also contain a wastewater pump station in the southwest corner of the site. Wastewater Pumping Facilities are land uses listed in BAAQMD's Odor Screening Distances Table. While the Wastewater Pumping Facilities considered in the Odor Screening Distance is likely a much larger scale than the one envisioned for the Project, the pumping station at Willow Village may have the potential to emit objectionable odors. Therefore, the pump station design should include a molecular neutralizer that would convert hydrogen sulfide to harmless, biodegradable effluent, ensuring that odors from the pump station would be appropriate for urban areas. With the installation of the molecular neutralizer, the Project is not expected to expose sensitive land uses to objectionable odors expected in urban areas.

As stated in the ConnectMenlo EIR, the following General Plan goals and policies would serve to minimize potential conflicts between land uses:

- Goal LU-2: Maintain and enhance the character, variety and stability of Menlo Park's residential neighborhoods.
    - Policy LU-2.3: Mixed Use Design. Allow mixed-use projects with residential units if project design addresses potential compatibility issues such as traffic, parking, light spillover, dust, odors, and transport and use of potentially hazardous materials.
- Goal LU-4: Promote the development and retention of business uses that provide goods or services needed by the community that generate benefits to the City, and avoid or minimize potential environmental and traffic impacts.
    - Policy LU-4.5: Business Uses and Environmental Impacts. Allow modifications to business operations and structures that promote revenue generating uses for which potential environmental impacts can be mitigated.

As stated above, the Project is not expected to create objectionable odors to sensitive receptors and thus would not create compatibility uses related to odor as stated in Policy LU-2.3. Specifically, the office, residential, and commercial uses proposed by the Project are compatible with each other because none produce substantial objectionable odors. All cooking areas in commercial kitchens will be covered with hoods. The exhaust from culinary uses is intended to go to the roof of the buildings and be disbursed with grease rated fans. In this case the odors dissipate before they can get back to occupied areas. For areas with low roofs needing grease exhaust that is adjacent to occupied areas, the Project proposes to use a pollution control unit (PCU) to clean the air. The wastewater pumping station would be equipped with a molecular neutralizer, which would reduce odors before release to the environment to acceptable levels in urban areas. Further, consistent with Policy LU-4.5, the Project would develop and retain business uses without creating objectionable odors. Therefore, the Project is consistent with the goals and policies in the General Plan related to odor.

Last, BAAQMD Regulation 7 contains requirements on the discharge of odorous substances after the Air Pollution Control Officer (APCO) receives odor complaints from ten or more complainants within a 90-day period, alleging that a person has caused odors perceived at or beyond the property line of such person and deemed to be objectionable by the complainants in the normal course of their work, travel or residence [BAAQMD 7-102]. The operations within the Project will be subject to this regulation and will comply with the requirements if the regulation becomes applicable via BAAQMD 7-102, which is not expected. Therefore, the Project would be in compliance with BAAQMD Regulation 7.

Because the Project does not contain land uses in BAAQMD’s odor screening distances, is consistent with the goals and policies of the General Plan related to odor, and would be in compliance with BAAQMD Regulation 7, the impact of the Project would be considered less than significant with respect to odors.

# 6. HEALTH RISK ASSESSMENT

In February 2015, OEHHA released the updated Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA 2015a), which combines information from previously released and adopted technical support documents to delineate OEHHA's revised risk assessment methodologies based on current science. The BAAQMD issued guidelines on adopting the OEHHA 2015 Guidance Manual (BAAQMD 2020c). This evaluation utilizes the 2015 methodology; details of which are discussed below.

## 6.1 Project Construction Sources Evaluated

As discussed in **Section 3.1**, excess lifetime cancer risk, non-cancer chronic hazard index and $PM_{2.5}$ concentration were evaluated for on-site and off-site sensitive receptor exposure to emissions from Proposed Project construction (construction off-road equipment and nearby off-site vehicles). Because buildings will be completed with residents moving in as construction occurs around them, the impact of subsequent construction on on-site residents was evaluated, as discussed below. All modeled construction source groups included in the HRA are presented in **Table 53**. Construction source group locations are presented in **Figures 3, 4,** and **5**.

## 6.2 Project Operational Sources Evaluated

For Project operations, excess lifetime cancer risk, non-cancer chronic hazard index and $PM_{2.5}$ concentration from on-site and off-site sensitive receptor exposure to emissions from Proposed Project generators and Proposed Project operational-related traffic were evaluated. The existing generator currently located at the Project site and existing traffic counts from uses that will be removed as part of the Project were evaluated and subtracted from Project risks in the HRA analysis, resulting in health impacts from net new operational emissions. Operational source group locations are presented in **Figures 6**, **7**, and **8**.

Health risks were estimated from construction and operations, separately as well as together to conservatively estimate the combined cancer risk effect of construction activities and Project operation.

## 6.3 Exposure Assessment

*Potentially Exposed Populations*: This analysis evaluates on- and off-site sensitive receptors based on OEHHA 2015 Hot Spots Guidelines.

Emissions and exposure to sensitive populations would vary across the four year and eleven-month construction period. Therefore, multiple exposure scenarios were evaluated to capture the period of maximum impact on each sensitive population and location. Health impacts were evaluated in four exposure scenarios: 1) exposure beginning at the start of construction; 2) exposure beginning at the start of Grading and Utilities construction for the second area; 3) exposure beginning at the conclusion of Town Square and Residential/Shopping District construction when residents would move in; and 4) exposure beginning at the conclusion of Project construction when the Project is fully operational. **Figure 9** shows a Gantt chart of the construction schedule and the four exposure scenarios.

The four exposure scenarios were developed to capture the maximum risks from Project construction and operations. Due to the complex timing of Project construction, the selection of exposure scenarios took into consideration the magnitude of potential activity associated with each year. Scenario 1 starts at the beginning of construction and captures initial demolition and grading. Scenario 2 starts after construction has begun and is intended to capture the maximum amount of overlapping construction activities that would occur during Project construction. Starting a receptor's exposure any time after these two scenarios would ignore the heaviest construction that occurs at the beginning of the Project. Therefore, these two exposure scenarios are designed to capture the maximum construction impacts. Scenario 3 starts when on-site residents move into the completed buildings while construction is still ongoing around them and captures overlapping construction and operational impacts on on-site residents for informational purposes. Lastly, Scenario 4 captures the fully operational Project once construction has concluded. The four exposure scenarios capture the maximum amount of health risk for on- and off-site receptors experiencing impacts from construction and operations.

For Scenarios 1 and 2, the following off-site receptor types were analyzed: resident child, daycare child, elementary school child, high school child. For Scenario 3, the following on-site receptor types were analyzed: resident child and recreational child. Senior residents living in the affordable senior building were conservatively analyzed using the resident child receptor type, since children have higher exposure parameters (including breathing rate and age sensitivity factor) than seniors.

Scenario 3 analyzes the risk experienced by on-site receptors that would move into the completed buildings while construction is still ongoing around them. Maximum construction risks for off-site receptors are captured in Scenarios 1 and 2 since those exposure scenarios start closer to the start of construction and include more activity, which corresponds to higher impacts. Therefore, off-site receptor types are not included in Scenario 3. For Scenario 3, the construction schedule was used to determine which phases of construction a specific residential building was exposed to. If construction of another building was complete before a residential building became operational, any exposure to construction of the complete building was not included in the exposure assessment. More details can be found in our memorandum regarding "Refinement of Onsite Health Impacts for the Willow Village Project" dated May 17, 2022, shown in Appendix E.

For Scenario 4, all of the above receptor types were analyzed. Similar to Scenario 3, senior residents living in the affordable senior building conservatively analyzed using the resident child receptor type. Two daycare receptor types were analyzed. One daycare child receptor type assumed infants could attend the daycare. One daycare child receptor type assumed only children over 18 months could attend, which is the age range for the daycare at Wund3r School located south of the Project site.[29]

*Exposure Assumptions*: The exposure parameters used to estimate excess lifetime cancer risks for all potentially exposed populations for the construction evaluation for this analysis were obtained using risk assessment guidelines from OEHHA (OEHHA 2015a) and BAAQMD (BAAQMD 2020c). **Table 54** shows the proposed exposure parameters that were used for the HRA.

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[29] The Wund3r School is a year-round academic and play-based program for children ages 18-months through Pre-K.

*Calculation of Intake*: The dose estimated for each exposure pathway is a function of the concentration of a chemical and the intake of that chemical. The intake factor for inhalation, $IF_{inh}$, can be calculated as follows:

$$IF_{inh} = \frac{DBR * FAH * EF * ED * CF}{AT}$$

Where:

$IF_{inh}$ = Intake Factor for Inhalation ($m^3$/kg-day)

DBR = Daily Breathing Rate (L/kg-day)

FAH = Frequency of time at home (unitless)

EF = Exposure Frequency (days/year)

ED = Exposure Duration (years)

AT = Averaging Time (days)

CF = Conversion Factor, 0.001 ($m^3$/L)

The chemical intake or dose was estimated by multiplying the inhalation intake factor, $IF_{inh}$, by the chemical concentration in air, $C_i$. When coupled with the chemical concentration, this calculation is mathematically equivalent to the dose algorithm given in the current OEHHA Hot Spots guidance (OEHHA 2015a).

### 6.3.1 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and non-cancer endpoints. Toxicity values that are used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

Toxicity values for all TACs are summarized in **Table 46**.

### 6.3.2 Age Sensitivity Factors

The estimated excess lifetime cancer risks for a resident were adjusted using age sensitivity factors (ASFs) that account for an "anticipated special sensitivity to carcinogens" of infants and children as recommended in the OEHHA Technical Support Document (OEHHA 2009) and OEHHA 2015 Guidance (2015a). Cancer risk estimates were weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to two years of age and by a factor of three for exposures that occur from two years through 15 years of age. No weighting factor (i.e., an ASF of one, which is equivalent to no adjustment) was applied to ages 16 and older. **Table 54** presents the ASF values that were used for the HRA. **Table 55** through **Table 58** show the age sensitivity weighted intake factors by year and age bin by exposure scenario.

## 6.4 Risk Characterization

### 6.4.1 Estimation of Cancer Risks

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unitless probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).

The equation that was used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_{inh} = C_i \times CF \times IF_{inh} \times CPF \times ASF$$

Where:

$Risk_{inh}$ = Cancer risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular potential carcinogen (unitless)

$C_i$ = Annual average air concentration for $chemical_i$ (µg/m$^3$)

CF = Conversion factor (mg/µg)

$IF_{inh}$ = Intake factor for inhalation (m$^3$/kg-day)

$CPF_i$ = Cancer potency factor for $chemical_i$ (mg chemical/kg body weight-day)$^{-1}$

## 6.5 Estimation of Chronic Noncancer Hazard Indices

The potential for exposure to result in adverse chronic noncancer effects was evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the noncancer chronic reference exposure level (cREL) for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ).

$$HQ_i = C_i / cREL$$

Where:

$HQ_i$ = Chronic hazard quotient for chemical i

$C_i$ = Annual average concentration of chemical i (µg/m$^3$)

$cREL_i$ = Chronic noncancer reference exposure level for chemical i (µg/m$^3$)

### 6.6 Filtration of Indoor Air

Since January 1, 2020, California Title 24 has required all residential heating/cooling and ventilation systems to have Minimum Efficiency Reporting Value (MERV)-13 filters.[30,31] As Project construction would begin after January 1, 2020, residential units on the Project site would have filtration installed. MERV-13 filters have a dust spot efficiency percent of 80-90%.[32] These filters remove particulates from the air that are brought into the building for ventilation and remove particulates from the indoor air when the heating or cooling is recirculating air in the building.

The health impact for onsite residents was refined to account for the filtration of the outdoor air, as discussed in our memorandum "Refinement of Onsite Health Impacts for the Willow Village Project" dated May 17, 2022, shown in Appendix E. Conservative assumptions were incorporated which overestimate the concentrations after filtration is applied to account for residents' preferences and behaviours. However, these estimates were not relied upon in the final estimation of health impacts for onsite residents and are provided in Appendix E and Appendix F for information purposes.

### 6.7 Comparison to Thresholds

Health impacts from construction for each exposure scenario were compared to BAAQMD thresholds discussed in **Section 1.3.3**. Health impacts from operation starting at full buildout were compared to BAAQMD thresholds. Health impacts from Project construction and overlapping Project operations were added together to estimate the combined health risk impacts of construction activities and Project operation for each exposure scenario and were compared to the BAAQMD thresholds.

### 6.8 Health Risk Assessment Results

Health impacts from Project construction and Project operations were added together to estimate the combined health risk impacts of construction activities and operation for Scenarios 1, 2, and 3 discussed above.

#### 6.8.1 Impacts from the Project

A summary of results from the HRA is shown in **Summary Table D**. A breakdown of excess lifetime cancer risk from Project construction, operational generators, and operational traffic at the MEIR is shown in **Table 59**. The table also shows the Scenario for which the maximum was identified. Similar breakdowns for chronic HI and $PM_{2.5}$ concentration are shown in **Table 60** and **Table 61**, respectively. These tables also show the Scenario for which the maximums were identified, as well as the year for which the maximum occurred since chronic HI and $PM_{2.5}$ concentrations are annual impacts.

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[30] California Energy Commission. 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. Title 24, Part 6, and Associated Administrative Regulations in Part 1. Available online at: https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf

[31] This requirement is carried forward in the adopted 2022 Building Energy Efficiency Standards that take effect January 1, 2023.

[32] USEPA. 2009. Residential Air Cleaners, A Summary of Available Information. EPA 402-F-09-002. August. Available online at: https://19january2017snapshot.epa.gov/indoor-air-quality-iaq/residential-air-cleaners-second-edition-summary-available-information_.html. Accessed May 11, 2022.

As discussed above, the pump station generator may be located in one of two locations. Reported impacts are the maximum across either location. The maximum impacts reported in Tables 59, 60 and 61 all occur with the pump station generator in Location 1. More detail on the maximum impact between each location can be found in our memorandum “Analysis of the Relocation of the Pump Station Generator for the Willow Village Project” dated June 9, 2022, shown in Appendix F.

Mitigated impacts assume construction equipment have an average of 95 percent and 98 percent Tier 4 Final engines before and after residents move on-site, respectively, and 5 percent and 2 percent Tier 2 engines before and after residents move on-site, respectively. Mitigated impacts include reductions to fugitive dust due to watering.

**Summary Table D. Summary of Health Risk Assessment Results**

| | BAAQMD Threshold of Significance | Unmitigated | | | | Mitigated | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | On-site MEIR | *Exceed Threshold?* | Off-site MEIR | *Exceed Threshold?* | On-site MEIR | *Exceed Threshold?* | Off-site MEIR | *Exceed Threshold?* |
| Excess Lifetime Cancer Risk (in a million) | 10 | 86 | *Yes* | 59 | *Yes* | 7.5 | *No* | 9.5 | *No* |
| Chronic HI | 1 | 0.23 | *No* | 0.11 | *No* | 0.011 | *No* | 0.015 | *No* |
| $PM_{2.5}$ Concentration ($\mu g/m^3$) | 0.3 | 1.1 | *Yes* | 0.56 | *Yes* | 0.13 | *No* | 0.18 | *No* |
| Source: Table 59, Table 60, and Table 61 of the Appendix | | | | | | | | | |

As discussed in Section 6.6 and in our memorandum “Refinement of Onsite Health Impacts for the Willow Village Project” dated May 17, 2022, shown in Appendix E, the required filtration for new residential units would further reduce health impacts experienced by residents. However, these impacts were conservatively not taken into account. Appendix E and Appendix F contain more information on the effects of filtration for informational purposes.

# 7. CUMULATIVE ANALYSIS

Consistent with the BAAQMD CEQA guidelines, the combined impacts from off-site and on-site sources were evaluated within the "zone of influence" of the Project. Off-site sources include BAAQMD permitted stationary sources, roadways with over 10,000 vehicles per day, and railways.

The cumulative impact was evaluated at the maximally exposed individual sensitive receptor (MEISR) for Project construction and operations. There is an on-site MEISR for informational purposes and, as required by CEQA, an off-site MEISR. The MEISR is the receptor with the highest incremental cancer risk, chronic HQ, and $PM_{2.5}$ concentration from the Project across all populations and exposure scenarios.

Health impacts from all identified sources within 1,000 feet of the Project were evaluated at this single location and added to the results from the Project's impacts. The sources that were considered in this analysis are described below.

Results at the MEISR were compared to the significance thresholds for cumulative impacts:

- An excess lifetime cancer risk level of more than 100 in one million;
- A chronic non-cancer HI greater than 10; and
- An incremental increase in the annual average $PM_{2.5}$ concentration of greater than 0.8 μg/m$^3$.

## 7.1 Stationary Sources

BAAQMD provides a stationary source GIS map tool to use to evaluate the impacts of off-site stationary sources (BAAQMD 2020a). Consistent with BAAQMD guidance, a request was sent to BAAQMD to provide the emissions from nearby stationary sources within 1,000 feet of the Project boundary. Using emissions made available by BAAQMD, risks, chronic hazard index, and $PM_{2.5}$ concentrations were estimated through the Risk and Hazards Emissions Screening Calculator, Beta Version 4.0 (BAAQMD 2020b).

Where appropriate, the impacts calculated using emissions provided by BAAQMD were scaled by the Diesel Internal Combustion Engine Distance Multiplier (BAAQMD 2012b) or Gasoline Dispensing Facility Multiplier (BAAQMD 2012c), per BAAQMD guidance. A summary of nearby stationary source impacts at the Project MEIR is summarized in **Table 62**.

## 7.2 Roadway Sources

BAAQMD recommends evaluating impacts from all roadways with traffic of over 10,000 vehicles per day within the "zone of influence." To evaluate potential health risk impacts from existing traffic on major roadways above 30,000 AADT and highways, BAAQMD provides raster files of health impacts. Ramboll pulled the corresponding values for the on-site and off-site MEISRs from the raster file. The BAAQMD tool represents the impact from the background traffic on the roadways as opposed to the impacts of net Project traffic as described in **Section 6.2**. These tools were used to estimate cancer risk and $PM_{2.5}$ concentrations from vehicle travel on major roadways and highways surrounding the Project. These tools do not provide specific estimates for chronic HI because the screening levels were found to be extremely low (BAAQMD 2015). Thus, there are no chronic hazard values associated with highways or major streets over 30,000 AADT. The tools developed by BAAQMD are based on an older version of EMFAC, traffic data that is a few years old, and an operational start year of 2017. However, they represent a conservative estimate of health impacts, largely due to the reduction in emissions of the vehicle fleet between 2017 and when project buildout will occur.

BAAQMD recommends evaluating roadways in the area where existing traffic is over 10,000 vehicles per day and under 30,000 vehicles per day, which is the limit for roadways to consider in their raster tool. The Transportation Engineer provided background trip volumes for nearby roadways with volumes between 10,000 and 30,000 vehicles per day. Of the roadways with background traffic in this range, only O’Brien Drive was located within the zone of influence. A summary of background traffic volumes on O’Brien Drive is summarized in **Table 63**. The impacts associated with background traffic on O’Brien Drive were quantified and included in the cumulative analysis. To perform this analysis, Ramboll used methodology consistent with the Project traffic HRA, as described in **Sections 3.1.2** and **3.2.5.2**.

## 7.3 Railway Sources

BAAMQD provides raster files with health impacts from railways. The Project is adjacent to a railway that is rarely used and Caltrain is over 1,000 feet from the Project. The health impacts from the raster file were used to estimate the potential impact from railways at the MEISRs.

## 7.4 Cumulative Summary

As described above, nearby cumulative sources include existing stationary sources, highways, major streets, and railways. Impacts from these cumulative sources are combined with Project construction, operational generator, and operational traffic impacts at the on-site and off-site Project MEIRs. A summary of cumulative impacts at the Project MEIR is shown in **Table 64** and **Summary Table E** below.

**Summary Table E. Summary of Cumulative Health Risk Assessment Results**

| | BAAQMD Threshold of Significance | Mitigated | | | |
|---|---|---|---|---|---|
| | | On-site MEIR | *Exceed Threshold?* | Off-site MEIR | *Exceed Threshold?* |
| Excess Lifetime Cancer Risk (in a million) | 100 | 22 | *No* | 23 | *No* |
| Chronic HI | 10 | 0.015 | *No* | 0.016 | *No* |
| $PM_{2.5}$ Concentration (µg/m$^3$) | 0.8 | 0.44 | *No* | 0.69 | *No* |
| Source: Table 64 of the Appendix | | | | | |

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# TABLES

**Table 1**
**Land Use Summary**
**Willow Village**
**Menlo Park, California**

| Land Use[1] | CalEEMod® Land Use | Size | Units[2] | Square Footage |
|---|---|---|---|---|
| **Existing Conditions (2019)** | | | | |
| Office | General Office Building | 252 | ksf | 251,530 |
| R&D | Research and Development | 124 | ksf | 123,870 |
| Warehouse | Unrefrigerated Warehouse-No Rail | 501 | ksf | 500,780 |
| Lab & Manufacture | Manufacturing | 24 | ksf | 23,570 |
| Health Center | Health Club | 24 | ksf | 24,060 |
| Former Fire Department Building | General Light Industry | 80 | ksf | 80,100 |
| Parking | Enclosed Parking with Elevator | 2,300 | Spaces | 920,000 |
| **Partial Buildout by Year[3]** | | | | |
| **Land Use Type[4]** | | **Percent Operational by Year** | | |
| | | **Year 4** | **Year 5** | **Year 6** |
| Office | | 3.1% | 58% | 95% |
| Retail | | 10% | 59% | 98% |
| Residential | | 0% | 16% | 64% |
| Hotel | | 0% | 41% | 100% |
| Parking | | 53% | 75% | 96% |
| Park | | 89% | 95% | 100% |
| **Full Buildout** | | | | |
| **Land Use Type[4]** | | **Size** | **Units[2]** | **Square Footage** |
| Office | | 1,600 | ksf | 1,600,000 |
| Retail | | 208 | ksf | 207,690 |
| Residential | | 1,730 | DU | 1,695,976 |
| Hotel | | 193 | Rooms | 172,000 |
| Parking | | 1,869 | ksf | 1,869,240 |
| Park | | 404 | ksf | 403,837 |

**Notes:**

1. Land uses analyzed based on information provided by the Project Applicant, as found in the Project Description. "Office" land use mapped to General Office Building and Research and Development; "Office/Lab" mapped to General Office Building, Research and Development, Health Club, and Manufacturing; "Warehouse" mapped to Unrefrigerated Warehouse-No Rail and General Light Industry, and "Warehouse/Office" mapped to Unrefrigerated Warehouse-No Rail and Research and Development CalEEMod land use types on a building-by-building basis.
2. The Project Applicant provided Project land uses in units of square footage, hotel rooms, and dwelling units. For the existing parking land use, each parking space is assumed to be 400 sqft. This assumption is based on CalEEMod defaults.
3. Partial buildout for Year 4, Year 5, and Year 6 were calculated based on the portion of building area for each land use type that becomes operational each year, based on the construction schedule, as shown in Table 2.
4. For Hamilton Avenue Parcels North and South, only net new square footage was included in the analysis. This is under the conservative assumption that the existing retail area and the retail land use that will replace it have similar operational emissions.

**Abbreviations:**

| | |
|---|---|
| DU - dwelling unit | sqft - square foot |
| ksf - 1,000 square feet | CalEEMod® - California Emissions Estimator Model |

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

**Table 2**
**Construction Phasing Schedule**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Start Month[2] | End Month[2] | Number of Days[3] |
|---|---|---|---|---|
| Area 1 | Demolition | Month 1 | Month 5 | 97 |
| | Grading and Utilities | Month 4 | Month 11 | 143 |
| Parcel 2 Foundations | | Month 15 | Month 23 | 161 |
| Parcel 2 Core and Shell | | Month 23 | Month 31 | 180 |
| Parcel 2 Tenant Improvements | | Month 31 | Month 43 | 261 |
| Parcel 2 Landscaping | | Month 43 | Month 45 | 59 |
| Parcel 3 Foundations | | Month 18 | Month 26 | 161 |
| Parcel 3 Core and Shell | | Month 26 | Month 34 | 180 |
| Parcel 3 Tenant Improvements | | Month 34 | Month 46 | 260 |
| Parcel 3 Landscaping | | Month 46 | Month 48 | 58 |
| North Garage | | Month 12 | Month 25 | 300 |
| Office Building 4 | | Month 14 | Month 35 | 449 |
| Meeting, Collaboration, Park | | Month 12 | Month 52 | 871 |
| Hotel Excavation | | Month 12 | Month 25 | 299 |
| Hotel Construction | | Month 30 | Month 45 | 329 |
| Town Square | | Month 15 | Month 43 | 610 |
| Area 2 | Demolition | Month 7 | Month 9 | 48 |
| | Grading and Utilities | Month 11 | Month 16 | 130 |
| Parcel 7 Foundations | | Month 26 | Month 31 | 116 |
| Parcel 7 Core and Shell | | Month 31 | Month 37 | 129 |
| Parcel 7 Tenant Improvements | | Month 37 | Month 45 | 188 |
| Parcel 7 Landscaping | | Month 45 | Month 48 | 58 |
| Parcel 6 Foundations | | Month 29 | Month 34 | 116 |
| Parcel 6 Core and Shell | | Month 34 | Month 40 | 129 |
| Parcel 6 Tenant Improvements | | Month 40 | Month 48 | 187 |
| Parcel 6 Landscaping | | Month 48 | Month 51 | 59 |
| South Garage | | Month 16 | Month 34 | 390 |
| Office Building 3 | | Month 17 | Month 40 | 501 |
| Office Building 1 | | Month 17 | Month 37 | 428 |
| Office Building 2 | | Month 18 | Month 38 | 426 |
| Office Building 5 | | Month 16 | Month 40 | 521 |
| Office Building 6 | | Month 19 | Month 43 | 520 |
| Area 3 | Grading and Utilities | Month 16 | Month 18 | 22 |
| | Tunnel Construction | Month 18 | Month 29 | 262 |
| | Foundations | Month 36 | Month 42 | 123 |
| | Core and Shell | Month 42 | Month 48 | 139 |
| | Tenant Improvements | Month 48 | Month 58 | 199 |
| | Landscaping | Month 58 | Month 60 | 59 |
| Hamilton Avenue Parcel North and South | Demolition | Month 37 | Month 37 | 22 |
| | Grading and Utilities | Month 37 | Month 38 | 23 |
| | Foundations | Month 38 | Month 40 | 22 |
| | Core and Shell | Month 40 | Month 41 | 43 |
| | Tenant Improvements | Month 41 | Month 43 | 33 |
| Substation Upgrade | PG&E Substation Work | Month 14 | Month 19 | 109 |
| Feeder Line | PG&E Offsite Work | Month 14 | Month 25 | 240 |
| | Surface Improvements | Month 14 | Month 15 | 23 |
| Intersection Improvements | O'Brien and Kavanaugh | Month 14 | Month 14 | 15 |
| | Adams and O'Brien | Month 14 | Month 14 | 10 |
| | Willow Road and Ivy Drive | Month 14 | Month 14 | 10 |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.

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[2.] Construction schedule and phasing information were provided by the Project Applicant. Construction is conservatively assumed to start December 15, 2021. The analysis uses the earliest possible start date to assess conservative impacts. Emissions and impacts would decrease if the construction start date is delayed due to the incorporation of cleaner equipment into the construction fleet with time.

[3.] Project construction will generally occur on Mondays through Fridays between the hours of 7 AM and 6 PM.

**Table 3**
**Equipment List for Campus and Town Square District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Subphase | Equipment Type[1] | CalEEMod® Equipment Category[2] | Horsepower[1] | Cumulative Hours per Building[1] | Year 2 Average Equipment Hours/Day[1] | Year 3 Average Equipment Hours/Day[1] | Year 4 Average Equipment Hours/Day[1] | Year 5 Average Equipment Hours/Day[1] | Year 6 Average Equipment Hours/Day[1] |
|---|---|---|---|---|---|---|---|---|---|
| North Garage | Air Compressor | Air Compressors | 150 | 144 | 0.47 | 0.48 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 10 | 0 | 0.039 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 10 | 0 | 0.039 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 345 | 0 | 1.3 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 163 | 0.33 | 0.58 | 0 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 163 | 0.33 | 0.58 | 0 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 31 | 0.59 | 0.023 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 612 | 12 | 0.47 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 654 | 4.7 | 1.8 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 900 | 2.9 | 3.0 | 0 | 0 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 1,421 | 2.9 | 5.0 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 306 | 5.9 | 0.23 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 174 | 4.1 | 0 | 0 | 0 | 0 |
| | Pressure Washer | Pressure Washers | 25 | 32 | 0 | 0.12 | 0 | 0 | 0 |
| | Semi Dump Truck | Onsite HHDT | 450 | 459 | 8.8 | 0.35 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 580 | 1.0 | 2.1 | 0 | 0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 438 | 1.2 | 1.5 | 0 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 219 | 2.9 | 0.37 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 111 | 0.15 | 0.41 | 0 | 0 | 0 |
| Office Building 4 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.049 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 306 | 0 | 1.3 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 306 | 0 | 1.3 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 2,091 | 0 | 7.4 | 1.4 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 24 | 0 | 0.10 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 18 | 0 | 0.075 | 0 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 34 | 0 | 0.14 | 0 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 9.2 | 0 | 0.04 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 15 | 0 | 0.06 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 702 | 0 | 2.9 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 216 | 0 | 0.48 | 0.48 | 0 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 438 | 0 | 1.8 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 174 | 0 | 0.72 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 174 | 0 | 0.72 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,120 | 0 | 2.3 | 2.7 | 0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 674 | 0 | 1.5 | 1.5 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 219 | 0 | 0.90 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 190 | 0 | 0.36 | 0.50 | 0 | 0 |
| Meeting, Collaboration, Park | Air Compressor | Air Compressors | 150 | 79 | 0 | 0.30 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 1,098 | 5.9 | 3.3 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 1,098 | 5.9 | 3.3 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 7,749 | 0 | 0.89 | 19 | 9.4 | 0 |
| | Compactor | Other Construction Equipment | 250 | 53 | 0.31 | 0.15 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 79 | 0 | 0.30 | 0 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 158 | 0 | 0.61 | 0 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 639 | 5.9 | 1.5 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 2,412 | 23 | 5.5 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 1,992 | 5.9 | 6.7 | 0 | 0 | 0 |

**Table 3**
**Equipment List for Campus and Town Square District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Subphase | Equipment Type[1] | CalEEMod® Equipment Category[2] | Horsepower[1] | Cumulative Hours per Building[1] | Year 2 Average Equipment Hours/Day[1] | Year 3 Average Equipment Hours/Day[1] | Year 4 Average Equipment Hours/Day[1] | Year 5 Average Equipment Hours/Day[1] | Year 6 Average Equipment Hours/Day[1] |
|---|---|---|---|---|---|---|---|---|---|
| Meeting, Collaboration, Park | Gradall | Forklifts | 350 | 8,661 | 8.8 | 7.7 | 10 | 12 | 12 |
| | Hydro/Crawler Crane | Cranes | 550 | 2,553 | 1.6 | 7.2 | 0.50 | 0.77 | 5.9 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 660 | 4.4 | 1.8 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 654 | 3.1 | 2.0 | 0 | 0 | 0 |
| | Pressure Washer | Pressure Washers | 25 | 40 | 0 | 0.15 | 0 | 0 | 0 |
| | Semi Dump Truck | Onsite HHDT | 450 | 570 | 5.9 | 1.2 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 2,603 | 0.39 | 1.4 | 4.2 | 4.2 | 1.0 |
| | Tire Wash | Other Construction Equipment | 100 | 275 | 1.5 | 0.82 | 0 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 718 | 2.9 | 1.9 | 0.37 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 1,425 | 0.73 | 1.0 | 2.0 | 2.0 | 2.0 |
| Hotel Excavation | Air Compressor | Air Compressors | 150 | 705 | 2.6 | 2.3 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 111 | 2.6 | 0 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 303 | 2.9 | 0.70 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 152 | 1.5 | 0.35 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 612 | 0.42 | 2.3 | 0 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 612 | 0.42 | 2.3 | 0 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 303 | 2.9 | 0.70 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 1,212 | 12 | 2.8 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 2,982 | 5.9 | 11 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 2,982 | 5.9 | 11 | 0 | 0 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 2,487 | 2.6 | 9.2 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 1,212 | 12 | 2.8 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 444 | 11 | 0 | 0 | 0 | 0 |
| | Pressure Washer | Pressure Washers | 25 | 12 | 0 | 0.046 | 0 | 0 | 0 |
| | Semi Dump Truck | Onsite HHDT | 450 | 606 | 5.9 | 1.4 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 115 | 0.16 | 0.42 | 0 | 0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 600 | 2.9 | 1.9 | 0 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 398 | 2.9 | 1.1 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 796 | 2.0 | 2.8 | 0 | 0 | 0 |
| Hotel Construction | Air Compressor | Air Compressors | 150 | 654 | 0 | 0 | 3.0 | 0.84 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 6,768 | 0 | 0 | 21 | 20 | 0 |
| | Concrete Pump | Pumps | 450 | 654 | 0 | 0 | 3.0 | 0.84 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 654 | 0 | 0 | 3.0 | 0.84 | 0 |
| | Gradall | Forklifts | 350 | 3,960 | 0 | 0 | 12 | 12 | 0 |
| | Pressure Washer | Pressure Washers | 25 | 13 | 0 | 0 | 0.060 | 0.017 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,733 | 0 | 0 | 1.9 | 9.1 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 495 | 0 | 0 | 1.5 | 1.5 | 0 |
| | Water Truck | Onsite HHDT | 300 | 158 | 0 | 0 | 0.48 | 0.48 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 400 | 0 | 0 | 1.4 | 1.0 | 0 |
| Town Square | Bob Cat | Tractors/Loaders/Backhoes | 200 | 975 | 0 | 3.0 | 1.0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 848 | 0 | 1.5 | 1.9 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 5.3 | 0 | 0 | 0.020 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 5.3 | 0 | 0 | 0.020 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 975 | 0 | 3.0 | 1.0 | 0 | 0 |
| | Excavator | Excavators | 500 | 3,900 | 0 | 12 | 4.0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 1,572 | 0 | 6.0 | 0.55 | 0 | 0 |
| | Gradall | Forklifts | 350 | 4,788 | 0 | 6.0 | 5.3 | 18 | 0 |

**Table 3**
**Equipment List for Campus and Town Square District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Subphase | Equipment Type[1] | CalEEMod® Equipment Category[2] | Horsepower[1] | Cumulative Hours per Building[1] | Year 2 Average Equipment Hours/Day[1] | Year 3 Average Equipment Hours/Day[1] | Year 4 Average Equipment Hours/Day[1] | Year 5 Average Equipment Hours/Day[1] | Year 6 Average Equipment Hours/Day[1] |
|---|---|---|---|---|---|---|---|---|---|
| Town Square | Hydro/Crawler Crane | Cranes | 550 | 290 | 0 | 0 | 1.0 | 0.18 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 3,900 | 0 | 12.0 | 4.0 | 0 | 0 |
| | Semi Dump Truck | Onsite HHDT | 450 | 1,950 | 0 | 6.0 | 2.0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 397 | 0 | 0.16 | 0.53 | 2.0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 975 | 0 | 3.0 | 1.0 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 975 | 0 | 3.0 | 1.0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 1,084 | 0 | 2.0 | 1.5 | 2.0 | 0 |
| South Garage | Air Compressor | Air Compressors | 150 | 187 | 0 | 0.48 | 0.48 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 11 | 0 | 0.055 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 11 | 0 | 0.055 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 891 | 0 | 0 | 4.7 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 204 | 0 | 0.45 | 0.60 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 218 | 0 | 0.52 | 0.60 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 30 | 0 | 0.15 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 600 | 0 | 3.0 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 654 | 0 | 3.2 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 1,170 | 0 | 3.0 | 3.0 | 0 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 1,688 | 0 | 4.9 | 3.7 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 300 | 0 | 1.5 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 174 | 0 | 0.86 | 0 | 0 | 0 |
| | Pressure Washer | Pressure Washers | 25 | 32 | 0 | 0.16 | 0 | 0 | 0 |
| | Semi Dump Truck | Onsite HHDT | 450 | 450 | 0 | 2.2 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 873 | 0 | 1.9 | 2.6 | 0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 575 | 0 | 1.4 | 1.5 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 216 | 0 | 1.1 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 159 | 0 | 0.32 | 0.50 | 0 | 0 |
| Office Building 3 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.067 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 456 | 0 | 2.6 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 456 | 0 | 2.6 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 2,097 | 0 | 1.7 | 6.9 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 36 | 0 | 0.21 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 23 | 0 | 0.12 | 5.0E-03 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 46 | 0 | 0.25 | 5.0E-03 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 14 | 0 | 0.077 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 23 | 0 | 0.13 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 852 | 0 | 4.8 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 240 | 0 | 0.48 | 0.48 | 0.48 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 588 | 0 | 3.3 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 330 | 0 | 1.9 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 330 | 0 | 1.9 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,223 | 0 | 1.8 | 2.8 | 3.0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 752 | 0 | 1.5 | 1.5 | 1.5 | 0 |
| | Water Truck | Onsite HHDT | 300 | 294 | 0 | 1.7 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 210 | 0 | 0.27 | 0.50 | 0.50 | 0 |
| Office Building 1 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.07 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 402 | 0 | 2.2 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 402 | 0 | 2.2 | 0 | 0 | 0 |

**Table 3**
**Equipment List for Campus and Town Square District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Subphase | Equipment Type[1] | CalEEMod® Equipment Category[2] | Horsepower[1] | Cumulative Hours per Building[1] | Year 2 Average Equipment Hours/Day[1] | Year 3 Average Equipment Hours/Day[1] | Year 4 Average Equipment Hours/Day[1] | Year 5 Average Equipment Hours/Day[1] | Year 6 Average Equipment Hours/Day[1] |
|---|---|---|---|---|---|---|---|---|---|
| Office Building 1 | Boom Lift | Aerial Lifts | 40 | 2,076 | 0 | 2.5 | 6.6 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 32 | 0 | 0.18 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 21 | 0 | 0.11 | 5.3E-03 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 41 | 0 | 0.22 | 5.3E-03 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 12 | 0 | 0.067 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 20 | 0 | 0.11 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 792 | 0 | 4.4 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 205 | 0 | 0.48 | 0.48 | 0 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 522 | 0 | 2.9 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 264 | 0 | 1.5 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 264 | 0 | 1.5 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,025 | 0 | 1.9 | 2.7 | 0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 642 | 0 | 1.5 | 1.5 | 0 | 0 |
| | Water Truck | Onsite HHDT | 300 | 261 | 0 | 1.5 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 176 | 0 | 0.29 | 0.50 | 0 | 0 |
| Office Building 2 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.076 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 390 | 0 | 2.5 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 390 | 0 | 2.5 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 2,097 | 0 | 1.2 | 7.3 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 31 | 0 | 0.20 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 21 | 0 | 0.12 | 5.0E-03 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 40 | 0 | 0.25 | 5.0E-03 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 12 | 0 | 0.075 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 20 | 0 | 0.12 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 786 | 0 | 5.0 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 204 | 0 | 0.48 | 0.48 | 0.48 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 522 | 0 | 3.3 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 264 | 0 | 1.7 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 264 | 0 | 1.7 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,020 | 0 | 1.8 | 2.8 | 3.0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 639 | 0 | 1.5 | 1.5 | 1.5 | 0 |
| | Water Truck | Onsite HHDT | 300 | 261 | 0 | 1.7 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 175 | 0 | 0.26 | 0.50 | 0.50 | 0 |
| Office Building 5 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.059 | 0 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 534 | 0 | 2.6 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 534 | 0 | 2.6 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 2,067 | 0 | 2.2 | 6.2 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 43 | 0 | 0.21 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 25 | 0 | 0.12 | 4.8E-03 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 52 | 0 | 0.25 | 4.8E-03 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 16 | 0 | 0.08 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 27 | 0 | 0.13 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 930 | 0 | 4.6 | 0 | 0 | 0 |
| | Gradall | Forklifts | 350 | 250 | 0 | 0.48 | 0.48 | 0.48 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 660 | 0 | 3.3 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 396 | 0 | 2.0 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 396 | 0 | 2.0 | 0 | 0 | 0 |

**Table 3**
**Equipment List for Campus and Town Square District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Subphase | Equipment Type[1] | CalEEMod® Equipment Category[2] | Horsepower[1] | Cumulative Hours per Building[1] | Year 2 Average Equipment Hours/Day[1] | Year 3 Average Equipment Hours/Day[1] | Year 4 Average Equipment Hours/Day[1] | Year 5 Average Equipment Hours/Day[1] | Year 6 Average Equipment Hours/Day[1] |
|---|---|---|---|---|---|---|---|---|---|
| Office Building 5 | Semi Truck | Onsite HHDT | 450 | 1,260 | 0 | 1.8 | 2.8 | 3.0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 782 | 0 | 1.5 | 1.5 | 1.5 | 0 |
| | Water Truck | Onsite HHDT | 300 | 330 | 0 | 1.6 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 217 | 0 | 0.28 | 0.50 | 0.50 | 0 |
| Office Building 6 | Air Compressor | Air Compressors | 150 | 12 | 0 | 0.062 | 0.013 | 0 | 0 |
| | Backhoe | Tractors/Loaders/Backhoes | 350 | 534 | 0 | 3.9 | 0 | 0 | 0 |
| | Bob Cat | Tractors/Loaders/Backhoes | 200 | 534 | 0 | 3.9 | 0 | 0 | 0 |
| | Boom Lift | Aerial Lifts | 40 | 2,097 | 0 | 0 | 8.0 | 0 | 0 |
| | Compactor | Other Construction Equipment | 250 | 43 | 0 | 0.31 | 0 | 0 | 0 |
| | Concrete Pump | Pumps | 450 | 25 | 0 | 0.16 | 0.014 | 0 | 0 |
| | Concrete Truck | Onsite HHDT | 400 | 52 | 0 | 0.35 | 0.014 | 0 | 0 |
| | Dump Truck | Onsite HHDT | 450 | 16 | 0 | 0.12 | 0 | 0 | 0 |
| | Excavator | Excavators | 500 | 27 | 0 | 0.20 | 0 | 0 | 0 |
| | Generator | Generator Sets | 25 | 930 | 0 | 6.0 | 0.44 | 0 | 0 |
| | Gradall | Forklifts | 350 | 250 | 0 | 0.48 | 0.48 | 0.48 | 0 |
| | Hydro/Crawler Crane | Cranes | 550 | 666 | 0 | 4.9 | 0 | 0 | 0 |
| | Loader | Tractors/Loaders/Backhoes | 100 | 408 | 0 | 3.0 | 0 | 0 | 0 |
| | Pile Rig | Bore/Drill Rigs | 600 | 408 | 0 | 3.0 | 0 | 0 | 0 |
| | Semi Truck | Onsite HHDT | 450 | 1,254 | 0 | 1.2 | 2.8 | 3.0 | 0 |
| | Tire Wash | Other Construction Equipment | 100 | 780 | 0 | 1.5 | 1.5 | 1.5 | 0 |
| | Water Truck | Onsite HHDT | 300 | 333 | 0 | 2.4 | 0 | 0 | 0 |
| | Work Truck | Onsite LHDT1 | 200 | 216 | 0 | 0.25 | 0.46 | 0.50 | 0 |

**Notes:**

1. Information on Project equipment list, horsepower, quantity, and hours per equipment per year were provided by the Project Applicant. Cumulative hours per building represents the sum of hours per equipment across all years. All off-road equipment is assumed to have diesel engines except aerial lifts and cranes which were assumed to be electric, as designated by Project Applicant.
2. Work trucks are assumed to be similar to light-heavy duty trucks (Onsite LHDT1) as defined in EMFAC2021. Concrete Trucks, Dump Trucks, Semi Trucks, and Water Trucks are assumed to be similar to heavy-heavy duty trucks (Onsite HHDT). Emission factors are from EMFAC2021 ("Emission Rates" mode) for LHDT1 and HHDT diesel vehicles (aggregated model year) in San Mateo County. RUNEX emission factors (and IDLEX emission factors for HHDT) are specific to vehicle speed of 15 mph. All other emission factor types are for aggregated speed. Emission factors were multiplied by the appropriate usage parameter based on the units. Emission factors in units of g/trip, g/mi, and g/vehicle/day, were multiplied by trips, miles, and total vehicles, respectively, in order to obtain mass emissions.

An average emission factors is calculated using the following criteria:
- Number of LHDT1/HHDT vehicles and schedule are provided by the client.
- Hours are calculated as number of equipment * utilization percent * number of construction days * hours/day as provided by the client.
- Miles are calculated as hours * the speed limit (15 miles per hour).
- Trips are calculated assuming there is one trip per hour, calculated as number of hours * 1 trip/hour.
- Total Vehicles are calculated as number of equipment for a given subphase * equipment utilization percent * number of construction subphase days as provided by the client.

**Abbreviations:**

CalEEMod® - CALifornia Emissions Estimator MODel

**Table 4**
**Equipment List for Residential/Shopping District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Equipment Type[2] | CalEEMod® Equipment Category[3] | Number[2] | Horsepower[2] | Hours/Day[2] | Utilization Percent[2] |
|---|---|---|---|---|---|---|---|
| Area 1 | Demolition | Excavator | Excavators | 4 | 131 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 12 | 450 | 8 | 25% |
| | | Generator | Generator Sets | 2 | 25 | 6 | 50% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Work Truck | Onsite LHDT1 | 24 | 250 | 0.5 | 100% |
| | | Water Truck | Onsite HHDT | 2 | 300 | 8 | 50% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 6 | 150 | 8 | 80% |
| | | Pressure Washer | Pressure Washers | 2 | 25 | 8 | 100% |
| | | Air Compressor | Air Compressors | 1 | 140 | 6 | 70% |
| | Grading and Utilities | Blade | Graders | 2 | 359 | 8 | 15% |
| | | Semi Dump Truck | Onsite HHDT | 10 | 450 | 8 | 25% |
| | | Scraper | Scrapers | 2 | 41 | 8 | 15% |
| | | Loader | Tractors/Loaders/Backhoes | 4 | 100 | 4 | 90% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Excavator | Excavators | 4 | 359 | 8 | 60% |
| | | Backhoe | Tractors/Loaders/Backhoes | 4 | 350 | 8 | 60% |
| | | Gradall | Forklifts | 4 | 350 | 4 | 60% |
| | | Compactor | Other Construction Equipment | 4 | 250 | 0.5 | 20% |
| | | Paver | Pavers | 2 | 250 | 8 | 1% |
| | | Water Truck | Onsite HHDT | 2 | 300 | 8 | 50% |
| | | Work Truck | Onsite LHDT1 | 38 | 250 | 0.5 | 100% |
| | | Generator | Generator Sets | 1 | 600 | 2 | 10% |
| | | Concrete Truck | Onsite HHDT | 2 | 400 | 2 | 10% |
| Parcel 2 Foundations | | Dump Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 1 | 131 | 8 | 60% |
| | | Semi Trucks | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Crane | Cranes | 1 | 215 | 4 | 50% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 8 | 400 | 8 | 15% |
| | | Concrete Pump | Pumps | 1 | 450 | 8 | 15% |
| Parcel 2 Core and Shell | | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Crane | Cranes | 1 | 600 | 8 | 20% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Manlift | Aerial Lifts | 1 | 48 | 8 | 40% |
| | | Work Truck | Onsite LHDT1 | 8 | 250 | 0.5 | 100% |
| Parcel 2 Tenant Improvements | | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Manlift | Aerial Lifts | 1 | 48 | 0.5 | 90% |
| | | Scissor Lift | Aerial Lifts | 1 | 3 | 4 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 6 | 250 | 0.5 | 90% |
| Parcel 2 Landscaping | | Excavator | Excavators | 1 | 25 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 100% |
| | | Work Truck | Onsite LHDT1 | 5 | 250 | 0.5 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| Parcel 3 Foundations | | Dump Truck | Onsite HHDT | 4 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 1 | 131 | 8 | 60% |
| | | Semi Trucks | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 2 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Crane | Cranes | 1 | 215 | 4 | 50% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 8 | 400 | 8 | 15% |
| | | Concrete Pump | Pumps | 1 | 450 | 8 | 15% |
| Parcel 3 Core and Shell | | Semi Truck | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Crane | Cranes | 1 | 600 | 8 | 20% |
| | | Gradall | Forklifts | 2 | 74 | 4 | 80% |
| | | Manlift | Aerial Lifts | 2 | 48 | 8 | 40% |
| | | Work Truck | Onsite LHDT1 | 8 | 250 | 0.5 | 100% |

**Table 4**
**Equipment List for Residential/Shopping District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Equipment Type[2] | CalEEMod® Equipment Category[3] | Number[2] | Horsepower[2] | Hours/Day[2] | Utilization Percent[2] |
|---|---|---|---|---|---|---|---|
| Parcel 3 Tenant Improvements | | Semi Truck | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Manlift | Aerial Lifts | 2 | 48 | 0.5 | 90% |
| | | Scissor Lift | Aerial Lifts | 2 | 3 | 4 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 7 | 250 | 0.5 | 90% |
| Parcel 3 Landscaping | | Excavator | Excavators | 1 | 25 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 100% |
| | | Work Truck | Onsite LHDT1 | 5 | 250 | 0.5 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 2 | 70 | 8 | 80% |
| Area 2 | Demolition | Excavator | Excavators | 4 | 131 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 12 | 450 | 8 | 25% |
| | | Generator | Generator Sets | 2 | 25 | 6 | 50% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Work Truck | Onsite LHDT1 | 24 | 250 | 0.5 | 100% |
| | | Water Truck | Onsite HHDT | 2 | 300 | 8 | 50% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 6 | 150 | 8 | 80% |
| | | Pressure Washer | Pressure Washers | 2 | 25 | 8 | 100% |
| | | Air Compressor | Air Compressors | 1 | 140 | 6 | 70% |
| | Grading and Utilities | Blade | Graders | 2 | 359 | 8 | 15% |
| | | Semi Dump Truck | Onsite HHDT | 10 | 450 | 8 | 25% |
| | | Scraper | Scrapers | 2 | 41 | 8 | 15% |
| | | Loader | Tractors/Loaders/Backhoes | 4 | 100 | 4 | 90% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Excavator | Excavators | 4 | 359 | 8 | 60% |
| | | Backhoe | Tractors/Loaders/Backhoes | 4 | 350 | 8 | 60% |
| | | Gradall | Forklifts | 4 | 350 | 4 | 60% |
| | | Compactor | Other Construction Equipment | 4 | 250 | 0.5 | 20% |
| | | Paver | Pavers | 2 | 250 | 8 | 1% |
| | | Water Truck | Onsite HHDT | 2 | 300 | 8 | 50% |
| | | Work Truck | Onsite LHDT1 | 38 | 250 | 0.5 | 100% |
| | | Generator | Generator Sets | 1 | 600 | 2 | 10% |
| | | Concrete Truck | Onsite HHDT | 2 | 400 | 2 | 10% |
| Parcel 7 Foundations | | Dump Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 1 | 131 | 8 | 60% |
| | | Semi Trucks | Onsite HHDT | 1 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Crane | Cranes | 1 | 215 | 4 | 50% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 1 | 400 | 1.5 | 70% |
| | | Concrete Pump | Pumps | 1 | 450 | 0.25 | 50% |
| Parcel 7 Core and Shell | | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Crane | Cranes | 1 | 600 | 8 | 20% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Manlift | Aerial Lifts | 1 | 48 | 8 | 40% |
| | | Work Truck | Onsite LHDT1 | 8 | 250 | 0.5 | 100% |
| Parcel 7 Tenant Improvements | | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Manlift | Aerial Lifts | 1 | 48 | 0.5 | 90% |
| | | Scissor Lift | Aerial Lifts | 1 | 3 | 4 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 6 | 250 | 0.5 | 90% |
| Parcel 7 Landscaping | | Excavator | Excavators | 1 | 25 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Work Truck | Onsite LHDT1 | 5 | 250 | 0.5 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| Parcel 6 Foundations | | Dump Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 1 | 131 | 8 | 60% |
| | | Semi Trucks | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |

**Table 4**
**Equipment List for Residential/Shopping District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Equipment Type[2] | CalEEMod® Equipment Category[3] | Number[2] | Horsepower[2] | Hours/Day[2] | Utilization Percent[2] |
|---|---|---|---|---|---|---|---|
| Parcel 6 Foundations | | Crane | Cranes | 1 | 215 | 4 | 50% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 1 | 400 | 3 | 70% |
| | | Concrete Pump | Pumps | 1 | 450 | 0.5 | 50% |
| Parcel 6 Core and Shell | | Semi Truck | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Crane | Cranes | 1 | 600 | 8 | 20% |
| | | Gradall | Forklifts | 2 | 74 | 4 | 80% |
| | | Manlift | Aerial Lifts | 1 | 48 | 8 | 40% |
| | | Work Truck | Onsite LHDT1 | 8 | 250 | 0.5 | 100% |
| Parcel 6 Tenant Improvements | | Semi Truck | Onsite HHDT | 2 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Manlift | Aerial Lifts | 1 | 48 | 0.5 | 90% |
| | | Scissor Lift | Aerial Lifts | 2 | 3 | 4 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 7 | 250 | 0.5 | 90% |
| Parcel 6 Landscaping | | Excavator | Excavators | 1 | 25 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Work Truck | Onsite LHDT1 | 5 | 250 | 0.5 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 2 | 70 | 8 | 80% |
| Area 3 | Grading and Utilities | Blade | Graders | 1 | 359 | 8 | 15% |
| | | Semi Dump Truck | Onsite HHDT | 6 | 450 | 8 | 25% |
| | | Scraper | Scrapers | 1 | 41 | 8 | 15% |
| | | Loader | Tractors/Loaders/Backhoes | 2 | 100 | 4 | 90% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 2 | 359 | 8 | 60% |
| | | Backhoe | Tractors/Loaders/Backhoes | 2 | 350 | 8 | 60% |
| | | Gradall | Forklifts | 2 | 350 | 4 | 60% |
| | | Compactor | Other Construction Equipment | 2 | 250 | 0.5 | 20% |
| | | Paver | Pavers | 1 | 250 | 8 | 1% |
| | | Water Truck | Onsite HHDT | 1 | 300 | 8 | 50% |
| | | Work Truck | Onsite LHDT1 | 20 | 250 | 0.5 | 100% |
| | | Generator | Generator Sets | 1 | 600 | 2 | 10% |
| | | Concrete Truck | Onsite HHDT | 2 | 400 | 2 | 10% |
| | Tunnel Construction | Crane | Cranes | 1 | 290 | 6 | 35% |
| | | Excavator | Excavators | 2 | 170 | 6 | 45% |
| | | Loader | Tractors/Loaders/Backhoes | 1 | 250 | 6 | 45% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 103 | 6 | 40% |
| | | Gradall | Forklifts | 1 | 130 | 6 | 35% |
| | | Boom Truck | Onsite HHDT | 1 | 200 | 6 | 35% |
| | | Concrete Truck | Onsite HHDT | 3 | 300 | 5 | 25% |
| | | Dump Truck | Onsite HHDT | 4 | 300 | 5 | 25% |
| | | Work Truck | Onsite LHDT1 | 5 | 250 | 4 | 30% |
| | | Compressor | Air Compressors | 2 | 50 | 6 | 30% |
| | Foundations | Dump Truck | Onsite HHDT | 4 | 450 | 8 | 25% |
| | | Generator | Generator Sets | 2 | 25 | 6 | 100% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Excavator | Excavators | 2 | 131 | 8 | 60% |
| | | Semi Trucks | Onsite HHDT | 4 | 450 | 8 | 25% |
| | | Backhoe | Tractors/Loaders/Backhoes | 2 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 2 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 2 | 74 | 4 | 80% |
| | | Crane | Cranes | 2 | 215 | 4 | 50% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 3 | 400 | 3 | 70% |
| | | Concrete Pump | Pumps | 3 | 450 | 0.5 | 50% |
| | Core and Shell | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Generator | Generator Sets | 2 | 25 | 6 | 100% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Crane | Cranes | 2 | 600 | 8 | 20% |
| | | Gradall | Forklifts | 3 | 74 | 4 | 80% |
| | | Manlift | Aerial Lifts | 3 | 48 | 8 | 40% |
| | | Work Truck | Onsite LHDT1 | 16 | 250 | 0.5 | 100% |
| | Tenant Improvements | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 25% |
| | | Generator | Generator Sets | 2 | 25 | 6 | 85% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Manlift | Aerial Lifts | 3 | 48 | 0.5 | 90% |
| | | Scissor Lift | Aerial Lifts | 3 | 3 | 4 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |

**Table 4**
**Equipment List for Residential/Shopping District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Equipment Type[2] | CalEEMod® Equipment Category[3] | Number[2] | Horsepower[2] | Hours/Day[2] | Utilization Percent[2] |
|---|---|---|---|---|---|---|---|
| Area 3 | Tenant Improvements | Work Truck | Onsite LHDT1 | 13 | 250 | 0.5 | 90% |
| | Landscaping | Excavator | Excavators | 1 | 25 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 6 | 450 | 8 | 25% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Backhoe | Tractors/Loaders/Backhoes | 2 | 90 | 8 | 60% |
| | | Work Truck | Onsite LHDT1 | 10 | 250 | 0.5 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 3 | 70 | 8 | 80% |
| Hamilton Avenue Parcels North and South | Demolition | Excavator | Excavators | 1 | 131 | 8 | 90% |
| | | Semi Truck | Onsite HHDT | 3 | 450 | 8 | 80% |
| | | Generator | Generator Sets | 1 | 25 | 6 | 50% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Work Truck | Onsite LHDT1 | 6 | 250 | 0.5 | 100% |
| | | Water Truck | Onsite HHDT | 1 | 300 | 8 | 100% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 2 | 70 | 8 | 80% |
| | | Pressure Washer | Pressure Washers | 2 | 25 | 8 | 100% |
| | | Air Compressor | Air Compressors | 1 | 140 | 6 | 70% |
| | Grading and Utilities | Semi Dump Truck | Onsite HHDT | 3 | 450 | 8 | 80% |
| | | Loader | Tractors/Loaders/Backhoes | 2 | 100 | 4 | 90% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Excavator | Excavators | 1 | 359 | 8 | 60% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 60% |
| | | Compactor | Other Construction Equipment | 1 | 250 | 0.5 | 20% |
| | | Paver | Pavers | 1 | 250 | 8 | 1% |
| | | Water Truck | Onsite HHDT | 1 | 300 | 8 | 100% |
| | | Work Truck | Onsite LHDT1 | 8 | 250 | 0.5 | 100% |
| | | Generator | Generator Sets | 1 | 600 | 2 | 10% |
| | | Concrete Truck | Onsite HHDT | 2 | 400 | 2 | 10% |
| | Foundations | Dump Truck | Onsite HHDT | 1 | 450 | 8 | 60% |
| | | Generator | Generator Sets | 1 | 25 | 6 | 100% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Semi Trucks | Onsite HHDT | 1 | 450 | 8 | 80% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Bob Cat | Tractors/Loaders/Backhoes | 1 | 70 | 8 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 2 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 1 | 400 | 3 | 60% |
| | | Concrete Pump | Pumps | 1 | 450 | 6 | 30% |
| | Core and Shell | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 75% |
| | | Generator | Generator Sets | 1 | 25 | 6 | 100% |
| | | Tire Wash | Other Construction Equipment | 1 | 100 | 4 | 90% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 4 | 250 | 0.5 | 100% |
| | | Concrete Truck | Onsite HHDT | 1 | 400 | 6 | 30% |
| | | Concrete Pump | Pumps | 1 | 450 | 6 | 45% |
| | Tenant Improvements | Semi Truck | Onsite HHDT | 1 | 450 | 8 | 60% |
| | | Generator | Generator Sets | 1 | 25 | 6 | 85% |
| | | Tire Wash | Other Construction Equipment | 2 | 100 | 4 | 90% |
| | | Scissor Lift | Aerial Lifts | 1 | 3 | 6 | 80% |
| | | Gradall | Forklifts | 1 | 74 | 4 | 80% |
| | | Work Truck | Onsite LHDT1 | 3 | 250 | 0.5 | 90% |
| Substation Upgrade | PG&E Substation Work | Backhoe | Tractors/Loaders/Backhoes | 2 | 90 | 8 | 60% |
| | | Loader | Tractors/Loaders/Backhoes | 2 | 100 | 8 | 45% |
| Feeder Line | PG&E Offsite Work | Excavator | Excavators | 2 | 131 | 8 | 90% |
| | | Loader | Tractors/Loaders/Backhoes | 1 | 100 | 8 | 45% |
| | Surface Improvements | Paver | Pavers | 1 | 250 | 8 | 60% |
| | | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | | Vibratory Roller | Other Construction Equipment | 1 | 250 | 8 | 20% |
| | | Finish Roller | Other Construction Equipment | 1 | 250 | 8 | 20% |

**Table 4**
**Equipment List for Residential/Shopping District Construction**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Equipment Type[2] | CalEEMod® Equipment Category[3] | Number[2] | Horsepower[2] | Hours/Day[2] | Utilization Percent[2] |
|---|---|---|---|---|---|---|---|
| Intersection Improvements | O'Brien and Kavanaugh | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | Adams and O'Brien | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |
| | Willow Road and Ivy Drive | Backhoe | Tractors/Loaders/Backhoes | 1 | 90 | 8 | 60% |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. Information on Project equipment list, horsepower, quantity, and utilization factor were provided by the Project Applicant. All off-road equipment is assumed to have diesel engines except aerial lifts which were assumed to be electric, as designated by Project Applicant. Utilizations for duration represent the usage percentage during the indicated equipment date range. Utilization percentage is multiplied by the number of hours per day in the calculation of off-road emissions.
3. Work trucks are assumed to be similar to light-heavy duty trucks (Onsite LHDT1) as defined in EMFAC2021. Concrete Trucks, Dump Trucks, Semi Trucks, and Water Trucks are assumed to be similar to heavy-heavy duty trucks (Onsite HHDT). Emission factors are from EMFAC2021 ("Emission Rates" mode) for LHDT1 and HHDT diesel vehicles (aggregated model year) in San Mateo County. RUNEX emission factors (and IDLEX emission factors for HHDT) are specific to vehicle speed of 15 mph. All other emission factor types are for aggregated speed. Emission factors were multiplied by the appropriate usage parameter based on the units. Emission factors in units of g/trip, g/mi, and g/vehicle/day, were multiplied by trips, miles, and total vehicles, respectively, in order to obtain mass emissions.

   An average emission factors is calculated using the following criteria:
   - Number of LHDT1/HHDT vehicles and schedule are provided by the client.
   - Hours are calculated as number of equipment * utilization percent * number of construction days * hours/day as provided by the client.
   - Miles are calculated as hours * the speed limit (15 miles per hour).
   - Trips are calculated assuming there is one trip per hour, calculated as number of hours * 1 trip/hour.
   - Total Vehicles are calculated as number of equipment for a given subphase * equipment utilization percent * number of construction subphase days as provided by the client.

**Abbreviations:**

CalEEMod® - CALifornia Emissions Estimator MODel

**Table 5**
**Construction Equipment OFFROAD Emission Factors**
**Willow Village**
**Menlo Park, California**

| CalEEMod Equipment Name | Year[1] | HP | Emission Factor (g/bhp-hr)[2] | | | | |
|---|---|---|---|---|---|---|---|
| | | | ROG | NOx | $CO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| Aerial Lifts | 2022 | 50 | 0.35 | 4.0 | 639 | 0.12 | 0.11 |
| Aerial Lifts | 2023 | 50 | 0.33 | 3.9 | 639 | 0.11 | 0.10 |
| Aerial Lifts | 2024 | 50 | 0.35 | 3.9 | 639 | 0.11 | 0.10 |
| Aerial Lifts | 2025 | 50 | 0.36 | 3.9 | 639 | 0.11 | 0.10 |
| Aerial Lifts | 2026 | 50 | 0.35 | 3.8 | 639 | 0.091 | 0.083 |
| Air Compressors | 2023 | 50 | 0.18 | 2.0 | 370 | 0.052 | 0.048 |
| Air Compressors | 2024 | 50 | 0.18 | 2.1 | 374 | 0.075 | 0.069 |
| Air Compressors | 2021 | 175 | 0.085 | 1.1 | 326 | 0.044 | 0.040 |
| Air Compressors | 2022 | 175 | 0.077 | 0.87 | 329 | 0.033 | 0.030 |
| Air Compressors | 2023 | 175 | 0.069 | 0.64 | 333 | 0.024 | 0.022 |
| Air Compressors | 2024 | 175 | 0.071 | 0.67 | 336 | 0.025 | 0.023 |
| Air Compressors | 2025 | 175 | 0.068 | 0.58 | 340 | 0.020 | 0.018 |
| Air Compressors | 2026 | 175 | 0.069 | 0.57 | 344 | 0.020 | 0.018 |
| Bore/Drill Rigs | 2022 | 600 | 0.10 | 0.94 | 521 | 0.032 | 0.029 |
| Bore/Drill Rigs | 2023 | 600 | 0.10 | 0.81 | 521 | 0.028 | 0.026 |
| Bore/Drill Rigs | 2024 | 600 | 0.10 | 0.77 | 522 | 0.028 | 0.025 |
| Bore/Drill Rigs | 2025 | 600 | 0.10 | 0.83 | 521 | 0.030 | 0.027 |
| Bore/Drill Rigs | 2026 | 600 | 0.10 | 0.76 | 521 | 0.027 | 0.025 |
| Cranes | 2023 | 300 | 0.31 | 3.5 | 527 | 0.15 | 0.13 |
| Cranes | 2024 | 300 | 0.29 | 3.2 | 528 | 0.13 | 0.12 |
| Cranes | 2025 | 300 | 0.27 | 2.8 | 528 | 0.12 | 0.11 |
| Cranes | 2022 | 600 | 0.24 | 2.6 | 527 | 0.10 | 0.10 |
| Cranes | 2023 | 600 | 0.21 | 2.2 | 528 | 0.089 | 0.082 |
| Cranes | 2024 | 600 | 0.21 | 2.1 | 528 | 0.086 | 0.079 |
| Cranes | 2025 | 600 | 0.20 | 2.0 | 528 | 0.079 | 0.073 |
| Cranes | 2026 | 600 | 0.20 | 1.8 | 527 | 0.075 | 0.069 |
| Crushing/Proc. Equipment | 2021 | 300 | 0.10 | 1.2 | 232 | 0.040 | 0.037 |
| Crushing/Proc. Equipment | 2022 | 300 | 0.10 | 1.0 | 232 | 0.033 | 0.031 |
| Crushing/Proc. Equipment | 2022 | 600 | 0.069 | 0.50 | 231 | 0.017 | 0.016 |
| Crushing/Proc. Equipment | 2023 | 600 | 0.068 | 0.47 | 231 | 0.016 | 0.015 |
| Crushing/Proc. Equipment | 2024 | 600 | 0.064 | 0.42 | 231 | 0.014 | 0.013 |
| Crushing/Proc. Equipment | 2025 | 600 | 0.062 | 0.38 | 231 | 0.013 | 0.012 |
| Crushing/Proc. Equipment | 2026 | 600 | 0.060 | 0.34 | 231 | 0.011 | 0.010 |
| Excavators | 2025 | 25 | 4.0 | 7.6 | 590 | 1.1 | 1.0 |
| Excavators | 2026 | 25 | 4.0 | 7.6 | 589 | 1.1 | 1.0 |
| Excavators | 2021 | 175 | 0.22 | 2.1 | 531 | 0.10 | 0.092 |
| Excavators | 2022 | 175 | 0.19 | 1.7 | 531 | 0.083 | 0.076 |
| Excavators | 2023 | 175 | 0.18 | 1.5 | 531 | 0.073 | 0.067 |
| Excavators | 2024 | 175 | 0.17 | 1.3 | 531 | 0.067 | 0.061 |

**Table 5**
**Construction Equipment OFFROAD Emission Factors**
**Willow Village**
**Menlo Park, California**

| CalEEMod Equipment Name | Year[1] | HP | Emission Factor (g/bhp-hr)[2] | | | | |
|---|---|---|---|---|---|---|---|
| | | | ROG | NOx | $CO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| Excavators | 2025 | 175 | 0.16 | 1.2 | 531 | 0.058 | 0.053 |
| Excavators | 2022 | 600 | 0.13 | 1.0 | 529 | 0.035 | 0.032 |
| Excavators | 2023 | 600 | 0.12 | 0.89 | 529 | 0.030 | 0.028 |
| Excavators | 2024 | 600 | 0.12 | 0.83 | 530 | 0.028 | 0.026 |
| Excavators | 2025 | 600 | 0.12 | 0.72 | 530 | 0.025 | 0.023 |
| Excavators | 2026 | 600 | 0.12 | 0.69 | 530 | 0.024 | 0.022 |
| Forklifts | 2023 | 75 | 1.8 | 15 | 528 | 1.0 | 0.92 |
| Forklifts | 2024 | 75 | 2.0 | 10 | 562 | 0.83 | 0.76 |
| Forklifts | 2025 | 75 | 1.5 | 12 | 530 | 0.88 | 0.81 |
| Forklifts | 2026 | 75 | 1.5 | 12 | 530 | 0.89 | 0.82 |
| Forklifts | 2023 | 175 | 0.23 | 2.0 | 528 | 0.13 | 0.12 |
| Forklifts | 2024 | 175 | 0.20 | 1.7 | 528 | 0.11 | 0.10 |
| Forklifts | 2022 | 600 | 0.069 | 0.59 | 525 | 0.0089 | 0.0082 |
| Forklifts | 2023 | 600 | 0.072 | 0.59 | 524 | 0.0090 | 0.0083 |
| Forklifts | 2024 | 600 | 0.071 | 0.53 | 528 | 0.0091 | 0.0084 |
| Forklifts | 2025 | 600 | 0.074 | 0.53 | 528 | 0.0092 | 0.0084 |
| Forklifts | 2026 | 600 | 0.077 | 0.53 | 528 | 0.0093 | 0.0085 |
| Generator Sets | 2021 | 50 | 0.20 | 1.3 | 235 | 0.019 | 0.018 |
| Generator Sets | 2022 | 50 | 0.20 | 1.3 | 237 | 0.019 | 0.018 |
| Generator Sets | 2023 | 50 | 0.21 | 1.3 | 240 | 0.019 | 0.018 |
| Generator Sets | 2024 | 50 | 0.21 | 1.3 | 243 | 0.020 | 0.018 |
| Generator Sets | 2025 | 50 | 0.21 | 1.4 | 245 | 0.020 | 0.018 |
| Generator Sets | 2026 | 50 | 0.21 | 1.4 | 248 | 0.020 | 0.019 |
| Generator Sets | 2022 | 600 | 0.085 | 0.53 | 213 | 0.023 | 0.021 |
| Generator Sets | 2023 | 600 | 0.083 | 0.50 | 216 | 0.022 | 0.020 |
| Generator Sets | 2024 | 600 | 0.083 | 0.49 | 218 | 0.021 | 0.020 |
| Generator Sets | 2025 | 600 | 0.077 | 0.36 | 221 | 0.017 | 0.015 |
| Graders | 2022 | 600 | 0.34 | 4.5 | 530 | 0.14 | 0.13 |
| Graders | 2023 | 600 | 0.34 | 3.8 | 526 | 0.14 | 0.12 |
| Graders | 2024 | 600 | 0.29 | 3.1 | 525 | 0.12 | 0.11 |
| Graders | 2025 | 600 | 0.29 | 3.1 | 526 | 0.11 | 0.10 |
| Graders | 2026 | 600 | 0.22 | 2.1 | 524 | 0.078 | 0.072 |
| Other Construction Equipment | 2021 | 100 | 0.46 | 4.3 | 528 | 0.31 | 0.29 |
| Other Construction Equipment | 2022 | 100 | 0.41 | 3.9 | 527 | 0.27 | 0.25 |
| Other Construction Equipment | 2023 | 100 | 0.38 | 3.5 | 528 | 0.24 | 0.22 |
| Other Construction Equipment | 2024 | 100 | 0.34 | 3.2 | 528 | 0.21 | 0.19 |
| Other Construction Equipment | 2025 | 100 | 0.30 | 2.9 | 528 | 0.17 | 0.16 |
| Other Construction Equipment | 2026 | 100 | 0.28 | 2.7 | 528 | 0.16 | 0.15 |
| Other Construction Equipment | 2022 | 300 | 0.24 | 2.7 | 529 | 0.10 | 0.10 |

**Table 5**
**Construction Equipment OFFROAD Emission Factors**
**Willow Village**
**Menlo Park, California**

| CalEEMod Equipment Name | Year[1] | HP | Emission Factor (g/bhp-hr)[2] | | | | |
|---|---|---|---|---|---|---|---|
| | | | ROG | NOx | $CO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| Other Construction Equipment | 2023 | 300 | 0.22 | 2.4 | 529 | 0.094 | 0.086 |
| Other Construction Equipment | 2024 | 300 | 0.21 | 2.2 | 529 | 0.087 | 0.080 |
| Other Construction Equipment | 2025 | 300 | 0.21 | 2.2 | 529 | 0.085 | 0.078 |
| Other Construction Equipment | 2026 | 300 | 0.20 | 2.0 | 529 | 0.081 | 0.075 |
| Pavers | 2022 | 300 | 0.15 | 2.0 | 528 | 0.061 | 0.056 |
| Pavers | 2023 | 300 | 0.14 | 1.7 | 528 | 0.054 | 0.050 |
| Pavers | 2024 | 300 | 0.13 | 1.5 | 528 | 0.048 | 0.044 |
| Pavers | 2025 | 300 | 0.11 | 1.1 | 528 | 0.036 | 0.033 |
| Pavers | 2026 | 300 | 0.11 | 1.0 | 528 | 0.034 | 0.031 |
| Pressure Washers | 2021 | 25 | 0.53 | 4.4 | 564 | 0.20 | 0.18 |
| Pressure Washers | 2022 | 25 | 0.53 | 4.4 | 572 | 0.19 | 0.18 |
| Pressure Washers | 2023 | 25 | 0.53 | 4.4 | 570 | 0.18 | 0.17 |
| Pressure Washers | 2024 | 25 | 0.53 | 4.3 | 572 | 0.18 | 0.17 |
| Pressure Washers | 2025 | 25 | 0.52 | 4.3 | 568 | 0.18 | 0.16 |
| Pressure Washers | 2026 | 25 | 0.52 | 4.3 | 573 | 0.17 | 0.16 |
| Pumps | 2022 | 600 | 0.043 | 0.46 | 213 | 0.018 | 0.017 |
| Pumps | 2023 | 600 | 0.043 | 0.45 | 216 | 0.018 | 0.016 |
| Pumps | 2024 | 600 | 0.041 | 0.39 | 218 | 0.016 | 0.014 |
| Pumps | 2025 | 600 | 0.038 | 0.27 | 221 | 0.012 | 0.011 |
| Pumps | 2026 | 600 | 0.039 | 0.27 | 223 | 0.012 | 0.011 |
| Scrapers | 2022 | 75 | 1.0 | 7.8 | 528 | 0.67 | 0.62 |
| Scrapers | 2023 | 75 | 0.88 | 6.8 | 528 | 0.58 | 0.53 |
| Scrapers | 2022 | 600 | 0.24 | 2.7 | 529 | 0.10 | 0.093 |
| Scrapers | 2023 | 600 | 0.24 | 2.5 | 529 | 0.095 | 0.087 |
| Scrapers | 2024 | 600 | 0.23 | 2.3 | 529 | 0.089 | 0.081 |
| Scrapers | 2025 | 600 | 0.20 | 1.9 | 529 | 0.074 | 0.068 |
| Scrapers | 2026 | 600 | 0.20 | 1.7 | 529 | 0.068 | 0.062 |
| Tractors/Loaders/Backhoes | 2023 | 75 | 1.6 | 12 | 529 | 1.0 | 0.93 |
| Tractors/Loaders/Backhoes | 2024 | 75 | 1.6 | 13 | 528 | 1.0 | 0.94 |
| Tractors/Loaders/Backhoes | 2025 | 75 | 1.6 | 13 | 527 | 1.0 | 0.94 |
| Tractors/Loaders/Backhoes | 2026 | 75 | 1.6 | 12 | 528 | 1.0 | 0.92 |
| Tractors/Loaders/Backhoes | 2022 | 100 | 0.25 | 2.5 | 530 | 0.13 | 0.12 |
| Tractors/Loaders/Backhoes | 2023 | 100 | 0.23 | 2.3 | 530 | 0.11 | 0.10 |
| Tractors/Loaders/Backhoes | 2024 | 100 | 0.22 | 2.2 | 530 | 0.10 | 0.089 |
| Tractors/Loaders/Backhoes | 2025 | 100 | 0.20 | 2.0 | 530 | 0.077 | 0.071 |
| Tractors/Loaders/Backhoes | 2026 | 100 | 0.18 | 1.9 | 530 | 0.063 | 0.058 |
| Tractors/Loaders/Backhoes | 2021 | 175 | 0.22 | 2.1 | 525 | 0.10 | 0.10 |
| Tractors/Loaders/Backhoes | 2022 | 175 | 0.20 | 1.8 | 525 | 0.089 | 0.082 |
| Tractors/Loaders/Backhoes | 2023 | 175 | 0.18 | 1.5 | 526 | 0.077 | 0.071 |

**Table 5**
**Construction Equipment OFFROAD Emission Factors**
**Willow Village**
**Menlo Park, California**

| CalEEMod Equipment Name | Year[1] | HP | Emission Factor (g/bhp-hr)[2] | | | | |
|---|---|---|---|---|---|---|---|
| | | | ROG | NOx | $CO_2$ | $PM_{10}$ | $PM_{2.5}$ |
| Tractors/Loaders/Backhoes | 2024 | 175 | 0.18 | 1.4 | 526 | 0.069 | 0.063 |
| Tractors/Loaders/Backhoes | 2022 | 300 | 0.19 | 2.0 | 527 | 0.070 | 0.065 |
| Tractors/Loaders/Backhoes | 2023 | 300 | 0.18 | 1.8 | 527 | 0.064 | 0.059 |
| Tractors/Loaders/Backhoes | 2024 | 300 | 0.18 | 1.6 | 526 | 0.060 | 0.055 |
| Tractors/Loaders/Backhoes | 2025 | 300 | 0.16 | 1.4 | 527 | 0.053 | 0.049 |
| Tractors/Loaders/Backhoes | 2026 | 300 | 0.16 | 1.3 | 528 | 0.050 | 0.046 |
| Tractors/Loaders/Backhoes | 2022 | 600 | 0.16 | 1.5 | 524 | 0.055 | 0.050 |
| Tractors/Loaders/Backhoes | 2023 | 600 | 0.15 | 1.2 | 525 | 0.047 | 0.043 |
| Tractors/Loaders/Backhoes | 2024 | 600 | 0.15 | 1.2 | 526 | 0.044 | 0.041 |
| Tractors/Loaders/Backhoes | 2025 | 600 | 0.14 | 1.0 | 526 | 0.038 | 0.035 |
| Tractors/Loaders/Backhoes | 2026 | 600 | 0.14 | 0.88 | 526 | 0.034 | 0.031 |

**Notes:**

1. Construction schedule and phasing information were provided by the Project Applicant. Construction is conservatively assumed to start December 15, 2021 and full buildout is expected to occur in 2027. The analysis uses the earliest possible start date to assess conservative impacts. Emissions and impacts would decrease if the construction start date is delayed due to the incorporation of cleaner equipment into the construction fleet with time.
2. Emission factors in (g/bhp-hr) were calculated by dividing OFFROAD's pollutant emissions by both OFFROAD's equipment horsepower hours per year and the equipment's default load factor from CalEEMod.

**References:**

CARB. OFFROAD 2017 - ORION v1.0.1. Available at: https://www.arb.ca.gov/orion/.

CAPCOA. 2021. CalEEMOD Appendix D Default Data Tables. Available at: http://www.aqmd.gov/docs/default-source/caleemod/user-guide-2021/appendix-d2020-4-0-full-merge.pdf?sfvrsn=12 [Appendix D-11].

**Abbreviations:**

ROG - reactive organic gases
HP - horsepower
PM - particulate matter

**Table 6**
**Offroad Electric Construction Equipment Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1] | Construction Subphase[2] | Equipment Type[2] | CalEEMod® Equipment Category | Fuel[2] | Number[2] | Horsepower[2] | kW[2] | Hours of Operation per Day[2] | Utilization Percent[2] | Usage (kWh/day) |
|---|---|---|---|---|---|---|---|---|---|---|
| Parcel 2 Core and Shell | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 8.0 | 40% | 115 |
| Parcel 2 TI | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 0.50 | 90% | 16 |
| | | Scissor Lift | Aerial Lifts | Electric | 1 | 3.0 | 2.2 | 4.0 | 80% | 7.2 |
| Parcel 3 Core and Shell | | Manlift | Aerial Lifts | Electric | 2 | 48 | 36 | 8.0 | 40% | 229 |
| Parcel 3 TI | | Manlift | Aerial Lifts | Electric | 2 | 48 | 36 | 0.50 | 90% | 32 |
| | | Scissor Lift | Aerial Lifts | Electric | 2 | 3.0 | 2.2 | 4.0 | 80% | 14 |
| Parcel 7 Core and Shell | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 8.0 | 40% | 115 |
| Parcel 7 TI | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 0.50 | 90% | 16 |
| | | Scissor Lift | Aerial Lifts | Electric | 1 | 3.0 | 2.2 | 4.0 | 80% | 7.2 |
| Parcel 6 Core and Shell | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 8.0 | 40% | 115 |
| Parcel 6 TI | | Manlift | Aerial Lifts | Electric | 1 | 48 | 36 | 0.50 | 90% | 16 |
| | | Scissor Lift | Aerial Lifts | Electric | 2 | 3.0 | 2.2 | 4.0 | 80% | 14 |
| Area 3 | Core and Shell | Manlift | Aerial Lifts | Electric | 3 | 48 | 36 | 8.0 | 40% | 344 |
| | TI | Manlift | Aerial Lifts | Electric | 3 | 48 | 36 | 0.50 | 90% | 48 |
| | | Scissor Lift | Aerial Lifts | Electric | 3 | 3.0 | 2.2 | 4.0 | 80% | 21 |
| Hamilton Avenue Parcels North and South | Core and Shell | Manlift | Aerial Lifts | Electric | 0 | 48 | 36 | 8.0 | 40% | 0 |
| | TI | Scissor Lift | Aerial Lifts | Electric | 1 | 3.0 | 2.2 | 6.0 | 80% | 11 |

| Construction Area[1] | Construction Subphase[2] | Days in Each Construction Year (Days/Year) | | | | Usage in Each Construction Year (kWh/Year) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Year 3 | Year 4 | Year 5 | Year 6 | Year 3 | Year 4 | Year 5 | Year 6 |
| Parcel 2 Core and Shell | | 64 | 116 | 0 | 0 | 7,331 | 13,287 | 0 | 0 |
| Parcel 2 TI | | 0 | 147 | 114 | 0 | 0 | 3,420 | 2,652 | 0 |
| Parcel 3 Core and Shell | | 0 | 180 | 0 | 0 | 0 | 41,234 | 0 | 0 |
| Parcel TI | | 0 | 82 | 178 | 0 | 0 | 3,816 | 8,283 | 0 |
| Parcel 7 Core and Shell | | 0 | 129 | 0 | 0 | 0 | 14,776 | 0 | 0 |
| Parcel 7 TI | | 0 | 17 | 171 | 0 | 0 | 396 | 3,978 | 0 |
| Parcel 6 Core and Shell | | 0 | 81 | 48 | 0 | 0 | 9,278 | 5,498 | 0 |
| Parcel 6 TI | | 0 | 0 | 187 | 0 | 0 | 0 | 5,689 | 0 |
| Area 3 | Core and Shell | 0 | 0 | 139 | 0 | 0 | 0 | 47,763 | 0 |
| | TI | 0 | 0 | 25 | 174 | 0 | 0 | 1,745 | 12,145 |
| Hamilton Avenue Parcels North and South | Core and Shell | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 |
| | TI | 0 | 0 | 33 | 0 | 0 | 0 | 354 | 0 |
| | **Total - Equipment** | **64** | **752** | **938** | **174** | **7,331** | **86,205** | **75,963** | **12,145** |

| Year | $CO_2e$ Intensity Factor[3] | Usage | Electric Equipment $CO_2e$ Emissions |
|---|---|---|---|
| | lb/MWh | MWh/Year | MT/Year |
| Year 3 | 215 | 7.3 | 0.71 |
| Year 4 | 204 | 86 | 8.0 |
| Year 5 | 194 | 76 | 6.7 |
| Year 6 | 183 | 12 | 1.0 |
| | **Total** | **182** | **16** |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. Information on Project equipment list, fuel type, quantity, horsepower, and utilization factor were provided by the Project Applicant. The equipment kilowatt usage was determined by converting from horsepower to kilowatts.
3. The energy intensity factors were taken from the local utility Pacific Gas & Electric. See Table 29 for derivation of factors. Values shown above are scaled linearly between the 2020 and 2026 values. Values were scaled to meet the requirements for 33% of energy from renewable sources in 2020 and 50% of energy from renewable sources in 2026 as required under Senate Bill 100.

**Abbreviations:**

CalEEMod® - CALifornia Emissions Estimator MODel
kW - kilowatt
kWh - kilowatt-hour
MWh - megawatt-hour
MT - metric tons
lb - pound
$CO_2e$ - carbon dioxide equivalent

**Table 7a**
**Construction Trips**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Year | Construction Roundtrips[2] Average Worker Trips[3,4] (trips/day) | Average Vendor Trips[3] (trips/day) | Hauling Trips[3] (trips/phase) |
|---|---|---|---|---|---|
| Area 1 | Demolition | Year 1 | 20 | -- | 1,252 |
| | | Year 2 | 20 | -- | 8,092 |
| | Grading and Utilities | Year 2 | 60 | -- | 16,320 |
| Campus District | Foundations + Core and Shell | Year 2 | -- | 5.6 | -- |
| | | Year 3 | -- | 5.6 | -- |
| | | Year 4 | -- | 5.6 | -- |
| | | Year 5 | -- | 5.6 | -- |
| | Tenant Improvements | Year 4 | -- | 3.1 | -- |
| | | Year 5 | -- | 3.1 | -- |
| | | Year 6 | -- | 3.1 | -- |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | -- | 0.86 | -- |
| | | Year 4 | -- | 0.86 | -- |
| | Core and Shell | Year 3 | -- | 1.0 | -- |
| | | Year 4 | -- | 1.0 | -- |
| | Tenant Improvements | Year 4 | -- | 1.1 | -- |
| | | Year 5 | -- | 1.1 | -- |
| | Landscaping | Year 5 | -- | 0.78 | -- |
| Campus District | O4 and NG Worker Mobile Trips | Year 2 | 200 | -- | -- |
| | | Year 3 | 200 | -- | -- |
| | | Year 4 | 200 | -- | -- |
| | MCS Worker Mobile Trips | Year 2 | 150 | -- | -- |
| | | Year 3 | 150 | -- | -- |
| | | Year 4 | 150 | -- | -- |
| | | Year 5 | 150 | -- | -- |
| | | Year 6 | 150 | -- | -- |
| Area 1 Town Square and Residential/Shopping District | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 225 | -- | -- |
| | | Year 4 | 225 | -- | -- |
| | | Year 5 | 225 | -- | -- |
| | Landscaping Worker Mobile Trips | Year 5 | 60 | -- | -- |
| Area 2 | Demolition | Year 2 | 20 | -- | 9,344 |
| | Grading and Utilities | Year 2 | 60 | -- | 8,160 |
| | | Year 3 | 60 | -- | 8,160 |
| Campus District | Foundations + Core and Shell | Year 3 | -- | 5.5 | -- |
| | | Year 4 | -- | 5.5 | -- |
| | Tenant Improvements | Year 4 | -- | 7.2 | -- |
| | | Year 5 | -- | 7.2 | -- |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | -- | 1.1 | -- |
| | Core and Shell | Year 4 | -- | 1.3 | -- |
| | | Year 5 | -- | 1.3 | -- |
| | Tenant Improvements | Year 4 | -- | 1.4 | -- |
| | | Year 5 | -- | 1.4 | -- |
| | Landscaping | Year 5 | -- | 0.78 | -- |
| | | Year 6 | -- | 0.78 | -- |
| Campus District | Worker Mobile Trips | Year 3 | 430 | -- | -- |
| | | Year 4 | 430 | -- | -- |
| | | Year 5 | 430 | -- | -- |
| Area 2 Town Square and Residential/Shopping District | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 225 | -- | -- |
| | | Year 5 | 225 | -- | -- |
| | Landscaping Worker Mobile Trips | Year 5 | 60 | -- | -- |
| | | Year 6 | 60 | -- | -- |
| Area 3 | Grading and Utilities | Year 3 | 296 | -- | 1,232 |
| | Tunnel Construction | Year 3 | 655 | 4.0 | -- |
| | | Year 4 | 655 | 4.0 | -- |
| | Foundations | Year 4 | 655 | 5.0 | -- |
| | | Year 5 | 655 | 5.0 | -- |
| | Core and Shell | Year 5 | 655 | 5.8 | -- |

**Table 7a**
**Construction Trips**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Construction Subphase | Year | Construction Roundtrips[2] | | |
|---|---|---|---|---|---|
| | | | Average Worker Trips[3,4] | Average Vendor Trips[3] | Hauling Trips[3] |
| | | | (trips/day) | (trips/day) | (trips/phase) |
| Area 3 | Tenant Improvements | Year 5 | 655 | 5.9 | -- |
| | | Year 6 | 655 | 5.9 | -- |
| | Landscaping | Year 6 | 30 | 3.3 | -- |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 10 | -- | 211 |
| | Grading and Utilities | Year 4 | 10 | -- | 9 |
| | | Year 5 | 10 | -- | 204 |
| | Foundations | Year 5 | -- | 6.2 | -- |
| | Core and Shell | Year 5 | -- | 2.8 | -- |
| | Tenant Improvements | Year 5 | -- | 4.6 | -- |
| | Worker Mobile Trips | Year 5 | 141 | -- | -- |
| Substation Upgrade | PG&E Substation Work | Year 3 | 8 | 0.5 | -- |
| Feeder Line | PG&E Offsite Work | Year 3 | 10 | 0.5 | -- |
| | Surface Improvements | Year 3 | 10 | 0.5 | -- |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 6 | 1.7 | -- |
| | Adams and O'Brien | Year 3 | 6 | 2.5 | -- |
| | Willow Road and Ivy Drive | Year 3 | 6 | 2.5 | -- |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. Construction trip rates were provided by the Project Applicant for each subphase.
3. CalEEMod® default fleet mixes were used for Worker (LD_Mix), Vendor (MHDT/HHDT), and Hauling (HHDT) trips. LD_Mix was assumed to be 100% gasoline vehicles and MHDT/HHDT and HHDT were assumed to be 100% diesel vehicles.
4. Worker mobile trips for Town Square and Residential/Shopping District and Campus District phases are presented in separate phase-wide subphases as reported by the Project Applicant.

**Abbreviations:**

LD_Mix - light duty mix
MHDT - medium-heavy duty trucks
HHDT - heavy-heavy duty trucks
CalEEMod® - CALifornia Emissions Estimator MODel
VMT - vehicle miles traveled

**Table 7b**
**Construction Trip Lengths**
**Willow Village**
**Menlo Park, CA**

| Trip Type | One-Way Trip Length (mi) |
|---|---|
| Worker[1] | 10.8 |
| Vendor[2] | 40.0 |
| Haul[3] | 22.9 |
| Haul - Grading & Utilities Subphases[4] | 8.2 |

**Notes:**

1. Consistent with CalEEMod methodology, worker trip length is based on the default Home-to-Work trip length for San Mateo County as reported in the CalEEMod® user guide, Appendix D.
2. Vendor trip length was provided by the Project Applicant. Most construction supplies will be available within 40 miles of the Project site. This is a conservative assumption as it is twice the default vendor trip length reported in CalEEMod.
3. Haul trip length was provided by the Project Applicant. A 50/25/25 split was assumed between Zanker Landfill, Ox Mountain Landfill, and Kirby Canyon landfill. The primary landfill was assumed to be Zanker Landfill, due to proximity.
4. Haul trip length for Grading & Utilities subphases was provided by the Project Applicant.

**Abbreviations:**

CalEEMod - CALifornia Emissions Estimator MODel
mi - mile

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**Table 8**
**Fugitive Road Dust Emission Factors**
**Willow Village**
**Menlo Park, California**

**Road Dust Equation[1]**

E [lb/VMT] = k*(sL)^0.91 * (W)^1.02 * (1-P/4N)

| Parameter | Value |
|---|---|
| k = particle size multiplier for $PM_{10}$ [lb/VMT] | 0.0022 |
| sL = roadway silt loading [grams per square meter - g/$m^2$] | 0.032 |
| W = average weight of vehicles traveling the road [tons] | 2.4 |
| P = number of “wet” days in county with at least 0.01 in of precipitation during the annual averaging period | 74 |
| N = number of days in the averaging period | 365 |
| $PM_{10}$ speciation profile fraction | 0.46 |
| $PM_{2.5}$ speciation profile fraction | 0.069 |
| E = Fugitive $PM_{10}$ Emission Factor [g/VMT] | 0.10 |
| E = Fugitive $PM_{2.5}$ Emission Factor [g/VMT][2] | 0.015 |
| E = Fugitive $PM_{10}$ Emission Factor with Street Sweeping Reduction [g/VMT][3] | 0.075 |
| E = Fugitive $PM_{2.5}$ Emission Factor with Street Sweeping Reduction [g/VMT][3] | 0.011 |

**Notes:**

1. Road dust equation is based on the U.S. EPA AP-42 Chapter 13.2.1: Paved Roads. Parameter values were obtained from the 2021 California ARB Miscellaneous Process Methodology using major roadways silt loading, annual San Mateo county "wet" days, and statewide average vehicle fleet weight.
2. $PM_{2.5}$ emission factor was scaled from the $PM_{10}$ value based on the ARB's guidance.
3. A 26% reduction in the $PM_{10}$ emission factor was taken for street sweeping of arterial/collector streets, based on SCAQMD's Fugitive Dust Table XI-C. The $PM_{2.5}$ emissions factor was scaled from the $PM_{10}$ value based on the ARB's guidance.

**Abbreviations:**

ARB - Air Resource Board
lb - pounds
g - grams
$m^2$ - square meters
PM - particulate matter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter
$PM_{10}$ - particulate matter less than 10 microns in diameter
SCAQMD - South Coast Air Quality Management District
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled

**References:**

USEPA. 2011. AP 42. Compilation of Air Pollutant Emission Factors, Volume 1. Fifth Edition. Chapter 13.2.1, Paved Roads. Available online at: https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf

California ARB. 2021. Miscellaneous Processes Methodologies - Paved Entrained Road Dust. Available online at: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf

SCAQMD. 2007. Table XI-C Mitigation Measure Examples: Dust From Paved Roads. Available online at: http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/fugitive-dust

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**Table 9a**
**Fugitive Dust Emissions from Building Demolition Waste**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1,2,3] | Year | Number of Days | Building Waste | Building Waste[4] | Emission Factor - Mechanical or Explosive Dismemberment[5] | Emission Factor - Debris Loading[6] | Uncontrolled Emissions[7,8] | | Controlled Emissions[7,8] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $PM_{2.5}$ | $PM_{2.5}$ | $PM_{2.5}$ | | $PM_{2.5}$ | |
| | | days | cy | ton | lb/ton | lb/ton | lb/day | ton/yr | lb/day | ton/yr |
| Area 1 | Year 1 | 13 | 123,169 | 155,706 | 1.7E-04 | 0.0031 | 3.48 | 0.023 | 1.6 | 0.010 |
| | Year 2 | 84 | | | | | | 0.15 | | 0.066 |
| Area 2 | Year 2 | 48 | | | | | | 0.08 | | 0.038 |
| Hamilton Avenue Parcels North and South | Year 4 | 22 | 3,563 | 4,504 | | | 0.66 | 0.0073 | 0.30 | 0.0033 |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. The modeled fugitive dust source groups included in the health risk assessment are shown in Figures 3 and 4. Figure 3 shows the modeled locations of Area 1 and Area 2, and Figure 4 shows the modeled location of Hamilton Avenue Parcels North and South (which is labeled as "RETAIL" in the figure).
3. Area 3 (Parcels 4, 5, and Tunnel Construction) do not require demolition, and thus do not have any associated fugitive dust emissions from demolition activities.
4. Conversion of building waste to tons assumes an average soil density of 1.5 grams per cubic centimeter, per the CalEEMod® User's Guide, Appendix A Truck Loading.
5. Emission factor calculated following guidance in the CalEEMod® User's Guide, Appendix A Mechanical or Explosive Dismemberment, which is based of AP 42 Section 13.2.4.3 for batch drop operations. The equation is:
   $EF = k*(0.0032)*(U/5)^{1.3}/(M/2)^{1.4}$ (lb/ton of debris)

   0.053 = $k_{PM2.5}$ Particle size multiplier (dimensionless)
   4.92 = U, mean wind speed (mph)
   2 = M, material moisture content (%)
6. Emission factor calculated following guidance in the CalEEMod® User's Guide, Appendix A Debris Loading, which is based of AP 42 Section 13.2. The equation is:
   $EF = k*EF_{L-TSP}$

   0.35 = $k_{PM10}$ Particle size multiplier (dimensionless)
   0.053 = $k_{PM2.5}$ Particle size multiplier (dimensionless)
   0.058 = $EF_{L-TSP}$, lb/ton
7. Fugitive $PM_{2.5}$ emissions from demolition will be controlled by watering the construction site two times per day, which is estimated to reduce emissions by 55% per CalEEMod® recommendation.
8. The mass emissions shown below are converted from ton per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.

**Abbreviations:**

CalEEMod® - California Emissions Estimator Model
cy - cubic yards
EF - emission factor
lb - pounds
$PM_{2.5}$ - particulate matter less than 2.5 microns in aerodynamic diameter
VMT - vehicle miles traveled
yr - years

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**Table 9b**
**Fugitive Dust Emissions from Grading Activity**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1,2] | Year | Maximum Area Disturbed[3] | VMT[4] | Uncontrolled $PM_{2.5}$ Emission Factor[5] | Uncontrolled Emissions[6,7] | | Controlled Emissions[6,7] | |
|---|---|---|---|---|---|---|---|---|
| | | | | | $PM_{2.5}$ | | $PM_{2.5}$ | |
| | | acre/day | mile/day | lb/VMT | lb/day | ton/yr | lb/day | ton/yr |
| Area 1 | Year 2 | 1 | 0.69 | 0.17 | 0.11 | 0.0082 | 0.052 | 0.0037 |
| Area 2 | Year 2 | 1 | 0.69 | 0.17 | 0.11 | 0.0037 | 0.052 | 0.0017 |
| | Year 3 | 1 | 0.69 | 0.17 | 0.11 | 0.0037 | 0.052 | 0.0017 |
| Area 3 | Year 3 | 1 | 0.69 | 0.17 | 0.11 | 0.0013 | 0.052 | 5.7E-04 |
| Hamilton Avenue Parcels North and South | Year 4 | 1 | 0.69 | 0.17 | 0.11 | 5.7E-05 | 0.052 | 2.6E-05 |
| | Year 5 | 1 | 0.69 | 0.17 | 0.11 | 0.0013 | 0.052 | 5.7E-04 |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.

2. The modeled fugitive dust source groups included in the health risk assessment are shown in Figures 3. The name of the construction area aligns with the name of the source groups presented in the figure.

3. Maximum graded area is based on Project-specific estimate.

4. VMT per day calculated following guidance in the CalEEMod® User's Guide, Appendix A, which is based on AP-42, Section 11.9 for grading equipment. The equation is:

$VMT = A_S/W_b \times (43{,}560 \text{ sqft/acre})/(5{,}280 \text{ ft/mile})$, where:

$A_S = A_S$, acres graded per day (varies by sub-activity)

$12 = W_b$, blade width of grading equipment (CalEEMod® default)

5. Emission factor calculated following guidance in the CalEEMod® User's Guide, Appendix A, which is based on AP-42, Section 11.9 for grading equipment. The equation is:

$EF_{PM2.5} = 0.04 \times (S)^{2.5} \times F_{PM2.5}$, where:

$7.1 = S$, mean vehicle speed (mph) (AP-42 default)

$0.031 = F_{PM2.5}$, $PM_{2.5}$ scaling factor (AP-42 default)

6. Fugitive $PM_{2.5}$ emissions from demolition will be controlled by watering the construction site two times per day, which is estimated to reduce emissions by 55% per CalEEMod® recommendation.

7. The mass emissions shown below are converted from ton per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.

**Abbreviations:**

CalEEMod® - California Emissions Estimator Model
EF - emission factor
ft - feet
lb - pounds
mph - miles per hour
$PM_{2.5}$ - particulate matter less than 2.5 microns in aerodynamic diameter
VMT - vehicle miles traveled
yr - years

**Table 9c**
**Fugitive Dust Emissions from Truck Loading Activity**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1,2] | Construction Subphase | Year | Material Loaded | Uncontrolled Emission Factor[3] | Uncontrolled Emissions[4,5] | | Controlled Emissions[4,5] | |
|---|---|---|---|---|---|---|---|---|
| | | | | $PM_{2.5}$ | $PM_{2.5}$ | | $PM_{2.5}$ | |
| | | | ton | lb/ton | lb/day | ton/yr | lb/day | ton/yr |
| Area 1 | Demolition | Year 1 | 3,786 | 1.35E-05 | 3.9E-03 | 2.6E-05 | 1.8E-03 | 1.2E-05 |
| | | Year 2 | 24,468 | | 3.9E-03 | 1.7E-04 | 1.8E-03 | 7.4E-05 |
| | Grading and Utilities | Year 2 | 49,348 | | 4.7E-03 | 3.3E-04 | 2.1E-03 | 1.5E-04 |
| Area 2 | Demolition | Year 2 | 28,254 | | 8.0E-03 | 1.9E-04 | 3.6E-03 | 8.6E-05 |
| | Grading and Utilities | Year 2 | 24,674 | | 5.1E-03 | 1.7E-04 | 2.3E-03 | 7.5E-05 |
| | | Year 3 | 24,674 | | 5.1E-03 | 1.7E-04 | 2.3E-03 | 7.5E-05 |
| Area 3 | Grading and Utilities | Year 3 | 3,725 | | 1.2E-03 | 2.5E-05 | 5.4E-04 | 1.1E-05 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 638 | | 3.9E-04 | 4.3E-06 | 1.8E-04 | 1.9E-06 |
| | Grading and Utilities | Year 4 | 27 | | 3.7E-04 | 1.8E-07 | 1.7E-04 | 8.3E-08 |
| | | Year 5 | 617 | | 3.8E-04 | 4.2E-06 | 1.7E-04 | 1.9E-06 |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. The modeled fugitive dust source groups included in the health risk assessment are shown in Figures 3 and 4. Figure 3 shows the modeled locations of Area 1, Area 2, and Area 3, and Figure 4 shows the modeled location of Hamilton Avenue Parcels North and South (which is labeled as "RETAIL" in the figure).
3. Emission factor calculated following guidance in the CalEEMod® User's Guide, Appendix A, which is based on AP-42, Section 13.2.4 for aggregate handling. The equation is:
   $EF = k \times (0.0032) \times (U/5)^{1.3} / (M/2)^{1.4}$ , where the following default values are used:
   0.053 = $k_{PM2.5}$, $PM_{2.5}$ particle size multiplier
   2.2 = mean wind speed (U), meters per second
   4.9 = mean wind speed (U), miles per hour
   12 = material moisture content (M), %
4. Fugitive $PM_{2.5}$ emissions from demolition will be controlled by watering the construction site two times per day, which is estimated to reduce emissions by 55% per CalEEMod® recommendation.
5. The mass emissions shown below are converted from ton per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.

**Abbreviations:**

CalEEMod® - California Emissions Estimator Model
EF - emission factor
lbs - pounds
$PM_{2.5}$ - particulate matter less than 2.5 microns in aerodynamic diameter

**Table 10**
**Construction Water Use Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1] | Construction Subphase | Year | Number of Work Days | Average Acreage Needing Water[2] | Water Usage[2] | Total Water Usage | Electricity Usage[3] | PG&E Energy Intensity Factor[4] | Total $CO_2e$ Emissions |
|---|---|---|---|---|---|---|---|---|---|
| | | | days | acre | gal/acre/day | million gal | MWh | lbs $CO_2e$/MWh | MT |
| Area 1 | Demolition | Year 1 | 13 | 18 | 500 | 0.11 | 0.40 | 235 | 0.043 |
| | | Year 2 | 84 | 18 | 500 | 0.74 | 2.6 | 225 | 0.27 |
| | Grading and Utilities | Year 2 | 143 | 18 | 500 | 1.3 | 4.4 | 225 | 0.45 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 224 | 4.0 | 143 | 0.13 | 0.45 | 215 | 0.044 |
| | | Year 4 | 1 | 4.0 | 143 | 0.0006 | 0.0 | 204 | 1.9E-04 |
| | Core and Shell | Year 3 | 64 | 4.0 | 148 | 0.038 | 0.1 | 215 | 0.013 |
| | | Year 4 | 180 | 4.0 | 148 | 0.11 | 0.372 | 204 | 0.034 |
| | Tenant Improvements | Year 4 | 147 | 4.0 | 161 | 0.094 | 0.3 | 204 | 0.031 |
| | | Year 5 | 178 | 4.0 | 161 | 0.11 | 0.40 | 194 | 0.035 |
| | Landscaping | Year 5 | 123 | 4.0 | 130 | 0.064 | 0.22 | 194 | 0.020 |
| Campus District | Vertical Construction | Year 2 | 42 | 4.5 | 200 | 0.038 | 0.13 | 225 | 0.014 |
| | | Year 3 | 260 | 4.5 | 200 | 0.24 | 0.82 | 215 | 0.080 |
| | | Year 4 | 262 | 4.5 | 200 | 0.24 | 0.83 | 204 | 0.077 |
| | | Year 5 | 261 | 4.5 | 200 | 0.24 | 0.83 | 194 | 0.073 |
| | | Year 6 | 46 | 4.5 | 200 | 0.042 | 0.15 | 183 | 0.012 |
| Area 2 | Demolition | Year 2 | 48 | 13 | 500 | 0.31 | 1.1 | 225 | 0.11 |
| | Grading and Utilities | Year 2 | 65 | 13 | 500 | 0.42 | 1.5 | 225 | 0.15 |
| | | Year 3 | 65 | 13 | 500 | 0.42 | 1.5 | 215 | 0.14 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 180 | 4.0 | 129 | 0.093 | 0.32 | 204 | 0.030 |
| | Core and Shell | Year 4 | 145 | 4.0 | 134 | 0.078 | 0.27 | 204 | 0.025 |
| | | Year 5 | 48 | 4.0 | 134 | 0.026 | 0.090 | 194 | 0.0079 |
| | Tenant Improvements | Year 4 | 17 | 4.0 | 148 | 0.010 | 0.035 | 204 | 0.0033 |
| | | Year 5 | 235 | 4.0 | 148 | 0.14 | 0.49 | 194 | 0.043 |
| | Landscaping | Year 5 | 91 | 4.0 | 96 | 0.035 | 0.12 | 194 | 0.011 |
| | | Year 6 | 32 | 4.0 | 96 | 0.012 | 0.043 | 183 | 0.0036 |
| Campus District | Vertical Construction | Year 3 | 202 | 5.6 | 200 | 0.23 | 0.79 | 215 | 0.077 |
| | | Year 4 | 262 | 5.6 | 200 | 0.29 | 1.0 | 204 | 0.095 |
| | | Year 5 | 122 | 5.6 | 200 | 0.14 | 0.48 | 194 | 0.042 |
| Area 3 | Grading and Utilities | Year 3 | 22 | 5.0 | 500 | 0.055 | 0.19 | 215 | 0.019 |
| | Tunnel Construction | Year 3 | 175 | 5.0 | 500 | 0.44 | 1.5 | 215 | 0.15 |
| | | Year 4 | 87 | 5.0 | 500 | 0.22 | 0.76 | 204 | 0.071 |
| | Foundations | Year 4 | 24 | 5.0 | 200 | 0.024 | 0.084 | 204 | 0.0078 |
| | | Year 5 | 99 | 5.0 | 200 | 0.10 | 0.35 | 194 | 0.030 |
| | Core and Shell | Year 5 | 139 | 5.0 | 200 | 0.14 | 0.487 | 194 | 0.043 |
| | Tenant Improvements | Year 5 | 25 | 5.0 | 200 | 0.025 | 0.088 | 194 | 0.0077 |
| | | Year 6 | 174 | 5.0 | 200 | 0.17 | 0.61 | 183 | 0.051 |
| | Landscaping | Year 6 | 59 | 8.0 | 200 | 0.09 | 0.33 | 183 | 0.027 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 22 | 3.7 | 682 | 0.056 | 0.19 | 204 | 0.018 |
| | Grading and Utilities | Year 4 | 1 | 3.7 | 2891 | 0.011 | 0.037 | 204 | 0.0035 |
| | | Year 5 | 22 | 3.7 | 2891 | 0.24 | 0.82 | 194 | 0.072 |
| | Foundations | Year 5 | 22 | 3.7 | 518 | 0.042 | 0.15 | 194 | 0.013 |
| | Core and Shell | Year 5 | 43 | 3.7 | 316 | 0.050 | 0.18 | 194 | 0.015 |
| | Tenant Improvements | Year 5 | 33 | 3.7 | 515 | 0.063 | 0.22 | 194 | 0.019 |
| Feeder Line | PG&E Offsite Work | Year 3 | 240 | -- | -- | 0.250 | 0.88 | 215 | 0.085 |
| | | | | | | | Total | **Year 1** | **0.043** |
| | | | | | | | | **Year 2** | **1.0** |
| | | | | | | | | **Year 3** | **0.61** |
| | | | | | | | | **Year 4** | **0.40** |
| | | | | | | | | **Year 5** | **0.43** |
| | | | | | | | | **Year 6** | **0.094** |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.

2 Information on Project water use was provided by the Project Applicant.

3 Energy usage is calculated by applying the electric intensity factor for outdoor water to total water usage. An electric intensity factor of 3,500 kWh/million gallons was taken from Table 9.2 in Appendix D of the CalEEMod User's Guide as the sum of supply water, treat water and distribute water electric intensity factors. Since the water use reported here is only for construction fugitive dust control, operational indoor water use-related emissions and wastewater treatment-related emissions are not estimated here.

4 The energy intensity factors were taken from the local utility Pacific Gas & Electric. See Table 29 for derivation of factors. Values shown above are scaled linearly between the 2020 and 2026 values. Values were scaled to meet the requirements for 33% of energy from renewable sources in 2020 and 50% of energy from renewable sources in 2026 as required under Senate Bill 100.

**Abbreviations:**

$CO_2e$ - Carbon dioxide-equivalent
gal - Gallons
GHG - Greenhouse gases
kWh - kilowatt-hours
MWh - megawatt-hours
lbs - pounds
MT - Metric Tons
CalEEMod - California Emissions Estimate Model

**References:**


CalEEMod User's Guide (Available online at: http://www.aqmd.gov/caleemod/user's-guide)
PG&E, Pacific Gas and Electric - Gas and power company for California (https://www.pge.com/)

**Table 11**
**Project Construction Asphalt Paving Off-Gassing Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[1] | Construction Subphase[2] | Land Use | Asphalt-Paved Area | Asphalt Paving ROG Off-Gassing Emission Factor[3] | ROG Off-Gassing Emissions |
|---|---|---|---|---|---|
| | | | acre | lb/acre | lb/subphase |
| Area 1 | Grading and Utilities | Roadway | 11.7 | 2.62 | 31 |
| Area 3 | Grading and Utilities | Roadway | 1.1 | 2.62 | 2.9 |
| Hamilton Avenue Parcels North and South | Grading and Utilities | Roadway | 1.3 | 2.62 | 3.4 |
| Feeder Line | Surface Improvements | Roadway | 1.09 | 2.62 | 2.9 |
| Intersection Improvements | O'Brien and Kavanaugh | Roadway | 0.11 | 2.62 | 0.3 |
| | Adams and O'Brien | Roadway | 0.11 | 2.62 | 0.3 |
| | Willow Road and Ivy Drive | Roadway | 0.11 | 2.62 | 0.3 |
| | | | | **Total Year 2** | **31** |
| | | | | **Total Year 3** | **6.6** |
| | | | | **Total Year 5** | **3.4** |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction. No paving occurs in Area 2.
2. Asphalt-paved roadway area was provided by the Project Applicant.
3. The VOC off-gassing emission factor is from CalEEMod User's Guide, Appendix A. VOC is assumed to be equivalent to ROG for these purposes.

**Abbreviations:**

lb - pound
VOC - volatile organic compound
ROG - reactive organic gas

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2016.3.2. Available online at http://www.caleemod.com/

**Table 12**
**Project Construction Architectural Coating Off-Gassing Emissions**
**Willow Village**
**Menlo Park, CA**

| Coating Category | Unmitigated Interior | Mitigated Interior | Exterior |
|---|---|---|---|
| **VOC Content (g/L)[1,2]** | 100 | 10 | 150 |
| **Emission Factor (lb/ft$^2$)[3]** | 0.0046 | 0.00046 | 0.0070 |
| **Land Use** | **Fraction of Surface Area Painted[3] (%)** | | **Painted Area Multiplier[3]** |
| | **Interior** | **Exterior** | |
| Residential | 75% | 25% | 2.7 |
| Non-Residential | 75% | 25% | 2 |
| Parking | 0% | 6% | -- |

| Building or Parcel | Land Use[4] | Start Year | End Year | Building Square Footage[5] | | | Painted Surface Area | | Unmitigated ROG Emissions | Mitigated ROG Emissions |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential Area | Non-Residential Area | Parking Area | Interior | Exterior | | |
| | | | | ft$^2$ | ft$^2$ | ft$^2$ | ft$^2$ | ft$^2$ | tons | tons |
| Parcel 2 | Residential | Year 4 | Year 5 | 320,569 | -- | -- | 649,152 | 216,384 | 2.3 | 0.90 |
| | Non-Residential | | | -- | 40,000 | -- | 60,000 | 20,000 | 0.21 | 0.083 |
| | Parking | | | -- | -- | 216,862 | -- | 13,012 | 0.045 | 0.045 |
| Parcel 3 | Residential | Year 4 | Year 5 | 410,760 | -- | -- | 831,788 | 277,263 | 2.9 | 1.2 |
| | Non-Residential | | | -- | 55,000 | -- | 82,500 | 27,500 | 0.29 | 0.11 |
| | Parking | | | -- | -- | 233,000 | -- | 13,980 | 0.049 | 0.049 |
| North Garage | Parking | Year 2 | Year 3 | -- | -- | 840,056 | -- | 50,403 | 0.18 | 0.18 |
| Office Building 4 | Non-Residential | Year 4 | | -- | 269,934 | -- | 404,902 | 134,967 | 1.4 | 0.56 |
| Meeting, Collaboration, Park | Non-Residential | Year 5 | Year 6 | -- | 454,563 | -- | 681,844 | 227,281 | 2.4 | 0.95 |
| Hotel | Non-Residential | Year 5 | | -- | 172,000 | -- | 258,000 | 86,000 | 0.90 | 0.36 |
| Other | Non-Residential | Year 4 | | -- | 6,085 | -- | 9,127 | 3,042 | 0.032 | 0.013 |
| | Parking | | | -- | -- | 13,600 | -- | 816 | 2.8E-03 | 2.8E-03 |
| Parcel 7 | Residential | Year 4 | Year 5 | 117,640 | -- | -- | 238,221 | 79,407 | 0.83 | 0.33 |
| | Parking | | | -- | -- | 9,547 | -- | 573 | 2.0E-03 | 2.0E-03 |
| Parcel 6 | Residential | Year 5 | | 174,499 | -- | -- | 353,361 | 117,787 | 1.2 | 0.49 |
| | Parking | | | -- | -- | 26,809 | -- | 1,609 | 5.6E-03 | 5.6E-03 |
| South Garage | Parking | Year 3 | Year 4 | -- | -- | 446,830 | -- | 26,810 | 0.093 | 0.093 |
| Office Building 3 | Non-Residential | Year 4 | Year 5 | -- | 212,805 | -- | 319,207 | 106,402 | 1.1 | 0.44 |
| Office Building 1 | Non-Residential | Year 4 | | -- | 134,237 | -- | 201,355 | 67,118 | 0.70 | 0.28 |
| Office Building 2 | Non-Residential | Year 4 | Year 5 | -- | 164,078 | -- | 246,118 | 82,039 | 0.86 | 0.34 |
| Office Building 5 | Non-Residential | Year 4 | Year 5 | -- | 236,320 | -- | 354,481 | 118,160 | 1.2 | 0.49 |
| Office Building 6 | Non-Residential | Year 4 | Year 5 | -- | 221,978 | -- | 332,967 | 110,989 | 1.2 | 0.46 |
| Parcels 4 + 5 | Residential | Year 5 | Year 6 | 672,508 | -- | -- | 1,361,830 | 453,943 | 4.7 | 1.9 |
| | Non-Residential | | | -- | 5,000 | -- | 7,500 | 2,500 | 0.026 | 0.010 |
| | Parking | | | -- | -- | 82,536 | -- | 4,952 | 0.017 | 0.017 |
| Hamilton Avenues Parcels North and South | Non-Residential | Year 5 | | -- | 7,690 | -- | 11,535 | 3,845 | 0.040 | 0.016 |
| | | | | | | | | **Total Year 2[6]** | **0.025** | **0.025** |
| | | | | | | | | **Total Year 3[6]** | **0.20** | **0.20** |
| | | | | | | | | **Total Year 4[6]** | **7.5** | **3.1** |
| | | | | | | | | **Total Year 5[6]** | **9.7** | **3.9** |
| | | | | | | | | **Total Year 6[6]** | **5.2** | **2.1** |

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**Table 12**
**Project Construction Architectural Coating Off-Gassing Emissions**
**Willow Village**
**Menlo Park, CA**

**Notes:**

1. VOC content of paint is assumed to be consistent with BAAQMD Regulation 8, Rule 3 for flat and nonflat coatings. VOC is assumed to be equivalent to ROG for these purposes.
2. Paint VOC content is consistent with or more stringent than BAAQMD Regulation 8 Rule 3 (Architectural Coatings). Emissions are estimated assuming that indoor painting will utilize "super-compliant" VOC architectural coatings that meet the more stringent limits in South Coast Air Quality Management District Rule 1113. For outdoor paint, assumes use of coatings with VOC content of 150 g/L, consistent with BAAQMD requirements. VOC is assumed to be equivalent to ROG for these purposes.
3. The emission factor is calculated using CalEEMod default architectural coating emissions parameters. The default assumptions account for the painting surface area relative to the floor square footage assuming 1 gallon of paint covers 180 sqft of surface area.
4. Consistent with CalEEMod Appendix A, recreational areas were excluded from the floor square footage in calculating VOC emissions due to architectural coatings.
5. Project square footage by land use was provided by the Project Applicant.
6. ROG emissions are allocated to each year based on the construction schedule for each building or parcel.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator MODel
CEQA - California Environmental Quality Act
$ft^2$ - square feet
g - gram
gal - gallons
L - liters
lb - pounds
ROG - reactive organic gas
sqft - square feet
VOC - volatile organic compound

**References:**

BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). 2016. Appendix A. Available at: http://www.caleemod.com

**Table 13**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

**Off-Road Emissions[1,2]**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 34 | 376 | 15 | 14 |
| | | Year 2 | 196 | 2,133 | 82 | 76 |
| | Grading and Utilities | Year 2 | 436 | 4,632 | 159 | 146 |
| Parcel 2 Foundations | | Year 3 | 285 | 2,758 | 163 | 150 |
| Parcel 2 Core and Shell | | Year 3 | 31 | 296 | 16 | 15 |
| | | Year 4 | 57 | 451 | 25 | 23 |
| Parcel 2 Tenant Improvements | | Year 4 | 52 | 371 | 24 | 22 |
| | | Year 5 | 32 | 302 | 18 | 16 |
| Parcel 2 Landscaping | | Year 5 | 134 | 896 | 70 | 65 |
| Parcel 3 Foundations | | Year 3 | 373 | 3,494 | 219 | 202 |
| | | Year 4 | 2.4 | 21 | 1.3 | 1.2 |
| Parcel 3 Core and Shell | | Year 4 | 128 | 938 | 54 | 50 |
| Parcel 3 Tenant Improvements | | Year 4 | 30 | 235 | 13 | 12.2 |
| | | Year 5 | 52 | 531 | 28 | 25 |
| Parcel 3 Landscaping | | Year 5 | 160 | 1,093 | 87 | 80 |
| North Garage | | Year 2 | 62 | 644 | 20 | 19 |
| | | Year 3 | 152 | 1,615 | 62 | 57 |
| Office Building 4 | | Year 3 | 132 | 1,355 | 54 | 50 |
| | | Year 4 | 17 | 227 | 7.3 | 6.8 |
| Meeting, Collaboration, Park | | Year 2 | 102 | 992 | 31 | 29 |
| | | Year 3 | 433 | 4,090 | 159 | 147 |
| | | Year 4 | 96 | 1,075 | 24 | 22 |
| | | Year 5 | 81 | 842 | 18 | 17 |
| | | Year 6 | 26 | 229 | 8.0 | 7.4 |
| Hotel Excavation | | Year 2 | 99 | 995 | 34 | 31 |
| | | Year 3 | 421 | 4,048 | 173 | 160 |
| Hotel Construction | | Year 4 | 94 | 1,011 | 27 | 25 |
| | | Year 5 | 71 | 845 | 18 | 16 |
| Town Square | | Year 3 | 608 | 5,208 | 301 | 277 |
| | | Year 4 | 256 | 2,207 | 120 | 111 |
| | | Year 5 | 26 | 218 | 3.7 | 3.4 |
| Area 2 | Demolition | Year 2 | 112 | 1,219 | 47 | 43 |
| | Grading and Utilities | Year 2 | 198 | 2,106 | 72 | 67 |
| | | Year 3 | 289 | 2,620 | 132 | 122 |
| Parcel 7 Foundations | | Year 4 | 200 | 1,666 | 113 | 104 |
| Parcel 7 Core and Shell | | Year 4 | 63 | 482 | 28 | 26 |
| Parcel 7 Tenant Improvements | | Year 4 | 6.0 | 41 | 2.7 | 2.5 |
| | | Year 5 | 48 | 438 | 26 | 24 |
| Parcel 7 Landscaping | | Year 5 | 110 | 704 | 55 | 51 |
| Parcel 6 Foundations | | Year 4 | 202 | 1,728 | 113 | 104 |
| Parcel 6 Core and Shell | | Year 4 | 58 | 410 | 24 | 22 |
| | | Year 5 | 27 | 256 | 14 | 13 |
| Parcel 6 Tenant Improvements | | Year 5 | 54 | 538 | 29 | 27 |
| Parcel 6 Landscaping | | Year 5 | 64 | 426 | 34 | 32 |
| | | Year 6 | 74 | 488 | 40 | 37 |
| South Garage | | Year 3 | 188 | 1,854 | 77 | 71 |
| | | Year 4 | 83 | 889 | 32 | 29 |
| Office Building 3 | | Year 3 | 168 | 1,611 | 72 | 66 |
| | | Year 4 | 35 | 442 | 13 | 12 |
| | | Year 5 | 3.9 | 58 | 1.6 | 1.5 |
| Office Building 1 | | Year 3 | 147 | 1,427 | 62 | 57 |
| | | Year 4 | 33 | 411 | 13 | 12 |
| Office Building 2 | | Year 3 | 142 | 1,366 | 60 | 56 |
| | | Year 4 | 36 | 448 | 14 | 13 |
| | | Year 5 | 0.44 | 6.4 | 0.18 | 0.17 |
| Office Building 5 | | Year 3 | 197 | 1,875 | 84 | 78 |
| | | Year 4 | 33 | 418 | 13 | 12 |
| | | Year 5 | 3.6 | 52 | 1.5 | 1.4 |

**Table 13**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Office Building 6 | | Year 3 | 189 | 1,775 | 82 | 75 |
| | | Year 4 | 39 | 476 | 14 | 13 |
| | | Year 5 | 7.6 | 112 | 3.2 | 3.0 |
| Area 3 | Grading and Utilities | Year 3 | 49 | 443 | 22 | 21 |
| | Tunnel Construction | Year 3 | 145 | 1,476 | 68 | 63 |
| | | Year 4 | 71 | 710 | 33 | 31 |
| | Foundations | Year 4 | 86 | 725 | 47 | 43 |
| | | Year 5 | 333 | 2,939 | 190 | 174 |
| | Core and Shell | Year 5 | 151 | 1,358 | 71 | 65 |
| | Tenant Improvements | Year 5 | 13 | 118 | 5.6 | 5.2 |
| | | Year 6 | 85 | 803 | 38 | 35 |
| | Landscaping | Year 6 | 210 | 1,522 | 119 | 110 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 42 | 428 | 23 | 21 |
| | Grading and Utilities | Year 4 | 2.1 | 20 | 1.2 | 1.1 |
| | | Year 5 | 45 | 441 | 25 | 23 |
| | Foundations | Year 5 | 35 | 309 | 20 | 18 |
| | Core and Shell | Year 5 | 18 | 189 | 7.9 | 7.3 |
| | Tenant Improvements | Year 5 | 14 | 141 | 7.1 | 6.5 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 223 | 1,749 | 142 | 131 |
| Feeder Line | PG&E Offsite Work | Year 3 | 180 | 1,438 | 99 | 91 |
| | Surface Improvements | Year 3 | 20 | 186 | 11 | 10 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 8.4 | 66 | 5.3 | 4.9 |
| | Adams and O'Brien | Year 3 | 5.6 | 44 | 3.6 | 3.3 |
| | Willow Road and Ivy Drive | Year 3 | 5.6 | 44 | 3.6 | 3.3 |

**On-Road and Paving[1]**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 10 | 513 | 4.6 | 4.4 |
| | | Year 2 | 56 | 3,017 | 23 | 22 |
| | Grading and Utilities | Year 2 | 132 | 2,549 | 17 | 17 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 1.6 | 90 | 0.92 | 0.88 |
| | | Year 4 | 0.0064 | 0.38 | 3.8E-03 | 3.7E-03 |
| | Core and Shell | Year 3 | 0.45 | 26 | 0.26 | 0.25 |
| | | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Tenant Improvements | Year 4 | 0.95 | 56 | 0.56 | 0.54 |
| | | Year 5 | 1.0 | 64 | 0.63 | 0.61 |
| | Landscaping | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 300 | 219 | 3.9 | 3.6 |
| | | Year 4 | 328 | 230 | 4.4 | 4.1 |
| | | Year 5 | 210 | 142 | 2.9 | 2.6 |
| | Landscaping Worker Mobile Trips | Year 5 | 39 | 26 | 0.53 | 0.49 |
| Campus District | Foundations + Core and Shell | Year 2 | 2.3 | 111 | 1.1 | 1.0 |
| | | Year 3 | 10 | 576 | 5.9 | 5.6 |
| | | Year 4 | 9.3 | 548 | 5.5 | 5.3 |
| | | Year 5 | 8.4 | 515 | 5.1 | 4.9 |
| | Tenant Improvements | Year 4 | 3.8 | 223 | 2.2 | 2.1 |
| | | Year 5 | 4.6 | 281 | 2.8 | 2.7 |
| | | Year 6 | 0.74 | 47 | 0.46 | 0.44 |
| | O4 and NG Worker Mobile Trips | Year 2 | 53 | 41 | 0.69 | 0.64 |
| | | Year 3 | 309 | 226 | 4.1 | 3.7 |
| | | Year 4 | 230 | 162 | 3.1 | 2.8 |
| | MCS Worker Mobile Trips | Year 2 | 40 | 31 | 0.52 | 0.48 |
| | | Year 3 | 232 | 169 | 3.1 | 2.8 |
| | | Year 4 | 219 | 153 | 2.9 | 2.7 |
| | | Year 5 | 205 | 139 | 2.8 | 2.6 |
| | | Year 6 | 34 | 22 | 0.47 | 0.43 |
| Area 2 | Demolition | Year 2 | 58 | 3,480 | 27 | 25 |
| | Grading and Utilities | Year 2 | 48 | 1,273 | 8.7 | 8.3 |
| | | Year 3 | 43 | 1,129 | 8.3 | 7.9 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Core and Shell | Year 4 | 1.4 | 83 | 0.83 | 0.79 |
| | | Year 5 | 0.42 | 26 | 0.26 | 0.25 |

**Table 13**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 2 Town Square and Residential/Shopping District | Tenant Improvements | Year 4 | 0.16 | 10 | 0.10 | 0.093 |
| | | Year 5 | 2.1 | 126 | 1.3 | 1.2 |
| | Landscaping | Year 5 | 0.54 | 33 | 0.32 | 0.31 |
| | | Year 6 | 0.17 | 11 | 0.11 | 0.10 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 326 | 228 | 4.4 | 4.0 |
| | | Year 5 | 277 | 187 | 3.8 | 3.5 |
| | Landscaping Worker Mobile Trips | Year 5 | 29 | 19 | 0.39 | 0.36 |
| | | Year 6 | 10 | 6.2 | 0.13 | 0.12 |
| Campus District | Foundations + Core and Shell | Year 3 | 7.8 | 447 | 4.5 | 4.3 |
| | | Year 4 | 8.2 | 486 | 4.9 | 4.7 |
| | Tenant Improvements | Year 4 | 7.0 | 410 | 4.1 | 3.9 |
| | | Year 5 | 5.0 | 306 | 3.0 | 2.9 |
| | Worker Mobile Trips | Year 3 | 516 | 377 | 6.8 | 6.3 |
| | | Year 4 | 627 | 440 | 8.4 | 7.7 |
| | | Year 5 | 275 | 186 | 3.8 | 3.5 |
| Area 3 | Grading and Utilities | Year 3 | 45 | 196 | 1.7 | 1.6 |
| | Tunnel Construction | Year 3 | 686 | 779 | 12 | 11 |
| | | Year 4 | 319 | 355 | 5.6 | 5.2 |
| | Foundations | Year 4 | 88 | 107 | 1.6 | 1.5 |
| | | Year 5 | 343 | 407 | 6.4 | 6.0 |
| | Core and Shell | Year 5 | 483 | 622 | 9.5 | 8.8 |
| | Tenant Improvements | Year 5 | 87 | 112 | 1.7 | 1.6 |
| | | Year 6 | 571 | 724 | 11 | 10 |
| | Landscaping | Year 6 | 10 | 71 | 0.77 | 0.73 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 2.1 | 66.3 | 0.58 | 0.55 |
| | Grading and Utilities | Year 4 | 0.077 | 1.3 | 0.010 | 9.2E-03 |
| | | Year 5 | 5.0 | 27 | 0.21 | 0.20 |
| | Foundations | Year 5 | 0.80 | 49 | 0.49 | 0.47 |
| | Core and Shell | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Tenant Improvements | Year 5 | 0.90 | 55 | 0.55 | 0.52 |
| | Worker Mobile Trips | Year 5 | 72 | 48 | 1.0 | 0.90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 5.5 | 24 | 0.27 | 0.26 |
| Feeder Line | PG&E Offsite Work | Year 3 | 15 | 56 | 0.65 | 0.62 |
| | Surface Improvements | Year 3 | 4.3 | 5.4 | 0.063 | 0.059 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.0 | 10 | 0.11 | 0.10 |
| | Adams and O'Brien | Year 3 | 0.83 | 10 | 0.11 | 0.10 |
| | Willow Road and Ivy Drive | Year 3 | 0.83 | 10 | 0.11 | 0.10 |

| Summary of Project Construction Unmitigated Annual CAP Emissions by Year | | | | |
|---|---|---|---|---|
| Year | Emissions[4] | | | |
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | ton/year | | | |
| Year 1 | 0.022 | 0.44 | 0.010 | 9.0E-03 |
| Year 2 | 0.82 | 12 | 0.26 | 0.24 |
| Year 3 | 3.5 | 23 | 1.06 | 0.98 |
| Year 4 | 9.5 | 9.8 | 0.41 | 0.38 |
| Year 5 | 11 | 8.1 | 0.39 | 0.36 |
| Year 6 | 5.7 | 2.0 | 0.11 | 0.10 |
| **Total** | 31 | 55 | 2.2 | 2.1 |

| Summary of Project Construction Unmitigated Daily CAP Emissions by Year | | | | |
|---|---|---|---|---|
| Year | Emissions | | | |
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | lb/day | | | |
| Year 1 | 2.8 | **56** | 1.2 | 1.1 |
| Year 2 | 4.5 | **64** | 1.4 | 1.3 |
| Year 3 | 19 | **124** | 5.8 | 5.4 |
| Year 4 | 52 | 53 | 2.3 | 2.1 |
| Year 5 | **63** | 45 | 2.1 | 2.0 |
| Year 6 | 35 | 12 | 0.68 | 0.62 |
| **Threshold[5]** | 54 | 54 | 82 | 54 |

**Notes:**

1. Construction emissions were estimated with methodology equivalent to CalEEMod 2020.4.0. Emissions were estimated using on-road emissions factors from EMFAC2021 and off-road construction equipment emission factors from OFFROAD2017. Onroad trips and offroad construction equipment use were provided by the Project Applicant.
2. Unmitigated construction emissions from offroad equipment are calculated using fleet-average emission factors.
3. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
4. The mass emissions shown above are converted from pound per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.
5. Thresholds are from BAAQMD California Environmental Quality Act (CEQA) Guidelines. Bolded values indicate threshold exceedances. Fugitive emissions sources are excluded from comparison to this threshold.

**Abbreviations:**

CAP - criteria air pollutant
CalEEMod - California Emissions Estimate Model
ROG - reactive organic gases
$NO_X$ - nitrous oxide

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**Table 14**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

**Off-Road Emissions[1,2]**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 13 | 168 | 2.4 | 2.4 |
| | | Year 2 | 79 | 1,045 | 15 | 15 |
| | Grading and Utilities | Year 2 | 189 | 2,033 | 36 | 35 |
| Parcel 2 Foundations | | Year 3 | 48 | 933 | 8.4 | 8.4 |
| Parcel 2 Core and Shell | | Year 3 | 7.3 | 81 | 1.4 | 1.4 |
| | | Year 4 | 13 | 143 | 2.5 | 2.4 |
| Parcel 2 Tenant Improvements | | Year 4 | 9.3 | 133 | 1.8 | 1.7 |
| | | Year 5 | 6.8 | 95 | 1.1 | 1.0 |
| Parcel 2 Landscaping | | Year 5 | 10 | 165 | 1.3 | 1.3 |
| Parcel 3 Foundations | | Year 3 | 53 | 1,008 | 9.5 | 9.4 |
| | | Year 4 | 0.33 | 6.2 | 0.059 | 0.058 |
| Parcel 3 Core and Shell | | Year 4 | 24 | 333 | 4.3 | 4.2 |
| Parcel 3 Tenant Improvements | | Year 4 | 6.1 | 102 | 1.11 | 1.09 |
| | | Year 5 | 13 | 207 | 1.9 | 1.9 |
| Parcel 3 Landscaping | | Year 5 | 11 | 215 | 1.3 | 1.3 |
| North Garage | | Year 2 | 31 | 310 | 5.7 | 5.7 |
| | | Year 3 | 57 | 568 | 11 | 11.0 |
| Office Building 4 | | Year 3 | 46 | 562 | 8.4 | 8.4 |
| | | Year 4 | 7.0 | 138 | 1.2 | 1.2 |
| Meeting, Collaboration, Park | | Year 2 | 50 | 453 | 9.3 | 9.3 |
| | | Year 3 | 172 | 1,532 | 32 | 32 |
| | | Year 4 | 55 | 818 | 10 | 10 |
| | | Year 5 | 50 | 561 | 7.2 | 7.2 |
| | | Year 6 | 12 | 69 | 1.8 | 1.8 |
| Hotel Excavation | | Year 2 | 50 | 441 | 10 | 9 |
| | | Year 3 | 160 | 1,462 | 32 | 32 |
| Hotel Construction | | Year 4 | 63 | 814 | 13 | 13 |
| | | Year 5 | 42 | 643 | 6.1 | 6.1 |
| Town Square | | Year 3 | 141 | 1,493 | 27 | 27 |
| | | Year 4 | 67 | 676 | 13 | 13 |
| | | Year 5 | 21 | 147 | 3.4 | 3.4 |
| Area 2 | Demolition | Year 2 | 45 | 597 | 8.7 | 8.6 |
| | Grading and Utilities | Year 2 | 86 | 924 | 16 | 16 |
| | | Year 3 | 83 | 886 | 16 | 16 |
| Parcel 7 Foundations | | Year 4 | 25 | 412 | 4.4 | 4.4 |
| Parcel 7 Core and Shell | | Year 4 | 14 | 139 | 2.7 | 2.7 |
| Parcel 7 Tenant Improvements | | Year 4 | 1.1 | 14 | 0.21 | 0.20 |
| | | Year 5 | 10 | 126 | 1.6 | 1.6 |
| Parcel 7 Landscaping | | Year 5 | 8.6 | 153 | 1.1 | 1.1 |
| Parcel 6 Foundations | | Year 4 | 27 | 474 | 4.7 | 4.6 |
| Parcel 6 Core and Shell | | Year 4 | 11 | 138 | 1.9 | 1.9 |
| | | Year 5 | 6.1 | 75 | 0.91 | 0.89 |
| Parcel 6 Tenant Improvements | | Year 5 | 13 | 198 | 2.0 | 2.0 |
| Parcel 6 Landscaping | | Year 5 | 4.6 | 96 | 0.54 | 0.54 |
| | | Year 6 | 5.4 | 112 | 0.63 | 0.63 |
| South Garage | | Year 3 | 68 | 674 | 13 | 13 |
| | | Year 4 | 34 | 372 | 6.5 | 6.5 |
| Office Building 3 | | Year 3 | 55 | 532 | 10 | 10 |
| | | Year 4 | 14 | 289 | 2.4 | 2.4 |
| | | Year 5 | 1.8 | 35 | 0.25 | 0.25 |
| Office Building 1 | | Year 3 | 48 | 492 | 9.2 | 9.1 |
| | | Year 4 | 13 | 269 | 2.2 | 2.2 |
| Office Building 2 | | Year 3 | 46 | 454 | 8.8 | 8.8 |
| | | Year 4 | 14 | 293 | 2.5 | 2.4 |
| | | Year 5 | 0.20 | 3.8 | 0.029 | 0.028 |
| Office Building 5 | | Year 3 | 63 | 617 | 12 | 12 |
| | | Year 4 | 13 | 271 | 2.3 | 2.3 |
| | | Year 5 | 1.7 | 31 | 0.23 | 0.23 |

**Table 14**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Office Building 6 | | Year 3 | 60 | 540 | 11 | 11 |
| | | Year 4 | 16 | 316 | 2.7 | 2.7 |
| | | Year 5 | 3.6 | 67 | 0.50 | 0.49 |
| Area 3 | Grading and Utilities | Year 3 | 14 | 150 | 2.7 | 2.7 |
| | Tunnel Construction | Year 3 | 43 | 557 | 7.6 | 7.5 |
| | | Year 4 | 21 | 275 | 3.7 | 3.7 |
| | Foundations | Year 4 | 12 | 208 | 2.2 | 2.1 |
| | | Year 5 | 49 | 796 | 6.5 | 6.5 |
| | Core and Shell | Year 5 | 41 | 445 | 5.9 | 5.8 |
| | Tenant Improvements | Year 5 | 4.2 | 52 | 0.61 | 0.60 |
| | | Year 6 | 29 | 361 | 4.1 | 4.1 |
| | Landscaping | Year 6 | 18 | 336 | 2.2 | 2.2 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 9.0 | 200 | 1.5 | 1.5 |
| | Grading and Utilities | Year 4 | 0.34 | 6.8 | 0.062 | 0.061 |
| | | Year 5 | 7.2 | 138 | 1.1 | 1.1 |
| | Foundations | Year 5 | 5.4 | 97 | 0.78 | 0.78 |
| | Core and Shell | Year 5 | 8.1 | 117 | 1.4 | 1.4 |
| | Tenant Improvements | Year 5 | 3.6 | 54 | 0.51 | 0.50 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 10 | 68 | 2.4 | 2.4 |
| Feeder Line | PG&E Offsite Work | Year 3 | 30 | 207 | 6.5 | 6.5 |
| | Surface Improvements | Year 3 | 3.3 | 22 | 0.66 | 0.65 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 0.36 | 2.6 | 0.091 | 0.091 |
| | Adams and O'Brien | Year 3 | 0.24 | 1.7 | 0.061 | 0.061 |
| | Willow Road and Ivy Drive | Year 3 | 0.24 | 1.7 | 0.061 | 0.061 |

**On-Road and Paving[1]**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 10 | 513 | 4.6 | 4.4 |
| | | Year 2 | 56 | 3,017 | 23 | 22 |
| | Grading and Utilities | Year 2 | 132 | 2,549 | 17 | 17 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 1.6 | 90 | 0.92 | 0.88 |
| | | Year 4 | 6.4E-03 | 0.38 | 3.8E-03 | 3.7E-03 |
| | Core and Shell | Year 3 | 0.45 | 26 | 0.26 | 0.25 |
| | | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Tenant Improvements | Year 4 | 0.95 | 56 | 0.56 | 0.54 |
| | | Year 5 | 1.0 | 64 | 0.63 | 0.61 |
| | Landscaping | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 300 | 219 | 3.9 | 3.6 |
| | | Year 4 | 328 | 230 | 4.4 | 4.1 |
| | | Year 5 | 210 | 142 | 2.9 | 2.6 |
| | Landscaping Worker Mobile Trips | Year 5 | 39 | 26 | 0.53 | 0.49 |
| Area 1 Campus District | Foundations + Core and Shell | Year 2 | 2.3 | 111 | 1.1 | 1.0 |
| | | Year 3 | 10 | 576 | 5.9 | 5.6 |
| | | Year 4 | 9.3 | 548 | 5.5 | 5.3 |
| | | Year 5 | 8.4 | 515 | 5.1 | 4.9 |
| | Tenant Improvements | Year 4 | 3.8 | 223 | 2.2 | 2.1 |
| | | Year 5 | 4.6 | 281 | 2.8 | 2.7 |
| | | Year 6 | 0.74 | 47 | 0.46 | 0.44 |
| | O4 and NG Worker Mobile Trips | Year 2 | 53 | 41 | 0.69 | 0.64 |
| | | Year 3 | 309 | 226 | 4.1 | 3.7 |
| | | Year 4 | 230 | 162 | 3.1 | 2.8 |
| | MCS Worker Mobile Trips | Year 2 | 40 | 31 | 0.52 | 0.48 |
| | | Year 3 | 232 | 169 | 3.1 | 2.8 |
| | | Year 4 | 219 | 153 | 2.9 | 2.7 |
| | | Year 5 | 205 | 139 | 2.8 | 2.6 |
| | | Year 6 | 34 | 22 | 0.47 | 0.43 |
| Area 2 | Demolition | Year 2 | 58 | 3,480 | 27 | 25 |
| | Grading and Utilities | Year 2 | 48 | 1,273 | 8.7 | 8.3 |
| | | Year 3 | 43 | 1,129 | 8.3 | 7.9 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Core and Shell | Year 4 | 1.4 | 83 | 0.83 | 0.79 |
| | | Year 5 | 0.42 | 26 | 0.26 | 0.25 |

**Table 14**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 2 Town Square and Residential/Shopping District | Tenant Improvements | Year 4 | 0.16 | 10 | 0.10 | 0.093 |
| | | Year 5 | 2.1 | 126 | 1.3 | 1.2 |
| | Landscaping | Year 5 | 0.54 | 33 | 0.3 | 0.31 |
| | | Year 6 | 0.17 | 11 | 0.11 | 0.10 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 326 | 228 | 4.4 | 4.0 |
| | | Year 5 | 277 | 187 | 3.8 | 3.5 |
| | Landscaping Worker Mobile Trips | Year 5 | 29 | 19 | 0.39 | 0.36 |
| | | Year 6 | 10 | 6.2 | 0.13 | 0.12 |
| Campus District | Foundations + Core and Shell | Year 3 | 7.8 | 447 | 4.5 | 4.3 |
| | | Year 4 | 8.2 | 486 | 4.9 | 4.7 |
| | Tenant Improvements | Year 4 | 7.0 | 410 | 4.1 | 3.9 |
| | | Year 5 | 5.0 | 306 | 3.0 | 2.9 |
| | Worker Mobile Trips | Year 3 | 516 | 377 | 6.8 | 6.3 |
| | | Year 4 | 627 | 440 | 8.4 | 7.7 |
| | | Year 5 | 275 | 186 | 3.8 | 3.5 |
| Area 3 | Grading and Utilities | Year 3 | 45 | 196 | 1.7 | 1.6 |
| | Tunnel Construction | Year 3 | 686 | 779 | 12 | 11 |
| | | Year 4 | 319 | 355 | 5.6 | 5.2 |
| | Foundations | Year 4 | 88 | 107 | 1.6 | 1.5 |
| | | Year 5 | 343 | 407 | 6.4 | 6.0 |
| | Core and Shell | Year 5 | 483 | 622 | 9.5 | 8.8 |
| | Tenant Improvements | Year 5 | 87 | 112 | 1.7 | 1.6 |
| | | Year 6 | 571 | 724 | 11 | 10 |
| | Landscaping | Year 6 | 10 | 71 | 0.77 | 0.73 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 2.1 | 66.3 | 0.58 | 0.55 |
| | Grading and Utilities | Year 4 | 0.077 | 1.3 | 0.010 | 9.2E-03 |
| | | Year 5 | 5.0 | 27 | 0.21 | 0.20 |
| | Foundations | Year 5 | 0.80 | 49 | 0.49 | 0.47 |
| | Core and Shell | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Tenant Improvements | Year 5 | 0.90 | 55 | 0.55 | 0.52 |
| | Worker Mobile Trips | Year 5 | 72 | 48 | 0.98 | 0.90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 5.5 | 24 | 0.27 | 0.26 |
| Feeder Line | PG&E Offsite Work | Year 3 | 15 | 56 | 0.65 | 0.62 |
| | Surface Improvements | Year 3 | 4.3 | 5.4 | 0.063 | 0.059 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.0 | 10 | 0.11 | 0.10 |
| | Adams and O'Brien | Year 3 | 0.83 | 10 | 0.11 | 0.10 |
| | Willow Road and Ivy Drive | Year 3 | 0.83 | 10 | 0.11 | 0.10 |

**Summary of Project Construction Mitigated Annual CAP Emissions by Year**

| Year | Emissions[4] | | | |
|---|---|---|---|---|
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | ton/year | | | |
| Year 1 | 0.012 | 0.34 | 3.5E-03 | 3.4E-03 |
| Year 2 | 0.48 | 8.2 | 0.089 | 0.087 |
| Year 3 | 1.9 | 8.6 | 0.142 | 0.140 |
| Year 4 | 4.4 | 5.3 | 0.069 | 0.067 |
| Year 5 | 5.1 | 4.0 | 0.047 | 0.046 |
| Year 6 | 2.4 | 0.88 | 0.011 | 0.011 |
| **Total** | 14 | 27 | 0.36 | 0.35 |

**Summary of Project Construction Mitigated Daily CAP Emissions by Year**

| Year | Emissions | | | |
|---|---|---|---|---|
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | lb/day | | | |
| Year 1 | 1.5 | 43 | 0.44 | 0.42 |
| Year 2 | 2.7 | 45 | 0.49 | 0.48 |
| Year 3 | 10 | 47 | 0.78 | 0.77 |
| Year 4 | 24 | 29 | 0.38 | 0.37 |
| Year 5 | 28 | 22 | 0.26 | 0.25 |
| Year 6 | 15 | 5.4 | 0.068 | 0.065 |
| **Threshold[5]** | 54 | 54 | 82 | 54 |

**Notes:**

1. Construction emissions were estimated with methodology equivalent to CalEEMod® 2020.4.0. Emissions were estimated using on-road emissions factors from EMFAC2021 and off-road construction equipment emission factors from OFFROAD. Onroad trips and offroad construction equipment use were provided by the Project Applicant.
2. Mitigated construction emissions from offroad equipment are calculated using Tier 4 Final emission factors for 95 percent of the equipment before residents move on-site in Year 5 and 98 percent of the equipment after residents move on-site in Year 5. The other 5 percent and 2 percent (before and after on-site residents, repspectively) of non-Tier 4 equipment are assumed to be Tier 2.
3. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
4. The mass emissions shown above are converted from pound per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.
5. Thresholds are from BAAQMD California Environmental Quality Act (CEQA) Guidelines. Fugitive emissions sources are excluded from comparison to this threshold.

**Abbreviations**:

CAP - criteria air pollutant
CalEEMod® - California Emissions Estimate Model
ROG - reactive organic gases
$NO_X$ - nitrous oxide

**Table 15**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village**
**Menlo Park, CA**

**Off-Road Emissions[1]**

| Construction Area[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 1 | Demolition | Year 1 | 45 | 8.0E-03 | 2.3E-03 | 46 |
| | | Year 2 | 287 | 5.2E-02 | 1.5E-02 | 292 |
| | Grading and Utilities | Year 2 | 705 | 1.5E-01 | 2.5E-02 | 716 |
| Parcel 2 Foundations | | Year 3 | 179 | 2.3E-02 | 1.3E-02 | 184 |
| Parcel 2 Core and Shell | | Year 3 | 24 | 4.7E-03 | 1.0E-03 | 24 |
| | | Year 4 | 43 | 8.5E-03 | 1.8E-03 | 44 |
| Parcel 2 Tenant Improvements | | Year 4 | 29 | 4.5E-03 | 1.9E-03 | 30 |
| | | Year 5 | 22 | 3.5E-03 | 1.5E-03 | 23 |
| Parcel 2 Landscaping | | Year 5 | 32 | 6.0E-03 | 1.6E-03 | 32 |
| Parcel 3 Foundations | | Year 3 | 200 | 2.7E-02 | 1.4E-02 | 205 |
| | | Year 4 | 1.2 | 1.7E-04 | 8.5E-05 | 1.3 |
| Parcel 3 Core and Shell | | Year 4 | 83 | 1.5E-02 | 4.2E-03 | 84 |
| Parcel 3 Tenant Improvements | | Year 4 | 21 | 2.6E-03 | 1.8E-03 | 22 |
| | | Year 5 | 45 | 5.5E-03 | 3.7E-03 | 46 |
| Parcel 3 Landscaping | | Year 5 | 32 | 6.1E-03 | 1.6E-03 | 32 |
| North Garage | | Year 2 | 118 | 2.9E-02 | 2.6E-03 | 119 |
| | | Year 3 | 206 | 4.9E-02 | 3.9E-03 | 208 |
| Office Building 4 | | Year 3 | 162 | 3.8E-02 | 4.0E-03 | 164 |
| | | Year 4 | 29 | 3.7E-03 | 2.3E-03 | 29.7 |
| Meeting, Collaboration, Park | | Year 2 | 192 | 4.9E-02 | 2.9E-03 | 194 |
| | | Year 3 | 640 | 1.7E-01 | 8.6E-03 | 647 |
| | | Year 4 | 190 | 4.3E-02 | 5.8E-03 | 193 |
| | | Year 5 | 185 | 4.3E-02 | 5.0E-03 | 187 |
| | | Year 6 | 45 | 1.2E-02 | 3.4E-04 | 45 |
| Hotel Excavation | | Year 2 | 185 | 4.8E-02 | 2.6E-03 | 187 |
| | | Year 3 | 529 | 1.2E-01 | 8.1E-03 | 535 |
| Hotel Construction | | Year 4 | 193 | 3.5E-02 | 4.2E-03 | 195 |
| | | Year 5 | 156 | 2.9E-02 | 6.4E-03 | 158 |
| Town Square | | Year 3 | 545 | 1.3E-01 | 1.4E-02 | 553 |
| | | Year 4 | 261 | 6.3E-02 | 6.0E-03 | 264 |
| | | Year 5 | 83 | 2.2E-02 | 1.2E-03 | 84 |
| Area 2 | Demolition | Year 2 | 164 | 3.0E-02 | 8.4E-03 | 167 |
| | Grading and Utilities | Year 2 | 320 | 7.0E-02 | 1.1E-02 | 326 |
| | | Year 3 | 319 | 7.0E-02 | 1.1E-02 | 324 |
| Parcel 7 Foundations | | Year 4 | 87 | 1.6E-02 | 4.4E-03 | 88 |
| Parcel 7 Core and Shell | | Year 4 | 48 | 9.5E-03 | 2.0E-03 | 48 |
| Parcel 7 Tenant Improvements | | Year 4 | 3.3 | 5.2E-04 | 2.2E-04 | 3.4 |
| | | Year 5 | 33 | 5.3E-03 | 2.2E-03 | 34 |
| Parcel 7 Landscaping | | Year 5 | 28 | 5.0E-03 | 1.6E-03 | 28 |
| Parcel 6 Foundations | | Year 4 | 97 | 1.6E-02 | 5.7E-03 | 99 |
| Parcel 6 Core and Shell | | Year 4 | 36 | 6.5E-03 | 1.9E-03 | 37 |
| | | Year 5 | 21 | 3.9E-03 | 1.1E-03 | 22 |
| Parcel 6 Tenant Improvements | | Year 5 | 47 | 5.8E-03 | 3.9E-03 | 48 |
| Parcel 6 Landscaping | | Year 5 | 13 | 2.4E-03 | 7.2E-04 | 13 |
| | | Year 6 | 15 | 2.8E-03 | 8.4E-04 | 16 |
| South Garage | | Year 3 | 255 | 6.2E-02 | 5.3E-03 | 258 |
| | | Year 4 | 120 | 2.7E-02 | 2.5E-03 | 122 |
| Office Building 3 | | Year 3 | 201 | 5.1E-02 | 3.5E-03 | 204 |
| | | Year 4 | 49 | 7.7E-03 | 3.0E-03 | 50 |
| | | Year 5 | 8.4 | 9.4E-04 | 7.4E-04 | 8.6 |
| Office Building 1 | | Year 3 | 178 | 4.4E-02 | 3.4E-03 | 180 |
| | | Year 4 | 45 | 7.2E-03 | 2.8E-03 | 46 |
| Office Building 2 | | Year 3 | 171 | 4.3E-02 | 3.1E-03 | 173 |
| | | Year 4 | 49 | 8.0E-03 | 3.0E-03 | 50 |
| | | Year 5 | 0.94 | 1.1E-04 | 8.3E-05 | 0.97 |
| Office Building 5 | | Year 3 | 234 | 5.9E-02 | 4.0E-03 | 237 |
| | | Year 4 | 47 | 7.4E-03 | 3.0E-03 | 48 |
| | | Year 5 | 7.7 | 8.6E-04 | 6.8E-04 | 7.9 |

**Table 15**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village**
**Menlo Park, CA**

**Off-Road Emissions[1]**

| Phase | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Office Building 6 | | Year 3 | 224 | 5.8E-02 | 3.2E-03 | 226 |
| | | Year 4 | 52 | 8.5E-03 | 2.9E-03 | 53 |
| | | Year 5 | 16 | 1.8E-03 | 1.5E-03 | 17 |
| Area 3 | Grading and Utilities | Year 3 | 56 | 1.2E-02 | 2.1E-03 | 57 |
| | Tunnel Construction | Year 3 | 156 | 2.6E-02 | 9.4E-03 | 159 |
| | | Year 4 | 77 | 1.3E-02 | 4.6E-03 | 79 |
| | Foundations | Year 4 | 40 | 7.0E-03 | 2.1E-03 | 41 |
| | | Year 5 | 163 | 2.9E-02 | 8.4E-03 | 167 |
| | Core and Shell | Year 5 | 121 | 2.3E-02 | 5.3E-03 | 123 |
| | Tenant Improvements | Year 5 | 12 | 1.7E-03 | 8.4E-04 | 12 |
| | | Year 6 | 81 | 1.2E-02 | 5.8E-03 | 83 |
| | Landscaping | Year 6 | 54 | 9.6E-03 | 3.1E-03 | 55 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 35 | 3.8E-03 | 2.9E-03 | 36 |
| | Grading and Utilities | Year 4 | 1.6 | 2.0E-04 | 1.3E-04 | 1.7 |
| | | Year 5 | 35 | 4.4E-03 | 2.9E-03 | 36 |
| | Foundations | Year 5 | 17 | 2.1E-03 | 1.1E-03 | 18 |
| | Core and Shell | Year 5 | 24 | 2.2E-03 | 1.4E-03 | 24 |
| | Tenant Improvements | Year 5 | 12 | 2.0E-03 | 6.6E-04 | 12 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 34 | 9.8E-03 | 0 | 34 |
| Feeder Line | PG&E Offsite Work | Year 3 | 108 | 3.1E-02 | 0 | 109 |
| | Surface Improvements | Year 3 | 12 | 2.3E-03 | 0 | 12 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.3 | 3.7E-04 | 0 | 1.3 |
| | Adams and O'Brien | Year 3 | 0.85 | 2.5E-04 | 0 | 0.85 |
| | Willow Road and Ivy Drive | Year 3 | 0.85 | 2.5E-04 | 0 | 0.85 |

**On-Road Emissions[1]**

| Phase[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 1 | Demolition | Year 1 | 112 | 2.5E-04 | 1.7E-02 | 117 |
| | | Year 2 | 717 | 1.4E-03 | 1.1E-01 | 750 |
| | Grading and Utilities | Year 2 | 585 | 3.1E-03 | 8.5E-02 | 610 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 27 | 3.3E-05 | 4.3E-03 | 28 |
| | | Year 4 | 0.12 | 1.4E-07 | 1.9E-05 | 0.13 |
| | Core and Shell | Year 3 | 7.7 | 9.5E-06 | 1.2E-03 | 8.1 |
| | | Year 4 | 22 | 2.4E-05 | 3.4E-03 | 23 |
| | Tenant Improvements | Year 4 | 18 | 2.0E-05 | 2.8E-03 | 18 |
| | | Year 5 | 21 | 2.2E-05 | 3.3E-03 | 22 |
| | Landscaping | Year 5 | 15 | 1.5E-05 | 2.3E-03 | 15 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 340 | 1.1E-02 | 9.6E-03 | 344 |
| | | Year 4 | 391 | 1.2E-02 | 1.0E-02 | 395 |
| | | Year 5 | 261 | 7.7E-03 | 6.7E-03 | 263 |
| | Landscaping Worker Mobile Trips | Year 5 | 48 | 1.4E-03 | 1.2E-03 | 49 |
| Campus District | Foundations + Core and Shell | Year 2 | 28 | 4.8E-05 | 4.5E-03 | 30 |
| | | Year 3 | 173 | 2.1E-04 | 2.7E-02 | 181 |
| | | Year 4 | 172 | 2.0E-04 | 2.7E-02 | 180 |
| | | Year 5 | 170 | 1.8E-04 | 2.7E-02 | 177 |
| | Tenant Improvements | Year 4 | 70 | 7.9E-05 | 1.1E-02 | 73 |
| | | Year 5 | 92 | 9.7E-05 | 1.5E-02 | 97 |
| | | Year 6 | 16 | 1.6E-05 | 2.5E-03 | 17 |
| | O4 and NG Worker Mobile Trips | Year 2 | 58 | 2.1E-03 | 1.7E-03 | 58 |
| | | Year 3 | 351 | 1.2E-02 | 9.9E-03 | 355 |
| | | Year 4 | 275 | 8.6E-03 | 7.3E-03 | 277 |
| | MCS Worker Mobile Trips | Year 2 | 43 | 1.6E-03 | 1.3E-03 | 44 |
| | | Year 3 | 263 | 8.9E-03 | 7.4E-03 | 266 |
| | | Year 4 | 261 | 8.2E-03 | 7.0E-03 | 263 |
| | | Year 5 | 255 | 7.5E-03 | 6.5E-03 | 257 |
| | | Year 6 | 44 | 1.2E-03 | 1.1E-03 | 45 |

**Table 15**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village**
**Menlo Park, CA**

**On-Road Emissions[1]**

| Phase[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 2 | Demolition | Year 2 | 821 | 1.3E-03 | 1.3E-01 | 859 |
| | Grading and Utilities | Year 2 | 290 | 1.5E-03 | 4.2E-02 | 302 |
| | | Year 3 | 286 | 1.3E-03 | 4.2E-02 | 298 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 22 | 2.4E-05 | 3.4E-03 | 23 |
| | Core and Shell | Year 4 | 26 | 3.0E-05 | 4.1E-03 | 27 |
| | | Year 5 | 8.5 | 8.9E-06 | 1.3E-03 | 8.9 |
| | Tenant Improvements | Year 4 | 3.1 | 3.5E-06 | 4.8E-04 | 3.2 |
| | | Year 5 | 42 | 4.4E-05 | 6.6E-03 | 44 |
| | Landscaping | Year 5 | 11 | 1.1E-05 | 1.7E-03 | 11 |
| | | Year 6 | 3.7 | 3.6E-06 | 5.9E-04 | 3.9 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 388 | 1.2E-02 | 1.0E-02 | 392 |
| | | Year 5 | 345 | 1.0E-02 | 8.8E-03 | 348 |
| | Landscaping Worker Mobile Trips | Year 5 | 36 | 1.0E-03 | 9.1E-04 | 36 |
| | | Year 6 | 12 | 3.4E-04 | 3.0E-04 | 12 |
| Campus District | Foundations + Core and Shell | Year 3 | 134 | 1.7E-04 | 2.1E-02 | 141 |
| | | Year 4 | 153 | 1.7E-04 | 2.4E-02 | 160 |
| | Tenant Improvements | Year 4 | 129 | 1.5E-04 | 2.0E-02 | 135 |
| | | Year 5 | 101 | 1.1E-04 | 1.6E-02 | 106 |
| | Worker Mobile Trips | Year 3 | 587 | 2.0E-02 | 1.6E-02 | 592 |
| | | Year 4 | 748 | 2.4E-02 | 2.0E-02 | 754 |
| | | Year 5 | 342 | 1.0E-02 | 8.8E-03 | 345 |
| Area 3 | Grading and Utilities | Year 3 | 83 | 1.5E-03 | 7.4E-03 | 85 |
| | Tunnel Construction | Year 3 | 859 | 2.6E-02 | 3.5E-02 | 870 |
| | | Year 4 | 420 | 1.2E-02 | 1.7E-02 | 425 |
| | Foundations | Year 4 | 119 | 3.3E-03 | 5.1E-03 | 120 |
| | | Year 5 | 481 | 1.3E-02 | 2.0E-02 | 487 |
| | Core and Shell | Year 5 | 692 | 1.8E-02 | 3.1E-02 | 702 |
| | Tenant Improvements | Year 5 | 124 | 3.2E-03 | 5.5E-03 | 126 |
| | | Year 6 | 852 | 2.0E-02 | 3.7E-02 | 863 |
| | Landscaping | Year 6 | 34 | 3.4E-04 | 3.8E-03 | 35 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 19 | 6.4E-05 | 2.9E-03 | 20 |
| | Grading and Utilities | Year 4 | 0.36 | 2.5E-06 | 4.7E-05 | 0.37 |
| | | Year 5 | 7.7 | 5.2E-05 | 1.0E-03 | 8.0 |
| | Foundations | Year 5 | 16 | 1.7E-05 | 2.5E-03 | 17 |
| | Core and Shell | Year 5 | 14 | 1.5E-05 | 2.3E-03 | 15 |
| | Tenant Improvements | Year 5 | 18 | 1.9E-05 | 2.8E-03 | 19 |
| | Worker Mobile Trips | Year 5 | 89 | 2.6E-03 | 2.3E-03 | 90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 12 | 2.1E-04 | 1.1E-03 | 12 |
| Feeder Line | PG&E Offsite Work | Year 3 | 30 | 5.6E-04 | 2.6E-03 | 31 |
| | Surface Improvements | Year 3 | 2.9 | 5.4E-05 | 2.5E-04 | 3.0 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 3.6 | 2.4E-05 | 4.9E-04 | 3.8 |
| | Adams and O'Brien | Year 3 | 3.4 | 1.7E-05 | 4.9E-04 | 3.6 |
| | Willow Road and Ivy Drive | Year 3 | 3.4 | 1.7E-05 | 4.9E-04 | 3.6 |

**Summary of Project Construction Annual GHG Emissions by Year**

| Year | Emissions[4,5] | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | MT/year | | | |
| Year 1 | 157 | 0.0083 | 0.020 | 163 |
| Year 2 | 4,514 | 0.44 | 0.44 | 4,657 |
| Year 3 | 7,605 | 1.1 | 0.30 | 7,722 |
| Year 4 | 4,871 | 0.40 | 0.25 | 4,954 |
| Year 5 | 4,304 | 0.28 | 0.23 | 4,379 |
| Year 6 | 1,157 | 0.059 | 0.056 | 1,175 |
| | | | **Total** | **23,050** |

**Notes:**

1. Emissions were estimated using onroad emissions factors from EMFAC2021 and offroad construction equipment emission factors from OFFROAD. Onroad trips and offroad construction equipment use were provided by the Project Applicant.
2. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
3. Carbon dioxide equivalent emissions were determined using IPCC 5th Assessment Report Global Warming Potentials for $CH_4$ and $N_2O$.
4. The Summary of Project Construction Annual GHG Emissions by Year is the sum of the values represented above as well as Construction Water Use Emissions, shown in Table 10.
5. The BAAQMD does not have an adopted Threshold of Significance for construction-related GHG emissions.

**Abbreviations:**

CalEEMod® - California Emissions Estimate Model
GHG - greenhouse gases
$CH_4$ - methane
$CO_2$ - carbon dioxide
$N_2O$ - nitrous oxide
$CO_2e$ - carbon dioxide equivalent
MT - metric ton
IPCC - Intergovernmental Panel on Climate Change

**Table 16**
**Building Operational Capacity For Emissions Scaling**
**Willow Village**
**Menlo Park, California**

| Building or Parcel[1] | | Percent Breakdown of Land Use Type by Building | | | | | | Percent of Year Building is Operational[2] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Office | Retail | Residential | Hotel | Parking | Park | Year 4 | Year 5 | Year 6 |
| North Garage | | -- | -- | -- | -- | 45% | -- | 100% | 100% | 100% |
| Office Building 4 | | 11% | 48% | -- | -- | -- | -- | 21% | 100% | 100% |
| Meeting, Collaboration, Park | | 28% | -- | -- | -- | -- | -- | 0% | 0% | 82% |
| Hotel Construction | | -- | -- | -- | 100% | -- | -- | 0% | 41% | 100% |
| Town Square | | -- | -- | -- | -- | -- | 14% | 0% | 58% | 100% |
| Parcel 2 | | -- | 19% | 19% | -- | 12% | -- | 0% | 34% | 100% |
| Parcel 3 | | -- | 26% | 24% | -- | 12% | -- | 0% | 10% | 100% |
| Other | | 0.38% | -- | -- | -- | 0.73% | 86% | 100% | 100% | 100% |
| South Garage | | -- | -- | -- | -- | 23.9% | -- | 29% | 100% | 100% |
| Office Building 3 | | 13% | -- | -- | -- | -- | -- | 0% | 76% | 100% |
| Office Building 1 | | 8.4% | -- | -- | -- | -- | -- | 5% | 100% | 100% |
| Office Building 2 | | 10% | -- | -- | -- | -- | -- | 0% | 98% | 100% |
| Office Building 5 | | 15% | -- | -- | -- | -- | -- | 0% | 78% | 100% |
| Office Building 6 | | 14% | -- | -- | -- | -- | -- | 0% | 53% | 100% |
| Parcel 6 | | -- | -- | 10% | -- | 1.4% | -- | 0% | 0% | 88% |
| Parcel 7 | | -- | -- | 6.9% | -- | 0.5% | -- | 0% | 99% | 100% |
| Parcels 4 + 5 | | -- | 2.4% | 40% | -- | 4.4% | -- | 0% | 0% | 11% |
| Hamilton Avenue Parcels North and South | | -- | 3.7% | -- | -- | -- | -- | 0% | 54% | 100% |
| **Partial Buildout by Year and Land Use Type[3]** | **Year 4** | 3.1% | 10% | 0% | 0% | 53% | 86% | | | |
| | **Year 5** | 58% | 59% | 16% | 41% | 75% | 94% | | | |
| | **Year 6** | 95% | 98% | 64% | 100% | 96% | 100% | | | |

**Notes:**

1. Construction area/subphasing information and full buildout square footage by building provided by Project Applicant.
2. The percentage of year that each building is operational is calculated using the last day of construction for each building. For each partial year of construction, the building is assumed to be operational during the fraction of the year between the last day of construction and the end of that year. The building is assumed to be 0% operational for each full year of construction and 100% operational for each year full year after the end of construction.
3. Partial buildout for Year 4, Year 5, and Year 6 were calculated based on the portion of building area that becomes operational each year over the total building area for each land use type.

**Abbreviations:**

% - percent

**Table 17**
**Traffic Data Provided by the Transportation Engineer**
**Willow Village**
**Menlo Park, California**

**Daily Trips Rates and VMT**

| Land Use | Fleet Type / Land Use | Trip Rate Units[1] | Weekday Trips per Day per Unit[1] | Weekday daily VMT[2] |
|---|---|---|---|---|
| | | | TOTAL | TOTAL |
| Main Project Site - Existing Conditions | Cars | per 1,000 s.f. | 9.19 | 110,860 |
| | Trucks | per 1,000 s.f. | 0.22 | 2,640 |
| | Shuttles | per 1,000 s.f. | 0.66 | 21,088 |
| | On-Demand | per 1,000 s.f. | 0.66 | 7,919 |
| Campus District - Full Buildout | Cars | per 1,000 s.f. | 10.05 | 178,766 |
| | Trucks | per 1,000 s.f. | 0.23 | 4,056 |
| | Shuttles | per 1,000 s.f. | 0.44 | 21,088 |
| | On-Demand | per 1,000 s.f. | 0.68 | 12,168 |
| Town Square and the Residential/Shopping District - Full Buildout | Residential | per d.u. | 4.35 | 71,524 |
| | Retail[3] | per 1,000 s.f. | 25.07 | 33,594 |
| | Hamilton Avenue Parcels North and South[3] | per 1,000 s.f. | 28.31 | 1,461 |
| | Park | per acre | 42.80 | 1,147 |
| | Hotel | per room | 6.69 | 14,814 |

**Notes:**
1. Daily project trip rates were provided by the Transportation Engineer in terms of trip rates per land use amount.
2. Daily Project VMT provided by the Transportation Engineer include reductions for pass-by and diverted trips. Daily VMT is given in VMT per day.
3. The trip rates and VMT for Hamilton Avenue Parcels North and South were provided separately and added to retail totals in calculations.

**Abbreviations:**
VMT - Vehicle miles traveled
s.f. - Square feet
d.u. - Dwelling unit

**Table 18**
**Trip Rates and VMT for Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Project Area[1] | Land Use | Fleet Type[2] | Total Weekday Daily VMT[3] | Total Weekday Daily Trips[3] | Total Average Daily VMT[4] | Total Average Daily Trips[4] | Total Annual VMT[5] | Total Annual Trips[5] |
|---|---|---|---|---|---|---|---|---|
| | | | VMT/day | trips/day | VMT/day | trips/day | VMT/year | trips/year |
| Existing Conditions | Campus District | Cars | 110,860 | 9,221 | 84,225 | 7,006 | 30,742,244 | 2,557,040 |
| | | Trucks | 2,640 | 220 | 2,005 | 167 | 731,958 | 60,882 |
| | | Shuttles | 21,088 | 659 | 15,063 | 470 | 3,916,358 | 122,319 |
| | | On-Demand | 7,919 | 659 | 5,656 | 470 | 1,470,590 | 122,319 |
| Year 4 | Campus District | Cars | 5,480 | 493 | 4,079 | 367 | 1,488,677 | 133,874 |
| | | Trucks | 124 | 11 | 93 | 8.3 | 33,776 | 3,037 |
| | | Shuttles | 646 | 22 | 462 | 15 | 120,048 | 3,996 |
| | | On-Demand | 373 | 34 | 266 | 24 | 69,267 | 6,229 |
| | Residential | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 |
| | Retail | San Mateo | 3,563 | 510 | 3,442 | 492 | 1,256,238 | 179,684 |
| | Park | San Mateo | 987 | 147 | 3,652 | 545 | 1,332,917 | 198,943 |
| | Hotel | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 5 | Campus District | Cars | 104,523 | 9,400 | 77,797 | 6,996 | 28,395,923 | 2,553,590 |
| | | Trucks | 2,371 | 213 | 1,765 | 159 | 644,259 | 57,937 |
| | | Shuttles | 12,330 | 410 | 8,807 | 293 | 2,289,859 | 76,227 |
| | | On-Demand | 7,114 | 640 | 5,082 | 457 | 1,321,238 | 118,816 |
| | Residential | San Mateo | 11,209 | 1,180 | 10,956 | 1,153 | 3,999,096 | 420,957 |
| | Retail | San Mateo | 20,794 | 2,974 | 20,085 | 2,873 | 7,331,178 | 1,048,602 |
| | Park | San Mateo | 1,080 | 161 | 3,993 | 596 | 1,457,557 | 217,546 |
| | Hotel | San Mateo | 6,049 | 527 | 5,816 | 507 | 2,122,939 | 184,925 |
| Year 6 | Campus District | Cars | 169,737 | 15,264 | 126,336 | 11,361 | 46,112,784 | 4,146,833 |
| | | Trucks | 3,851 | 346 | 2,866 | 258 | 1,046,226 | 94,085 |
| | | Shuttles | 20,023 | 667 | 14,302 | 476 | 3,718,554 | 123,787 |
| | | On-Demand | 11,553 | 1,039 | 8,252 | 742 | 2,145,589 | 192,949 |
| | Residential | San Mateo | 45,534 | 4,793 | 44,507 | 4,685 | 16,244,920 | 1,709,992 |
| | Retail | San Mateo | 34,307 | 4,907 | 33,137 | 4,740 | 12,095,154 | 1,730,009 |
| | Park | San Mateo | 1,147 | 171 | 4,243 | 633 | 1,548,641 | 231,140 |
| | Hotel | San Mateo | 14,814 | 1,290 | 14,244 | 1,241 | 5,199,035 | 452,878 |
| Full Buildout | Campus District | Cars | 178,766 | 16,076 | 133,057 | 11,966 | 48,565,689 | 4,367,418 |
| | | Trucks | 4,056 | 365 | 3,019 | 271 | 1,101,879 | 99,090 |
| | | Shuttles | 21,088 | 702 | 15,063 | 501 | 3,916,358 | 130,371 |
| | | On-Demand | 12,168 | 1,094 | 8,691 | 782 | 2,259,721 | 203,212 |
| | Residential | San Mateo | 71,524 | 7,529 | 69,910 | 7,359 | 25,517,254 | 2,686,027 |
| | Retail | San Mateo | 35,055 | 5,014 | 33,860 | 4,843 | 12,358,799 | 1,767,718 |
| | Park | San Mateo | 1,147 | 171 | 4,243 | 633 | 1,548,641 | 231,140 |
| | Hotel | San Mateo | 14,814 | 1,290 | 14,244 | 1,241 | 5,199,035 | 452,878 |

**Table 18**

**Trip Rates and VMT for Existing Conditions and Project Operations**

**Willow Village**

**Menlo Park, California**

**Notes:**

1. Partial years are scaled from the full buildout based on the portion of each land use that becomes operational for each year of construction. See Table 16 for more details.
2. The fleet type for each land use was provided by the Transportation Engineer. The Campus District will have various fleets for specific uses. Town Square and the Residential/Shopping District land uses (Residential, Retail, Park, and Hotel) are analyzed assuming a default San Mateo fleet. Hamilton Avenue Parcels North and South are combined with retail land uses. See Table 19 for more information.
3. Daily VMT and trip rates were provided by the Transportation Engineer on October 5, 2021. Total trip rates are calculated using land uses in Table 1.
4. Weekday VMT and trip rates provided by the Transportation Engineer were scaled to average trip rates using the ratio between CalEEMod® weekday and weekend one-way trip rates.
5. Annual trips and VMT are calculated by multiplying daily values by 365 for all fleets with the exception of shuttles and on-demand, which are multiplied by 260 days/year.

**Abbreviations:**

VMT - vehicle miles traveled

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

**Table 19**
**Summary of Fleet Mix Categories**
**Willow Village**
**Menlo Park, California**

| Land Use | Fleet Type | EMFAC2007 Category[1] | Fuel[1,2] |
|---|---|---|---|
| Town Square and the Residential/Shopping District[3] | San Mateo County Mix | All | Mix of Gasoline, Diesel, Electric, and Natural Gas |
| Campus District[4] | Cars | LDA, LDT1, LDT2, MCY Mix | Mix of Gasoline and Diesel |
| | On-Demand | LDA | Gasoline |
| | Shuttles | Motor Coach, All Other Buses Mix | Diesel |
| | Trams | LDT1, LDT2 | Mix of Gasoline and Diesel |
| | Trucks | HHDT, LHDT1, LHDT2, MHDT Mix | Mix of Gasoline, Diesel, and Natural Gas |

**Notes:**

1. EMFAC2007 categories and fuel types were chosen to match vehicle type descriptions provided by Meta Transportation Operations Team.
2. Electric vehicles were not considered in the emission factors of the Campus District fleets because Campus District-specific emissions reductions are applied later.
3. Land uses other than the Campus District were assumed to have the same distribution of vehicle types as San Mateo County, per EMFAC2021. Hamilton Avenue Parcels North and South were combined with the retail land uses having the EMFAC2021 fleet for San Mateo County.
4. Default split between EMFAC categories assumed for all fleets associated with the Office (Existing and Full Buildout).

**Abbreviations:**

HHDT - heavy-heavy duty trucks
LDA - light duty auto (passenger cars)
LDT- light duty trucks
LHDT - light-heavy duty trucks
LHDT - light-heavy duty trucks
MHDT - medium-heavy duty trucks
MCY - motorcycles

**References:**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 20a**
**Mobile CAP Emission Factors**
**Willow Village**
**Menlo Park, California**

| Fleet Type[2] | Calendar Year[3] | CAPs Emission Factors[1] | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ROG | | | | | | $NO_x$ | | | $PM_{10}$ | | | | | $PM_{2.5}$ | | | | |
| | | RUNEX | RUNLOSS | STREX | IDLEX | DIURN | HOTSOAK | RUNEX | STREX | IDLEX | RUNEX | PMTW | PMBW | STREX | IDLEX | RUNEX | PMTW | PMBW | STREX | IDLEX |
| | | g/mile | | g/trip | | | | g/mile | g/trip | | g/mile | | | g/trip | | g/mile | | | g/trip | |
| San Mateo Fleet | 2019 | 0.031 | 0.038 | 0.46 | 0.0057 | 0.29 | 0.12 | 0.23 | 0.41 | 0.088 | 0.0041 | 0.0083 | 0.011 | 0.0023 | 4.7E-04 | 0.0039 | 0.0021 | 0.0039 | 0.0022 | 4.5E-04 |
| | 2024 | 0.016 | 0.033 | 0.30 | 0.0046 | 0.23 | 0.10 | 0.10 | 0.32 | 0.050 | 0.0020 | 0.0083 | 0.012 | 0.0018 | 1.4E-04 | 0.0019 | 0.0021 | 0.0041 | 0.0017 | 1.4E-04 |
| | 2025 | 0.015 | 0.033 | 0.28 | 0.0045 | 0.22 | 0.094 | 0.092 | 0.30 | 0.048 | 0.0019 | 0.0083 | 0.012 | 0.0017 | 1.3E-04 | 0.0018 | 0.0021 | 0.0041 | 0.0016 | 1.3E-04 |
| | 2026 | 0.014 | 0.033 | 0.26 | 0.0044 | 0.21 | 0.091 | 0.085 | 0.29 | 0.046 | 0.0018 | 0.0084 | 0.012 | 0.0017 | 1.3E-04 | 0.0017 | 0.0021 | 0.0041 | 0.0015 | 1.2E-04 |
| Cars | 2019 | 0.024 | 0.039 | 0.50 | 0 | 0.33 | 0.14 | 0.090 | 0.36 | 0 | 0.0017 | 0.0080 | 0.0072 | 0.0027 | 0 | 0.0016 | 0.0020 | 0.0025 | 0.0025 | 0 |
| | 2024 | 0.014 | 0.037 | 0.34 | 0 | 0.27 | 0.12 | 0.048 | 0.26 | 0 | 0.0013 | 0.0080 | 0.0072 | 0.0021 | 0 | 0.0012 | 0.0020 | 0.0025 | 0.0020 | 0 |
| | 2025 | 0.014 | 0.037 | 0.32 | 0 | 0.26 | 0.12 | 0.044 | 0.25 | 0 | 0.0013 | 0.0080 | 0.0072 | 0.0021 | 0 | 0.0012 | 0.0020 | 0.0025 | 0.0019 | 0 |
| | 2026 | 0.013 | 0.037 | 0.30 | 0 | 0.25 | 0.12 | 0.041 | 0.24 | 0 | 0.0012 | 0.0080 | 0.0073 | 0.0020 | 0 | 0.0011 | 0.0020 | 0.0025 | 0.0018 | 0 |
| Trucks | 2019 | 0.15 | 0.050 | 0.12 | 0.045 | 0.10 | 0.030 | 2.3 | 0.62 | 0.72 | 0.046 | 0.014 | 0.074 | 2.8E-04 | 0.0040 | 0.044 | 0.0034 | 0.026 | 2.6E-04 | 0.0038 |
| | 2024 | 0.057 | 0.035 | 0.083 | 0.034 | 0.070 | 0.019 | 0.84 | 0.66 | 0.37 | 0.013 | 0.013 | 0.075 | 1.5E-04 | 0.0011 | 0.012 | 0.0033 | 0.026 | 1.4E-04 | 0.0011 |
| | 2025 | 0.053 | 0.034 | 0.078 | 0.032 | 0.065 | 0.017 | 0.76 | 0.64 | 0.35 | 0.012 | 0.013 | 0.075 | 1.4E-04 | 0.0010 | 0.011 | 0.0033 | 0.026 | 1.3E-04 | 0.0010 |
| | 2026 | 0.049 | 0.033 | 0.073 | 0.031 | 0.061 | 0.016 | 0.69 | 0.62 | 0.33 | 0.011 | 0.013 | 0.075 | 1.3E-04 | 0.0010 | 0.011 | 0.0033 | 0.026 | 1.2E-04 | 9.3E-04 |
| Shuttles | 2019 | 0.0056 | 0 | 0 | 0.021 | 0 | 0 | 0.36 | 1.5 | 0.48 | 0.0029 | 0.012 | 0.048 | 0 | 1.4E-04 | 0.0028 | 0.0030 | 0.017 | 0 | 1.3E-04 |
| | 2024 | 0.0072 | 0 | 0 | 0.024 | 0 | 0 | 0.47 | 1.5 | 0.51 | 0.0040 | 0.012 | 0.049 | 0 | 1.5E-04 | 0.0038 | 0.0030 | 0.017 | 0 | 1.4E-04 |
| | 2025 | 0.0073 | 0 | 0 | 0.025 | 0 | 0 | 0.47 | 1.5 | 0.48 | 0.0041 | 0.012 | 0.049 | 0 | 1.6E-04 | 0.0039 | 0.0030 | 0.017 | 0 | 1.5E-04 |
| | 2026 | 0.0075 | 0 | 0 | 0.026 | 0 | 0 | 0.47 | 1.5 | 0.46 | 0.0043 | 0.012 | 0.049 | 0 | 1.6E-04 | 0.0041 | 0.0030 | 0.017 | 0 | 1.5E-04 |
| On Demand | 2019 | 0.015 | 0.033 | 0.45 | 0 | 0.31 | 0.10 | 0.069 | 0.32 | 0 | 0.0016 | 0.0080 | 0.0068 | 0.0027 | 0 | 0.0015 | 0.0020 | 0.0024 | 0.0024 | 0 |
| | 2024 | 0.0078 | 0.032 | 0.32 | 0 | 0.27 | 0.083 | 0.038 | 0.25 | 0 | 0.0013 | 0.0080 | 0.0067 | 0.0021 | 0 | 0.0012 | 0.0020 | 0.0023 | 0.0020 | 0 |
| | 2025 | 0.0070 | 0.032 | 0.30 | 0 | 0.27 | 0.081 | 0.035 | 0.24 | 0 | 0.0012 | 0.0080 | 0.0067 | 0.0021 | 0 | 0.0011 | 0.0020 | 0.0023 | 0.0019 | 0 |
| | 2026 | 0.0063 | 0.032 | 0.28 | 0 | 0.26 | 0.077 | 0.032 | 0.23 | 0 | 0.0012 | 0.0080 | 0.0067 | 0.0020 | 0 | 0.0011 | 0.0020 | 0.0023 | 0.0018 | 0 |

**Notes:**

1. Emission factors for each fleet type were developed by creating weighted emission factors based on the vehicle classes in each fleet type. EMFAC emissions were summed across each year for each vehicle class within a fleet type, then a vehicle class emission factor based on VMT and trip counts for the vehicle class was calculated. Emission factors for each vehicle class within a fleet type were weighted based on total VMTs and trips to create a fleet-wide emission factor for each year.
2. Emission factors for the Project fleets (all except the San Mateo Fleet) were calculated without electric vehicles because electric vehicle reductions are calculated separately.
3. The existing conditions for this analysis used emission factors from 2019. Partial buildout years 4, 5, and 6 used emission factors from years 2024, 2025, and 2026, respectively. Full buildout emissions used emission factors from 2026 to conservatively estimate emissions.

**Abbreviations:**

ROG - Reactive organic gases
$NO_x$ - Nitrogen oxides
$PM_{10}$ - Particulate matter less than 10 microns in diameter
$PM_{2.5}$ - Particulate matter less than 2.5 microns in diameter

RUNEX - Running exhaust emissions
RUNLOSS - Evaporative losses
STREX - Start exhaust tailpipe emissions
IDLEX - Idle exhaust emissions

DIURN - Diurnal Evaporative Hydrocarbon Emissions
HOTSOAK - Hot soak evaporative hydrocarbon emissions

**References**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 20b**
**Mobile GHG Emission Factors**
**Willow Village**
**Menlo Park, California**

| Fleet Type[2,3] | Calendar Year | GHG Emission Factors[1] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $CO_2$ | | | $CH_4$ | | | $N_2O$ | | | $CO_2e$ | | |
| | | RUNEX | STREX | IDLEX | RUNEX | STREX | IDLEX | RUNEX | STREX | IDLEX | RUNEX | STREX | IDLEX |
| | | g/mile | g/trip | | g/mile | g/trip | | g/mile | g/trip | | g/mile | g/trip | |
| San Mateo Fleet | 2019 | 377 | 76 | 11 | 0.0076 | 0.091 | 0.0024 | 0.014 | 0.037 | 0.0016 | 382 | 89 | 11 |
| | 2026 | 341 | 65 | 8.9 | 0.0055 | 0.055 | 0.0023 | 0.011 | 0.028 | 0.0013 | 345 | 75 | 9.4 |
| Cars | 2019 | 318 | 82 | 0 | 0.0050 | 0.10 | 0 | 0.0073 | 0.038 | 0 | 321 | 96 | 0 |
| | 2026 | 289 | 72 | 0 | 0.0028 | 0.063 | 0 | 0.0044 | 0.030 | 0 | 290 | 83 | 0 |
| Trucks | 2019 | 1,131 | 17 | 86 | 0.056 | 0.024 | 0.019 | 0.11 | 0.031 | 0.013 | 1,164 | 27 | 90 |
| | 2026 | 979 | 15 | 65 | 0.034 | 0.015 | 0.017 | 0.093 | 0.025 | 0.010 | 1,007 | 23 | 68 |
| Shuttles | 2019 | 1,264 | 0 | 138 | 0.0047 | 0 | 0.0025 | 0.20 | 0 | 0.022 | 1,323 | 0 | 144 |
| | 2026 | 1,214 | 0 | 123 | 9.0E-04 | 0 | 0.0015 | 0.19 | 0 | 0.019 | 1,271 | 0 | 128 |
| On Demand | 2019 | 295 | 76 | 0 | 0.0037 | 0.092 | 0 | 0.0062 | 0.036 | 0 | 297 | 89 | 0 |
| | 2026 | 264 | 67 | 0 | 0.0017 | 0.060 | 0 | 0.0038 | 0.029 | 0 | 266 | 77 | 0 |

`

**Notes:**

1. Emission factors for each fleet type were developed by creating weighted emission factors based on the vehicle classes in each fleet type. EMFAC emissions were summed across each year for each vehicle class within a fleet type, then a vehicle class emission factor based on VMT and trip counts for the vehicle class was calculated. Emission factors for each vehicle class within a fleet type were weighted based on total VMTs and trips to create a fleet-wide emission factor for each year.

2. Vehicle classes within a fleet type were determined as the best match based on information provided from the Project Applicant.
3. Emission factors for all fleets except the San Mateo Fleet were calculated without electric vehicles because reductions are calculated separately.

**Abbreviations:**

GHG - Greenhouse Gas
$CO_2$ - Carbon Dioxide
$N_2O$ - Nitrous Oxide
$CH_4$ - Methane
$CO_2e$ - Carbon dioxide equivalent

RUNEX - Running exhaust emissions
STREX - Start exhaust tailpipe emissions
IDLEX - Idle exhaust emissions

**References:**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 21a**
**Mobile CAP Emissions Before EV Reductions**
**Willow Village**
**Menlo Park, California**

| Year | Land Use[1] | Fleet Type | Annual Trips[2] | Annual VMT[2] | CAP Emissions[3,4] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ROG | NOX | $PM_{10}$ | $PM_{2.5}$ | ROG | NOX | $PM_{10}$ | $PM_{2.5}$ |
| | | | trips/year | VMT/year | tons/year | | | | lb/day | | | |
| **Existing Conditions** | Campus District | Cars | 2,557,040 | 30,742,244 | 4.9 | 4.1 | 3.1 | 0.59 | 27 | 22 | 17 | 3.3 |
| | | Trucks | 60,882 | 731,958 | 0.18 | 2.0 | 0.17 | 0.068 | 1.0 | 11 | 0.92 | 0.37 |
| | | Shuttles | 122,319 | 3,916,358 | 0.027 | 1.8 | 0.59 | 0.15 | 0.15 | 10 | 3.3 | 0.80 |
| | | On-Demand | 122,319 | 1,470,590 | 0.19 | 0.15 | 0.15 | 0.028 | 1.1 | 0.8 | 0.81 | 0.15 |
| | | | **2,862,559** | **36,861,150** | **5.3** | **8.0** | **4.0** | **0.84** | **29** | **44** | **22** | **4.6** |
| **Partial Buildout - Year 4** | Campus District | Cars | 133,874 | 1,488,677 | 0.19 | 0.12 | 0.15 | 0.028 | 1.1 | 0.65 | 0.82 | 0.15 |
| | | Trucks | 3,037 | 33,776 | 0.0041 | 0.035 | 0.0065 | 0.0020 | 0.023 | 0.19 | 0.036 | 0.011 |
| | | Shuttles | 3,996 | 120,048 | 0.0011 | 0.071 | 0.018 | 0.0046 | 0.0058 | 0.39 | 0.10 | 0.025 |
| | | On-Demand | 6,229 | 69,267 | 0.0077 | 0.0046 | 0.0069 | 0.0013 | 0.042 | 0.025 | 0.038 | 0.0071 |
| | Residential | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Retail | San Mateo | 179,684 | 1,256,238 | 0.19 | 0.21 | 0.13 | 0.027 | 1.1 | 1.2 | 0.74 | 0.15 |
| | Park | San Mateo | 198,943 | 1,332,917 | 0.21 | 0.23 | 0.14 | 0.029 | 1.2 | 1.2 | 0.78 | 0.16 |
| | Hotel | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | **525,763** | **4,300,922** | **0.61** | **0.67** | **0.46** | **0.092** | **3.4** | **3.7** | **2.5** | **0.50** |
| **Partial Buildout - Year 5** | Campus District | Cars | 2,553,590 | 28,395,923 | 3.6 | 2.1 | 2.9 | 0.53 | 20 | 11 | 16 | 2.9 |
| | | Trucks | 57,937 | 644,259 | 0.073 | 0.60 | 0.12 | 0.037 | 0.40 | 3.3 | 0.68 | 0.20 |
| | | Shuttles | 76,227 | 2,289,859 | 0.021 | 1.4 | 0.35 | 0.089 | 0.11 | 7.4 | 1.9 | 0.49 |
| | | On-Demand | 118,816 | 1,321,238 | 0.14 | 0.081 | 0.13 | 0.025 | 0.78 | 0.45 | 0.72 | 0.13 |
| | Residential | San Mateo | 420,957 | 3,999,096 | 0.49 | 0.57 | 0.43 | 0.085 | 2.7 | 3.1 | 2.3 | 0.47 |
| | Retail | San Mateo | 1,048,602 | 7,331,178 | 1.1 | 1.1 | 0.78 | 0.16 | 5.9 | 6.3 | 4.3 | 0.86 |
| | Park | San Mateo | 217,546 | 1,457,557 | 0.22 | 0.23 | 0.16 | 0.031 | 1.2 | 1.3 | 0.85 | 0.17 |
| | Hotel | San Mateo | 184,925 | 2,122,939 | 0.23 | 0.29 | 0.23 | 0.045 | 1.3 | 1.6 | 1.2 | 0.25 |
| | | | **4,678,601** | **47,562,050** | **5.8** | **6.3** | **5.1** | **1.0** | **32** | **35** | **28** | **5.5** |
| **Partial Buildout - Year 6** | Campus District | Cars | 4,146,833 | 46,112,784 | 5.6 | 3.1 | 4.6 | 0.86 | 31 | 17 | 25 | 4.7 |
| | | Trucks | 94,085 | 1,046,226 | 0.11 | 0.89 | 0.20 | 0.059 | 0.62 | 4.9 | 1.1 | 0.33 |
| | | Shuttles | 123,787 | 3,718,554 | 0.034 | 2.2 | 0.57 | 0.15 | 0.19 | 12 | 3.1 | 0.80 |
| | | On-Demand | 192,949 | 2,145,589 | 0.22 | 0.12 | 0.21 | 0.040 | 1.2 | 0.68 | 1.2 | 0.22 |
| | Residential | San Mateo | 1,709,992 | 16,244,920 | 1.9 | 2.1 | 1.7 | 0.35 | 10 | 12 | 9.5 | 1.9 |
| | Retail | San Mateo | 1,730,009 | 12,095,154 | 1.7 | 1.8 | 1.3 | 0.26 | 9.3 | 10 | 7.1 | 1.4 |
| | Park | San Mateo | 231,140 | 1,548,641 | 0.22 | 0.23 | 0.17 | 0.033 | 1.2 | 1.3 | 0.91 | 0.18 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 0.55 | 0.65 | 0.55 | 0.11 | 3.0 | 3.6 | 3.0 | 0.60 |
| | | | **8,681,672** | **88,110,903** | **10** | **11** | **9.4** | **1.9** | **57** | **61** | **51** | **10** |
| **Full Buildout** | Campus District | Cars | 4,367,418 | 48,565,689 | 5.9 | 3.3 | 4.9 | 0.91 | 32 | 18 | 27 | 5.0 |
| | | Trucks | 99,090 | 1,101,879 | 0.12 | 0.94 | 0.21 | 0.062 | 0.65 | 5.2 | 1.2 | 0.34 |
| | | Shuttles | 130,371 | 3,916,358 | 0.036 | 2.3 | 0.61 | 0.15 | 0.20 | 13 | 3.3 | 0.84 |
| | | On-Demand | 203,212 | 2,259,721 | 0.23 | 0.13 | 0.23 | 0.042 | 1.3 | 0.71 | 1.2 | 0.23 |
| | Residential | San Mateo | 2,686,027 | 25,517,254 | 3.0 | 3.4 | 2.7 | 0.54 | 16 | 18 | 15 | 3.0 |
| | Retail | San Mateo | 1,767,718 | 12,358,799 | 1.7 | 1.8 | 1.3 | 0.26 | 9.5 | 10 | 7.2 | 1.4 |
| | Park | San Mateo | 231,140 | 1,548,641 | 0.22 | 0.23 | 0.17 | 0.033 | 1.2 | 1.3 | 0.91 | 0.18 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 0.55 | 0.65 | 0.55 | 0.11 | 3.0 | 3.6 | 3.0 | 0.60 |
| | | | **9,937,855** | **100,467,375** | **12** | **13** | **11** | **2.1** | **64** | **70** | **59** | **12** |

**Table 21a**
**Mobile CAP Emissions Before EV Reductions**
**Willow Village**
**Menlo Park, California**

**Notes:**

1. Hamilton Avenue Parcels North and South were provided separately and added to the retail land use totals.
2. Trip counts and VMTs by land use type were broken out by year using a scaling factor representing the percent of each fleet that is operational in a given year leading up to full buildout. This percent was determined based on the square footage of the land use associated with each fleet that is operational in a given year relative to that land use's full buildout square footage. See Table 16 for more details on scaling. See Table 18 for Project Trip Rates and VMT.
3. Criteria air pollutants are calculated by year using emission factors for the associated year and fleet from EMFAC2021. Electric vehicles are not included in the emission factors for Campus District fleets (all fleet types except San Mateo Fleet), as reductions associated with EVs are considered separately. Project emission factors are shown in Table 20a.
4. Full buildout emissions are conservatively calculated using 2026 emission factors.

**Abbreviations:**

| | |
|---|---|
| EV - electric vehicle | $PM_{10}$ - particulate matter less than 10 microns in diameter |
| lb - pound | $PM_{2.5}$ - particulate matter less than 2.5 microns in diameter |
| $NO_x$ - nitrogen oxides | ROG - reactive organic gases |
| VMT- vehicle miles traveled | |

**References:**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 21b**
**Summary of Mobile GHG Emissions Before EV Reductions**
**Willow Village**
**Menlo Park, California**

| Year | Land Use[1] | Fleet Type | Annual Trips[2] | Annual VMT[2] | GHGs Emissions[3,4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | trips/year | VMT/year | MT/year | | | |
| Existing Conditions | Campus District | Cars | 2,557,040 | 30,742,244 | 9,997 | 0.41 | 0.32 | 10,104 |
| | | Trucks | 60,882 | 731,958 | 834 | 0.043 | 0.082 | 859 |
| | | Shuttles | 122,319 | 3,916,358 | 4,965 | 0.019 | 0.78 | 5,199 |
| | | On-Demand | 122,319 | 1,470,590 | 444 | 0.017 | 0.014 | 448 |
| | | | **2,862,559** | **36,861,150** | **16,240** | **0.48** | **1.2** | **16,610** |
| Full Buildout | Campus District | Cars | 4,367,418 | 48,565,689 | 14,353 | 0.41 | 0.34 | 14,465 |
| | | Trucks | 99,090 | 1,101,879 | 1,086 | 0.040 | 0.11 | 1,119 |
| | | Shuttles | 130,371 | 3,916,358 | 4,772 | 0.0037 | 0.75 | 4,996 |
| | | On-Demand | 203,212 | 2,259,721 | 611 | 0.016 | 0.015 | 616 |
| | Residential | San Mateo | 2,686,027 | 25,517,254 | 8,912 | 0.29 | 0.36 | 9,025 |
| | Retail | San Mateo | 1,767,718 | 12,358,799 | 4,351 | 0.17 | 0.19 | 4,411 |
| | Park | San Mateo | 231,140 | 1,548,641 | 546 | 0.022 | 0.024 | 554 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 1,809 | 0.055 | 0.070 | 1,831 |
| | | | **9,937,855** | **100,467,375** | **36,439** | **1.0** | **1.9** | **37,016** |

**Notes:**
1. Hamilton Avenue Parcels North and South were provided separately and added to the retail land use totals.
2. VMT and trip rates were provided by the Transportation Engineer on October 5, 2021 and are summarized in Table 18.
3. Greenhouse Gases are calculated by year using emission factors for the associated year and fleet from EMFAC2021. Electric vehicles are not included in the emission factors for Campus District fleets (all fleet types except San Mateo Fleet), as reductions associated with EVs are considered separately. Project emission factors are shown in Table 20b.
4. Full buildout emissions are conservatively calculated using 2026 emission factors.

**Abbreviations:**
GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
EV - electric vehicle
MT - Metric Ton
VMT- vehicle miles traveled

**References:**
California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 22**
**EV Assumptions for Campus District**
**Willow Village**
**Menlo Park, California**

**Campus District EV Parameters**

| Description | Units | Value |
|---|---|---|
| Electricity required per mile charged[1] | kWh/mi | 0.30 |
| Total Charging Energy of Meta Campuses[2] | kWh/year | 3,791,856 |
| Total Area of Meta Campuses[2] | sqf | 4,753,594 |
| Total Meta Campus Energy per Area[2] | kWh/sqf | 0.80 |
| Existing Conditions Fleet eVMT per Total VMT[3] | Percent | 5.5% |
| Full Buildout Fleet MSS eVMT per Total VMT[4] | Percent | 14% |
| Electricity Loss Factor[5] | Percent | 10% |
| Existing Conditions Charging Energy Usage[6] | kWh/year | 534,955 |
| Full Buildout Charging Energy Usage[7] | kWh/year | 2,925,608 |

**eVMTs from Project Chargers at the proposed Campus District**

| Year | Land Use Category[8] | Project Increase in Annual eVMTs[9] |
|---|---|---|
| | | eVMT/year |
| **Existing Conditions** | Campus District | 1,783,182 |
| **Partial Buildout - Year 4** | | 298,927 |
| **Partial Buildout - Year 5** | | 5,701,922 |
| **Partial Buildout - Year 6** | | 9,259,481 |
| **Full Buildout** | | 9,752,026 |

**Notes:**

1. An average EV fuel economy of 0.30 kWh per mile was used. The fuel economy is based on electric fleet data from fueleconomy.gov. Available at: https://www.fueleconomy.gov/.
2. Meta provided energy usage and areas for EV charging at their existing campuses: Classic, Bayfront, Chilco, Willow, Gateway. The provided data was used to evaluate an average ratio of EV charging energy usage per campus area.
3. The percent eVMT for existing conditions is calculated by dividing the eVMT in existing conditions by the annual VMT from the 'Car' and 'On-Demand' vehicle types in existing conditions. For existing conditions VMT, see Table 18.
4. ARB is currently preparing its 2020 Mobile Source Strategy (MSS) update to the ARB VISION Model (version 2.1) estimating future fleet characteristics. The Mobile Source Strategy projects eVMTs reflecting the aspirational target identified in EO N-79-20, assuming 100% of passenger vehicle sales in California are ZEV or PHEV, and GHG emissions assumed to have reduced by 2.0% per year from 2026 to 2035. The increase in annual eVMTs charged by the Campus District is scaled from the increase in fleet eVMT from existing conditions to full buildout.
5. A 10% Loss Factor was applied to the annual project energy uses to account for expected losses. Source available at: https://www.fueleconomy.gov/

**Table 22**
**EV Assumptions for Campus District**
**Willow Village**
**Menlo Park, California**

6. The EV charging energy consumption for existing conditions was based on existing charger energy usage data for Willow Village for 2019 provided by the Project applicant. The total energy usage was reduced assuming a 10% loss factor.

7. The EV charging energy consumption for the Project at full buildout was determined using an average ratio of existing charging sites kWh/sqf and multiplying it by the Campus District land use area at full buildout (1.6 million sqf). This number was scaled by the increase in fleet eVMT from existing conditions to full buildout based on the MSS scenario of the VISION model. A 10% loss factor was applied to the total energy usage per year. All relevant data sources were provided by the Project applicant.

8. Meta offers an EV charging program to its workers. Charging on campus is free and valets move cars into chargers to maximize charging time. Therefore, the EV charging annual electricity for the Campus District was provided based on studies from Meta's existing campuses in the area. The electricity for EV charging at the Project would be supplied with 100% renewable energy.

9. For years where the Campus District is only operational a proportion of the year, the annual kWh is multiplied by a scaling fraction for the Campus District land use, found in Table 16.

**Abbreviations:**

EV - Electric vehicle (includes battery electric or plug-in hybrid technology)
eVMT- Electric vehicle miles traveled
kWh - Kilowatt hour
sqf- Square foot
MSS - Mobile Source Strategy

**References:**

City of Menlo Park Nonresidential EV Charging Requirements. Published July 17, 2019. Available at: https://www.menlopark.org/DocumentCenter/View/22382/Nonresidential-EV-Charging-Requirements

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

CalEEMod Appendix D. Available at: http://www.aqmd.gov/docs/default-source/caleemod/user-guide-2021/appendix-d2020-4-0-full-merge.pdf?sfvrsn=12

**Table 23**
**EV Assumptions for Town Square and the Residential/Shopping District**
**Willow Village**
**Menlo Park, CA**

**EV Assumptions**

| Description | Units | Input |
|---|---|---|
| Miles Charged per Hour Charged[1] | (miles/hr) | 21 |
| Scenario1[2] | - | Reference |
| Scenario 2[2] | - | MSS |
| Number of Chargers[3] | Total # | 249 |
| Average Daily Hours for Charging per Charger[4] | hr | 10 |
| Annual Days of Charger Activity[4] | days/yr | 365 |

**eVMTs from Project Chargers - Reference Scenario**

| Year | Total Annual Project Trips[5,6] | Total Annual Project VMT[5,6] | % of total Fleet using Electric Fuel[2] | Annual Project EV Trips[6] | Annual Project Electric VMT[6] | Number of Project EV Chargers Available[7] | Total Annual EV Charge Hours Available from Project Chargers[8] | Number of EV Annual VMT Available from Project Chargers[8] | Project Chargers at Capacity Relative to Project Electric VMT[9] | Total Annual eVMTs Charged by Project[9] |
|---|---|---|---|---|---|---|---|---|---|---|
| | trips/year | VMT/year | | trips/year | eVMT/year | | hours/year | eVMT/year | | |
| **Partial Buildout - Year 4** | 378,626 | 2,589,154 | **4.7%** | 17,714 | 121,137 | 131 | 477,218 | 10,021,583 | Under Capacity | **121,137** |
| **Partial Buildout - Year 5** | 1,872,030 | 14,910,770 | **5.2%** | 97,457 | 776,244 | 187 | 683,944 | 14,362,828 | Under Capacity | **776,244** |
| **Partial Buildout - Year 6** | 4,124,018 | 35,087,750 | **5.6%** | 229,894 | 1,955,968 | 239 | 871,770 | 18,307,160 | Under Capacity | **1,955,968** |
| **Full Buildout** | 5,137,763 | 44,623,729 | **5.9%** | 304,407 | 2,643,906 | 249 | 908,850 | 19,085,850 | Under Capacity | **2,643,906** |

**eVMTs from Project Chargers - Mobile Source Strategy (MSS) Scenario**

| Year | Total Annual Project Trips[5,6] | Total Annual Project VMT[5,6] | % of total Fleet using Electric Fuel[2] | Annual Project EV Trips[6] | Annual Project Electric VMT[6] | Number of Project EV Chargers Available[7] | Total Annual EV Charge Hours Available from Project Chargers[8] | Number of EV Annual VMT Available from Project Chargers[8] | Project Chargers at Capacity Relative to Project Electric VMT[9] | Total Annual eVMTs Charged by Project[9] |
|---|---|---|---|---|---|---|---|---|---|---|
| | trips/year | VMT/year | | trips/year | eVMT/year | | hours/year | eVMT/year | | |
| **Partial Buildout - Year 4** | 378,626 | 2,589,154 | **8.3%** | 31,482 | 215,280 | 131 | 477,218 | 10,021,583 | Under Capacity | **215,280** |
| **Partial Buildout - Year 5** | 1,872,030 | 14,910,770 | **10.6%** | 198,125 | 1,578,074 | 187 | 683,944 | 14,362,828 | Under Capacity | **1,578,074** |
| **Partial Buildout - Year 6** | 4,124,018 | 35,087,750 | **13.1%** | 538,834 | 4,584,475 | 239 | 871,770 | 18,307,160 | Under Capacity | **4,584,475** |
| **Full Buildout** | 5,137,763 | 44,623,729 | **15.8%** | 811,528 | 7,048,476 | 249 | 908850 | 19,085,850 | Under Capacity | **7,048,476** |

**Notes:**

1. The miles charged per hour charged is representative of a typical charge rate for an EV of 6.25 kWh per hour and a fuel economy of 0.30 kWh per mile. The charge rate is based on capability of existing battery-electric vehicles and Level 2 charging stations. Reference: Chargepoint. 2017. Level Up Your EV Charging Knowledge. Available at: https://www.chargepoint.com/blog/level-your-ev-charging-knowledge/. The fuel economy is based on electric fleet data from fueleconomy.gov. Available at: https://www.fueleconomy.gov/.
2. The two scenarios analyzed are the Reference and the Mobile Source Strategy scenarios. ARB is currently preparing its 2020 Mobile Source Strategy (MSS) update to the ARB VISION Model (version 2.1). The 2020 MSS uses "scenario planning to take an integrated approach to identifying the technology trajectories and programmatic concepts" to model projected years of electric vehicle miles for assessed scenarios. The Mobile Source Strategy projects eVMTs reflecting the aspirational target identified in EO N-79-20, assuming 100% of passenger vehicle sales in California are ZEV or PHEV, and GHG emissions assumed to have reduced by 2.0% per year from 2026 to 2035. The 2020 update only considers passenger vehicles (LDA, LDT1, LDT2, and MDV). To determine the eVMT percent of the passenger vehicle fleets, the 2020 MSS update was downloaded in July 13, 2021. The increase in annual eVMTs charged by the Project from the Reference Scenario to the MSS Scenario is used to determine the eVMTs the Project can take credit for based on providing additional charging infrastructure for the state to reach aspirational EV fleet penetration.
3. The number of chargers in the Town Square and the Residential/Shopping District was provided by the Project Applicant in the Willow Village Mixed Use Development Concept Level Energy Use Summary, dated June 14, 2021, detailing chargers available for all mixed-use traffic. 249 EV Charging Stations are available to serve the 1,694 residential spaces and 500 commercial spaces.
4. Meta offers a valet service to charge EVs from 7am to 7pm, average daily hours of availability for charging per charger is conservatively assumed to be 10 hours per day. When demand is met, the full 10 hours will be used for charging, with each vehicle cycling out of the charging spot before or as the car reaches full charge. The number of chargers are available for all Town Square and the Residential/Shopping District land uses, and it is expected that there will be 10 hours a day of active charging taking place due to the frequency of turnover associated with retail, restaurant, hotel, and park land uses. Town Square and the Residential/Shopping District land uses are assumed to operate 365 days per year. Any charging inefficiencies associated with cars remaining plugged in after reaching full charge is assumed to balance out due the likelihood of more than 10 hours of activity a day associated with Town Square and the Residential/Shopping District activity.
5. Town Square and the Residential/Shopping District Total VMT and trips includes all proposed Project residential, retail, park, and hotel land uses, consistent with Table 18. Retail land uses include Hamilton Parcels North and South and are added to total VMT and trips.
6. EV Annual Trips and EV Annual VMT are determined based on Project trips and VMTs and the VISION Reference Scenario percent of Electric Fleet. These eVMTs (electric vehicle miles traveled) represents the number of project VMTs that are driven by electric vehicles.
7. 249 EV Charging Stations are proposed for the full buildout. To reflect the EV charging stations that will come online during construction in the partial years leading up to full buildout, a scaling factor was applied based on the ratio of square feet of the parking land use that is built out in a given year to the total square feet that will be built. The scaling factor for a given year was applied to the 249 chargers at full buildout. To see scaling factors used, refer to the parking land use from Table 16.
8. Total annual charge hours available from the project are determined by multiplying the average daily hours of charging per charger (10 hours) by the annual days of charger activity (365 days). The annual charge hours available from the project are then multiplied by 25 miles charged per charge hour to determine the number of eVMT available from the project.
9. The Project EV chargers for Town Square and the Residential/Shopping District land uses are determined to be at capacity, meaning used fully for all available charge hours per day, when the electric vehicle miles associated with the Project are in excess of the maximum electric vehicle miles the Project chargers can charge. If there is a surplus of chargers relative to EVs coming to the site, then the Project chargers are under-capacity, and only a fraction of chargers will be used as the number of EVs coming to the site are fewer than the total number of charger capacity. If there is a surplus of EVs coming to the site relative to the chargers at the site, all chargers will be used and the site will be at capacity. In the scenario when the chargers are at capacity, the full capacity of VMTs the site can charge are assumed to be charged.

**Abbreviations:**

EV - electric vehicle (includes battery electric or plug-in hybrid technology)
Hr - hour
TDM - Transportation Demand Management
VMT - vehicle miles travelled
eVMT - electric vehicle mile traveled

**References:**

U.S. Census. 2019. Factfinder. Available at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2016.3.2. Available online at http://www.caleemod.com/
California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/
California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

**Table 24a**
**EV CAP Emissions Reductions Summary**
**Willow Village**
**Menlo Park, California**

**Town Square and the Residential/Shopping District**

| Year | Scenario | Miles Charged by Project Chargers[1] | EV Trips Charged by Project Chargers[1] | eVMT from Additional Project Chargers[2] | Trip Counts from additional Project Chargers[2] | Electric VMT CAP Emissions Reduction (lb/year)[3,4] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | eVMT/year | trips/year | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | Reference | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MSS | 0 | 0 | | | | | | |
| Year 4 | Reference | 121,137 | 17,714 | 94,143 | 13,767 | -33 | -18 | -0.34 | -0.31 |
| | MSS | 215,280 | 31,482 | | | | | | |
| Year 5 | Reference | 776,244 | 97,457 | 801,830 | 100,669 | -246 | -133 | -2.7 | -2.5 |
| | MSS | 1,578,074 | 198,125 | | | | | | |
| Year 6 | Reference | 1,955,968 | 229,894 | 2,628,507 | 308,940 | -746 | -396 | -8.3 | -7.7 |
| | MSS | 4,584,475 | 538,834 | | | | | | |
| Full Buildout | Reference | 2,643,906 | 304,407 | 4,404,570 | 507,121 | -1,234 | -658 | -14 | -13 |
| | MSS | 7,048,476 | 811,528 | | | | | | |

**Campus District**

| Year | eVMT from Additional Project Chargers[5] | Trip Counts from additional Project Chargers[5,6] | Electric VMT CAP Emissions Reduction (lb/year)[3,4] | | | |
|---|---|---|---|---|---|---|
| | eVMT/year | trips/year | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | 1,783,182 | 148,319 | -564 | -472 | -7.6 | -7.0 |
| Year 4 | 298,927 | 26,882 | -78 | -47 | -1.0 | -0.91 |
| Year 5 | 5,701,922 | 512,763 | -1,432 | -833 | -18 | -17 |
| Year 6 | 9,259,481 | 832,687 | -2,249 | -1,262 | -28 | -26 |
| Full Buildout | 9,752,026 | 876,981 | -2,369 | -1,329 | -30 | -27 |

| Year | Electric VMT CAP Emissions Reduction (lb/year) | | | |
|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | -564 | -472 | -7.6 | -7.0 |
| Partial Buildout- Year 4 | -111 | -65 | -1.3 | -1.2 |
| Partial Buildout- Year 5 | -1,677 | -966 | -21 | -19 |
| Partial Buildout- Year 6 | -2,995 | -1,658 | -37 | -34 |
| Full Buildout | -3,603 | -1,988 | -44 | -40 |

**Notes:**

1. Expected eVMT and trips charged by the Project chargers in Town Square and the Residential/Shopping District land uses are calculated based on the San Mateo Fleet, charger usage assumptions, ARB's Vision Model, and traffic data provided by the Transportation Engineer. For calculation details, see Table 23.

2. Emissions reductions from EV charging represent the decrease in emissions from increases in electric vehicle use due to the installation of EV chargers throughout the site. For Town Square and the Residential/Shopping District land uses, the eVMT and trips from additional Project chargers is calculated based on the difference between the MSS scenario and the baseline scenario, representing the additional eVMT due to the installation of additional chargers.

3. Emissions reductions use emission factors developed in EMFAC2021 that represent passenger vehicles (LDA, LDT1, LDT2, MCY). The eVMTs determined for Town Square and the Residential/Shopping District are based on ARB's VISION Model, which includes expected electric vehicle fleet % for passenger vehicles only (LDA, LDT1, LDT2, MCY).
4. EVs emit particulate matter brake wear and tire wear, therefore those emissions are not considered in the reductions.
5. Expected eVMT charged by additional Project chargers is measured based on anticipated charging energy usage provided by the Project Applicant. For calculation details see Table 22.
6. Trip counts from Project chargers were calculated by dividing the increased eVMTs from project chargers by the average VMTs per trip for the passenger vehicles (Cars) in a given year, based on traffic data provided by the Transportation Engineer.

**Abbreviations:**

eVMT - electric vehicle miles traveled
lb - pound
EV - electric vehicle
ROG - reactive organic gases
NOx - nitrogen oxides
$PM_{10}$ - particulate matter less than 10 microns in diameter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter

**References:**

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

**Table 24b**
**EV GHG Emissions Reductions Summary**
**Willow Village**
**Menlo Park, California**

**Town Square and the Residential/Shopping District**

| Year | Scenario | Miles Charged by Project Chargers[1] | EV Trips Charged by Project Chargers[1] | eVMT from Additional Project Chargers[2] | Trip Counts from additional Project Chargers[2] | Electric VMT GHG Emissions Reduction (MT/year)[3,4] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | eVMT/year | trips/year | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Full Buildout | Reference | 2,643,906 | 304,407 | 4,404,570 | 507,121 | -1,310 | -0.044 | -0.034 | -1,321 |
| | MSS | 7,048,476 | 811,528 | | | | | | |

**Campus District**

| Year | eVMT from Additional Project Chargers[4] | Trip Counts from additional Project Chargers[4,5] | Electric VMT GHG Emissions Reduction (MT/year)[3] | | | |
|---|---|---|---|---|---|---|
| | eVMT/year | trips/year | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Existing Conditions | 1,783,182 | 148,319 | -580 | -0.024 | -0.019 | -586 |
| Full Buildout | 9,752,026 | 876,981 | -2,882 | -0.082 | -0.069 | -2,905 |

| Year | Electric VMT GHG Emissions Reduction (MT/year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Existing Conditions | -580 | -0.024 | -0.019 | -586 |
| Full Buildout | -4,192 | -0.13 | -0.10 | -4,226 |

**Notes:**

1. Expected eVMT and trips charged by the Project chargers in Town Square and the Residential/Shopping District land uses are calculated based on the San Mateo Fleet, charger usage assumptions, ARB's Vision Model, and traffic data provided by the Transportation Engineer. For calculation details, see Table 23.

2. Emissions reductions from EV charging represent the decrease in emissions from increases in electric vehicle use due to the installation of EV chargers throughout the site. For Town Square and the Residential/Shopping District land uses, the eVMT and trips from additional Project chargers is calculated based on the difference between the MSS scenario and the baseline scenario, representing the additional eVMT due to the installation of additional chargers.

3. Emissions reductions use emission factors developed in EMFAC2021 that represent passenger vehicles (LDA, LDT1, LDT2, MCY). The eVMTs determined for Town Square and the Residential/Shopping District are based on ARB's VISION Model, which includes expected electric vehicle fleet % for passenger vehicles only (LDA, LDT1, LDT2, MCY).

4. Expected eVMT charged by additional Project chargers is measured based on anticipated charging energy usage provided by the Project Applicant. For calculation details see Table 22.

5. Trip counts from Project chargers were calculated by dividing the increased eVMTs from project chargers by the average VMTs per trip for the passenger vehicles (Cars) in a given year, based on traffic data provided by the Transportation Engineer.

**Abbreviations:**

GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
eVMT - electric vehicle miles traveled
MT - metric ton
EV - electric vehicle

**References:**

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

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**Table 25a**
**Summary of Mobile CAP Emissions**
**Willow Village**
**Menlo Park, California**

**Total Emissions Before Reductions:**[1]

| Year | CAP Emissions without Reductions (ton/year) | | | |
|---|---|---|---|---|
| | ROG | $NO_x$ | $PM_{10}$[2] | $PM_{2.5}$[2] |
| **Total Emissions by Year** | | | | |
| Existing Conditions[3] | 5.0 | 8.0 | 4.0 | 0.84 |
| Year 4 | 0.61 | 0.67 | 0.46 | 0.092 |
| Year 5 | 5.8 | 6.3 | 5.1 | 1.0 |
| Year 6 | 10 | 11 | 9.4 | 1.9 |
| **Full Buildout** | 12 | 13 | 11 | 2.1 |
| **Net Emissions by Year** | | | | |
| Year 4 | -4.4 | -7.3 | -3.6 | -0.74 |
| Year 5 | 0.8 | -1.7 | 1.0 | 0.17 |
| Year 6 | 5.3 | 3.1 | 5.4 | 1.0 |
| **Full Buildout** | **6.8** | **4.7** | **6.7** | **1.3** |

**Total Emissions with Reductions:**[4]

| Year | CAP Emissions with Reductions (ton/year) | | | |
|---|---|---|---|---|
| | ROG | $NO_x$ | $PM_{10}$[2] | $PM_{2.5}$[2] |
| **Total Emissions by Year** | | | | |
| Existing Conditions[3] | 5.0 | 8.0 | 4.0 | 0.84 |
| Year 4 | 0.56 | 0.64 | 0.46 | 0.091 |
| Year 5 | 5.0 | 5.9 | 5.1 | 1.0 |
| Year 6 | 8.8 | 10 | 9.4 | 1.8 |
| **Full Buildout** | **10** | **12** | **11** | **2.1** |
| **Net Emissions by Year** | | | | |
| Year 4 | -4.4 | -7.4 | -3.6 | -0.74 |
| Year 5 | 0.0 | -2.2 | 1.0 | 0.16 |
| Year 6 | 3.9 | 2.3 | 5.3 | 1.0 |
| **Full Buildout** | **5.0** | **3.7** | **6.6** | **1.3** |

**Notes:**

1. Calculations of CAP emissions before reductions are shown in detail in Table 21a. Net emissions subtract the emissions from the existing conditions in 2019.
2. PM10 and PM2.5 emissions include exhaust, tire wear, brake wear, and fugitive dust. Fugitive dust emissions factors are calculated in Table 8.
3. The Existing Conditions includes EV reductions associated with existing Project Site chargers.
4. CAP Emissions after reductions account for the reductions associated with EVs as shown in Table 24a. The emissions reductions are subtracted from the total Project emissions.

**Abbreviations:**

lb - pound
MT - metric ton
EV - electric vehicle
ROG - reactive organic gases
NOx - nitrogen oxides
$PM_{10}$ - particulate matter less than 10 microns in diameter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter

**References:**


California ARB. 2021. Miscellaneous Processes Methodologies - Paved Entrained Road Dust. Available online at: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 25b**
**Summary of Mobile GHG Emissions**
**Willow Village**
**Menlo Park, California**

**Total Emissions Before Reductions:**[1]

| Year | GHG Emissions without Reductions (MT/year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| **Total Emissions by Year** | | | | |
| Existing Conditions[2] | 15,660 | 0.46 | 1.2 | 16,024 |
| **Full Buildout** | 36,439 | 1.0 | 1.9 | 37,016 |
| **Net Emissions** | | | | |
| **Full Buildout** | **20,779** | **0.55** | **0.67** | **20,992** |

**Total Emissions with Reductions:**[3]

| Year | GHG Emissions with Reductions (MT/year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| **Total Emissions by Year** | | | | |
| Existing Conditions[2] | 15,660 | 0.46 | 1.2 | 16,024 |
| **Full Buildout** | 32,247 | 0.88 | 1.7 | 32,790 |
| **Net Emissions** | | | | |
| **Full Buildout** | **16,587** | **0.42** | **0.57** | **16,766** |

**Notes:**

1. Calculations of GHG emissions before reductions are shown in detail in Table 21b. Net emissions subtract the emissions from the existing conditions in 2019.
2. The Existing Conditions includes EV reductions associated with existing Project Site chargers.
3. GHG Emissions after reductions account for the reductions associated with EVs as shown in Table 24b. The emissions reductions are subtracted from the total Project emissions.

**Abbreviations:**

GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
MT - metric ton
EV - electric vehicle

**References:**

California ARB. 2021. Miscellaneous Processes Methodologies - Paved Entrained Road Dust. Available online at: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

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**Table 26**
**Generator Emission Factors for Diesel Engines**
**Willow Village**
**Menlo Park, California**

| Fuel | Engine Tier | Generator Size Range (hp) | | Engine Emission Factors[1] (g/bhp-hr) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Minimum | Maximum | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ |
| Diesel | Tier 2 | 750 | 1,200 | 0.26 | 4.6 | 0.15 | 0.15 | 523 |
| Diesel | Tier 3 | 300 | 600 | 0.16 | 2.9 | 0.15 | 0.15 | 523 |
| Diesel | Tier 4 | 1,200 | -- | 0.15 | 0.50 | 0.020 | 0.020 | 523 |

**Notes:**

1. Engine emission factors for $PM_{10}$ and $PM_{2.5}$ (assumed all engines are diesel fueled and that all $PM_{10}$ is diesel particulate matter) based on ARB standards for diesel generator engines. Emission factors for TOG and ROG were converted from NMHC values provided in the Tier standards using EPA hydrocarbon conversion factors. When an emission factor was specified as a combined NMHC+NOx factor, the NMHC/NOx ratio of 5%/95% were taken from BAAQMD guidance. The emission factors for $CO_2e$ are based on diesel emergency generator $CO_2$ and $CH_4$ emission factors from CalEEMod User's Guide Appendix D, Table 12.1, along with a GWP of 25 for $CH_4$.

**Abbreviations:**

ARB - [California] Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CalEEMod - CALifornia Emissions Estimator MODel
CEIDERS - California Emission Inventory Data and Reporting System
$CO_2e$ - carbon dioxide equivalents
EPA - US Environmental Protection Agency
g/bhp-hr -  Grams per Brake Horsepower Hour
GWP - global warming potential

**References:**


CalEEMod Version 2020.4.0. Available online at: http://www.caleemod.com

Californi Air Resources Board. Non-road Diesel Engine Certification Tier Chart. Available online at: https://ww2.arb.ca.gov/resources/documents/non-road-diesel-engine-certification-tier-chart

USEPA. 2010. Conversion Factors for Hydrocarbon Emission Components, NR-002d. EPA-420-R-10-015. July. Available online at: https://nepis.epa.gov/Exe/ZyPDF.cgi/P10081RP.PDF?Dockey=P10081RP.PDF

BAAQMD. 2004. CARB Emission Factors for CI Diesel Engines - Percent HC in Relation to NMHC + NOx. Available at: https://www.baaqmd.gov/~/media/files/engineering/policy_and_procedures/engines/emissionfactorsfordieselengines.pdf

**Table 27**
**Generator Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

**Generator Information[1]**

| Scenario | Number of Generators | Engine Control[2] | Size (HP) | Fuel Type | Annual Operation[3] (hr/yr) |
|---|---|---|---|---|---|
| Existing Conditions | 1 | Tier 3 | 324 | Diesel | 50 |
| Full Buildout | 2 | Tier 3 | 324 | Diesel | 50 |
| | 1 | Tier 3 | 464 | Diesel | 50 |
| | 3 | Tier 2 | 755 | Diesel | 50 |
| | 1 | Tier 2 | 900 | Diesel | 50 |
| | 3 | Tier 4 | 1,220 | Diesel | 50 |
| | 1 | Tier 4 | 1,490 | Diesel | 50 |
| | 2 | Tier 4 | 2,900 | Diesel | 50 |

**Generator Emissions**

| Size (hp) | Quantity | Annual Emissions (ton/yr) ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | (MT/yr) $CO_2e$ |
|---|---|---|---|---|---|---|
| **Existing Conditions Generator Emissions[3]** | | | | | | |
| 324 | 1 | 0.0029 | 0.051 | 2.7E-03 | 2.7E-03 | 8.5 |
| | **Total Emissions** | **0.0029** | **0.051** | **0.0027** | **0.0027** | **8.5** |
| **Full Buildout Conditions Generator Emissions[3]** | | | | | | |
| 324 | 2 | 5.7E-03 | 1.0E-01 | 5.4E-03 | 5.4E-03 | 17 |
| 464 | 1 | 4.1E-03 | 7.3E-02 | 3.8E-03 | 3.8E-03 | 12 |
| 755 | 3 | 3.2E-02 | 5.7E-01 | 1.9E-02 | 1.9E-02 | 59 |
| 900 | 1 | 1.3E-02 | 2.3E-01 | 7.4E-03 | 7.4E-03 | 24 |
| 1,220 | 3 | 3.0E-02 | 1.0E-01 | 4.0E-03 | 4.0E-03 | 96 |
| 1,490 | 1 | 1.2E-02 | 4.1E-02 | 1.6E-03 | 1.6E-03 | 39 |
| 2,900 | 2 | 4.8E-02 | 1.6E-01 | 6.4E-03 | 6.4E-03 | 152 |
| | **Total Emissions** | **0.15** | **1.3** | **0.047** | **0.047** | **399** |

**Notes:**

1. Number, size, and fuel of emergency generators were provided by the Project Applicant.
2. All generators over 1,000 HP were assumed to be Tier 4, consistent with BAAQMD BACT guidelines.
3. Operation for routine maintenance and testing was conservatively assumed to be 50 hours per year, the maximum allowable by the Airborne Toxics Control Measure (ATCM) for Stationary Compression Ignition Engines (17 CCR 93115).

**Abbreviations:**

BACT - Best Available Control Technology
$CO_2$ - carbon dioxide
$CO_2e$ - carbon dioxide equivalents
g - grams
hp - horsepower
hr - hour
MT - metric tons
NOx - oxides of nitrogen
PM - particulate matter
$PM_{10}$ - PM less than 10 microns in diameter
$PM_{2.5}$ - PM matter less than 2.5 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

BAAQMD. Best Available Constrol Technology (BACT) Guideline. Available online at: https://www.baaqmd.gov/~/media/files/engineering/bact-tbact-workshop/combustion/96-1-5.pdf?la=en.

**Table 28**
**Energy Usage for Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Floor Area | Annual Electricity Use | Annual Natural Gas Use |
|---|---|---|---|
| | (sqft) (DU - Residential) | (MWh/yr) | (MMBtu/yr) |
| **Existing Conditions (2019)[1]** | | | |
| All | 1,923,910 | 12,050 | 30,039 |
| | **Total Existing Energy Usage** | **12,050** | **30,039** |
| **Full Buildout[2,3]** | | | |
| Office | 1,600,000 | 23,828 | 0 |
| Retail | 207,690 | 4,517 | 2,195 |
| Residential | 1,730 | 16,855 | 0 |
| Hotel | 172,000 | 2,528 | 0 |
| Parking | 1,869,240 | 32,183 | 0 |
| Park | 403,837 | 38 | 0 |
| | **Total Full Buildout Energy Usage** | **79,950** | **2,195** |

**Notes:**

1. Energy use rates for existing conditions were provided for 2019 by the Project Applicant via email on August 10, 2021.
2. Electricity and natural gas usage rates for the retail, residential, and parking land uses were provided by PAE in the June 14, 2021 memorandum. Electricity usage rates for Office, Hotel, and Park were provided by Hines on June 21, 2021. The hotel and office do not use natural gas. The electricity usage includes 27,986 MWh/year of electricity use associated with the Campus District EV charging stations, which is summarized in the parking land use category. Electricity and energy use rates for the Willow Road Retail were calculated based on the CalEEMod defaults the retail land use type in Climate Zone 5.
3. Natural gas for the project is only used for Hamilton Avenue Parcels North and South and the supermarket and restaurant land uses, which are summarized in the retail category.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
DU - dwelling unit
kBTU - thousand British Thermal Units
kWh - kilowatt-hour
MMBTU - million British Thermal Units
MWh - Megawatt-hour
sqft - square feet
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2020.4.0. Available online at http://www.caleemod.com

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**Table 29**
**Energy Usage Emission Factors**
**Willow Village**
**Menlo Park, California**

**Historical Electricity Intensity - PG&E**

| Annual Electricity Data | 2016 | 2017 | 2018 | Average[1] | Units |
|---|---|---|---|---|---|
| $CO_2$ Intensity Factor per Total Energy Delivered[2] | 294 | 210 | 206 | 237 | lbs $CO_2$/MWh delivered |
| CO2e Intensity Factor per Total Energy Delivered | 296 | 213 | 209 | 239 | lbs $CO_2e$/MWh delivered |
| % of Total Energy From RPS-Eligible Renewables[3] | 33% | 33% | 39% | 35% | - |
| $CO_2$ Intensity Factor per Total Non-RPS-Eligible Energy[4] | 437 | 314 | 338 | 364 | lbs $CO_2$/MWh delivered |
| $CO_2e$ Intensity Factor per Total Non-RPS-Eligible Energy[4] | 441 | 318 | 342 | 368 | lbs $CO_2e$/MWh delivered |

**Estimated Intensity Factor for Total Energy Delivered by PG&E[5]**

| Year | 2016 | 2017 | 2018 | Average[5] | Units |
|---|---|---|---|---|---|
| 2019 (35%) | 294 | 210 | 206 | 237 | lbs $CO_2$/MWh delivered |
| | 296 | 213 | 209 | 239 | lbs $CO_2e$/MWh delivered |
| 2024 (44%) | 240 | 173 | 186 | 200 | lbs $CO_2$/MWh delivered |
| | 242 | 175 | 188 | 202 | lbs $CO_2e$/MWh delivered |
| 2025 (47%) | 229 | 165 | 177 | 191 | lbs $CO_2$/MWh delivered |
| | 231 | 167 | 179 | 193 | lbs $CO_2e$/MWh delivered |
| 2026 (50%) | 219 | 157 | 169 | 181 | lbs $CO_2$/MWh delivered |
| | 220 | 159 | 171 | 183 | lbs $CO_2e$/MWh delivered |
| 2030 (60%) | 175 | 126 | 135 | 145 | lbs $CO_2$/MWh delivered |
| | 176 | 127 | 137 | 147 | lbs $CO_2e$/MWh delivered |

**Estimated Intensity Factor for Total Energy Delivered by PCE[6]**

| Model Year | 2016 | 2017 | 2018 | Average[1] | Units |
|---|---|---|---|---|---|
| 86% Renewable (2019 - 2030) | 59 | 42 | 45 | 49 | lbs $CO_2$/MWh delivered |
| | 62 | 45 | 48 | 51 | lbs $CO_2e$/MWh delivered |
| 100% Renewable (Campus District) | 0 | 0 | 0 | 0 | lbs $CO_2$/MWh delivered |
| | 0 | 0 | 0 | 0 | lbs $CO_2e$/MWh delivered |

**Greenhouse Gas Energy Emission Factors**

| Greenhouse Gas | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ | Units |
|---|---|---|---|---|---|
| Global Warming Potential[7] | 1 | 25 | 298 | - | - |
| 2019 - 2030 Electricity Use Emission Factor[8] | 49 | 0.029 | 0.0062 | 51 | lb/MWh |
| | 2.2E-02 | 1.3E-05 | 2.8E-06 | 2.3E-02 | MT/MWh |
| Natural Gas Use Emission Factor[9] | 118 | 0.0023 | 0.0022 | 118 | lb/MMBTU |
| | 0.0053 | 0.0000 | 0.0000 | 0.0054 | MT/therm |

**Criteria Air Pollutant Energy Emission Factors[9]**

| Land Use Type | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ | Units |
|---|---|---|---|---|---|
| Residential | 0.011 | 0.092 | 0.0075 | 0.0075 | lb/MMBtu |
| Nonresidential | 0.011 | 0.10 | 0.0075 | 0.0075 | lb/MMBtu |

**Notes:**

1. This average uses the most recent three years of data.
2. Total $CO_2$ intensity factors from The Climate Registry. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/. Accessed: April 2021.
3. Percent of total energy from eligible renewables is from the PG&E 2017, 2018, and 2019 Corporate Responsibility Report.
4. The emissions metric presented here was calculated based on the total CO2 intensity factor divided by the percent of energy delivered from non-RPS-eligible sources. This CO2 intensity factor includes both fossil fuel and carbon-free sources of energy, such as largescale hydro and nuclear. Diablo Canyon Nuclear Plant, which accounts for a portion of the carbon-free energy in this CO2 intensity factor, is planned to be closed by 2024-2025 (https://www.pge.com/en_US/safety/how-the-system-works/diablo-canyon-power-plant/diablo-canyon-power-plant/engagement-panel.page). According to SB 1090 (approved 9/2018), "The [California Public Utilities] commission shall ensure that integrated resource plans are designed to avoid any increase in emissions of greenhouse gases as a result of the retirement of the Diablo Canyon Units 1 and 2 powerplant." This was incorporated into CPUC section 712.7(2)(b). Based on this information, the total Non-RPS-Eligible energy CO2 intensity factor was assumed to remain constant.
5. The RPS of 44% by 2024, 52% by 2027, and 60% for 2030 are consistent with SB 100. The RPS for 2026 and 2027 were estimated by assuming a linear increase between 2024 and 2027. Available at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100. The average percentage of energy from renewables for 2016-2018 is greater than the 2020 RPS of 33% as required by SB100. Thus, it is assumed that the 2016-2018 average CO2 and CO2e intensity factors remain constant through 2020, at which point the carbon intensity then decreases each year to comply with the future RPS requirements.
6. The intensity factor for total energy delivered was estimated by multiplying the percentage of energy delivered from non-RPS-eligible renewable energy by the $CO_2$ emissions per total non-RPS-eligible energy metric calculated above.

**Table 29**
**Energy Usage Emission Factors**
**Willow Village**
**Menlo Park, California**

7. Global Warming Potentials (GWP) are based on the IPCC Fourth Assessment Report. CH4 and N2O emission factors are from the CalEEMod® version 2020.4.0 defaults for PGE, and are conservatively assumed not to change from these estimates. As more renewable energy is integrated into the electricity grid, these intensity factors will also decrease.
8. Peninsula Clean Energy comes from 51% renewable sources, 35% hydro electric and 14% unspecified sources. The 14% unspecified sources were assumed to come from the same mix as the non-renewable PG&E mix of power. This is assumed to remain constant until 2030, after which the renewable percentage of the power mix is assumed to linearly increase to 100% in 2045, conistent with SB 100. Available at:
9. Natural Gas Use emission factors from Table 8.2 of CalEEMod User's Guide Appendix D.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CH_4$ - methane
$CO_2$ - carbon dioxide
$CO_2e$ - carbon dioxide equivalents
CPUC - California Public Utilities Commission
GWP - global warming potential
lb - pound(s)
MMBtu - million British Thermal Units
MT - metric ton(s)
MWh - megawatt-hour
$N_2O$ - nitrous oxide
$NO_x$ - nitrogen oxides
PCE - Peninsula Clean Energy
PG&E - Pacific Gas & Electric
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
RPS - Renewable Portolio Standard
SB - Senate Bill

**References:**


California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2020.4.0. Available online at http://www.caleemod.com/

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**Table 30**
**Energy Usage Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Location | Natural Gas Emissions[1,2] | | | | | Electricity Emissions[1,2] |
|---|---|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ | |
| | (tons/yr) | | | | (MT/yr) | |
| **Existing Conditions (2019)** | | | | | | |
| All | 0.16 | 1.5 | 0.11 | 0.11 | 1,613 | 0 |
| **Total Existing Emissions** | **0.16** | **1.5** | **0.11** | **0.11** | **1,613** | **0** |
| **Full Buildout** | | | | | | |
| Retail | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 118 | 0 |
| **Total Full Buildout Emissions** | **0.012** | **0.11** | **8.2E-03** | **8.2E-03** | **118** | **0** |
| **Partial Buildout[3]** | | | | | | |
| Total Year 4 Emissions | 0.0012 | 0.011 | 8.3E-04 | 8.3E-04 | 12 | 0 |
| Total Year 5 Emissions | 0.0070 | 0.064 | 4.9E-03 | 4.9E-03 | 70 | 0 |
| Total Year 6 Emissions | 0.012 | 0.11 | 8.0E-03 | 8.0E-03 | 115 | 0 |

**Notes:**
1. CAP emissions result from the combustion of natural gas. As a result, CAP emissions were only calculated for natural gas usage. In compliance with the City of Menlo Park Municipal Code, natural gas usage for the Project will be offset; however, since the carbon intensity of the offset production is not known at this time, GHG emissions from natural gas were conservatively included alongside electricity GHG emissions.
2. Emissions were calculated based on energy use, shown in Table 28, and energy emission factors, shown in Table 29. Existing electricity is sourced from PCE. Project electricity will be sourced from 100% renewable sources; as such, emissions from Project electricity use are expected to be zero. Project natural gas will only be used in retail land uses for commercial cooking equipment.
3. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**
CAP - Criteria Air Pollutants
$CO_2e$ - carbon dioxide equivalents
GHG - Greenhouse Gas
MT - metric ton(s)
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**
California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2020.4.0. Available online at http://www.caleemod.com

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**Table 31**
**Water Usage for Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

**Water Usage**

| Land Use | CalEEMod® Land Use Subtype | Size | Size Metric | Indoor Water (million gal/year) | Outdoor Water (million gal/year) |
|---|---|---|---|---|---|
| **Existing Conditions (2019)[1]** | | | | | |
| Office | General Office Building | 251,530 | sqft | 45 | 27 |
| Commercial | Research and Development | 123,870 | sqft | 61 | 0 |
| Industrial - Warehouse | Unrefrigerated Warehouse-No Rail | 500,780 | sqft | 116 | 0 |
| Industrial - Manufacturing | Manufacturing | 23,570 | sqft | 5.5 | 0 |
| Recreational | Health Club | 24,060 | sqft | 1.4 | 0.87 |
| Light Industrial | General Light Industry | 80,100 | sqft | 19 | 0 |
| Parking | Enclosed Parking with Elevator | 920,000 | sqft | 0 | 0 |
| **Full Buildout[2]** | | | | | |
| Office | | 1,600,000 | sqft | 35 | 10 |
| Retail | | 207,690 | sqft | 4.2 | 0.36 |
| Residential | | 1,695,976 | sqft | 67 | 6.3 |
| Hotel | | 172,000 | sqft | 7.6 | 2.5 |
| Parking | | 1,869,240 | sqft | 0 | 1.4 |
| Park | | 403,837 | sqft | 0 | 14 |
| **Partial Buildout[3]** | | | | | |
| | | | Total Year 4 Usage[3] | 1.5 | 13 |
| | | | Total Year 5 Usage[3] | 37 | 23 |
| | | | Total Year 6 Usage[3] | 88 | 32 |

**Notes:**

1. Existing water use was calculated using the CalEEMod default water consumption profile for each land use.
2. Project indoor water use rates and outdoor water use for all parcels except Hamilton Avenue Parcels North and South were provided by the Project Applicant on June 14, 2021. Indoor and outdoor water use rates for Hamilton Avenue Parcels North and South were calculated using the CalEEMod default water consumption profile for the retail land use type.
3. Partial buildout usage rates were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
gal - gallon
kWh - kilowatt-hours
ksf - thousand square feet
sqft - square feet

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 32**
**Water Usage and Wastewater Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Electricity Indirect Emissions[1,2] | Septic Tank Direct Emissions[1,2] | Aerobic Direct Emissions[1,2] | Facultative Lagoon Direct Emissions[1,2] | Total Emissions |
|---|---|---|---|---|---|
| | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT CO2e/yr) |
| **Existing Conditions (2019)** | | | | | |
| Office | 37 | 27 | 24 | 10 | 98 |
| Commercial | 36 | 37 | 33 | 13.1 | 119 |
| Industrial - Warehouse | 68 | 71 | 62 | 25 | 226 |
| Industrial - Manufacturing | 3.2 | 3.3 | 2.9 | 1.2 | 10.6 |
| Recreational | 1.2 | 0.87 | 0.76 | 0.30 | 3.1 |
| Light Industrial | 11 | 11.3 | 9.9 | 4.0 | 36 |
| Parking | 0 | 0 | 0 | 0 | 0 |
| **Total Existing Emissions** | **156** | **151** | **132** | **53** | **492** |
| **Full Buildout** | | | | | |
| Office | 19 | 21 | 19 | 7.5 | 67 |
| Retail | 2.0 | 2.6 | 2.3 | 0.91 | 7.8 |
| Residential | 32 | 41 | 36 | 14 | 123 |
| Hotel | 4.1 | 4.6 | 4.1 | 1.6 | 14 |
| Parking | 0.42 | 0 | 0 | 0 | 0.42 |
| Park | 4.2 | 0 | 0 | 0 | 4.2 |
| **Total Full Buildout Emissions** | **62** | **70** | **61** | **24** | **217** |
| **Partial Buildout[3]** | | | | | |
| Total Year 4 Emissions[3] | 5.0 | 0.92 | 0.81 | 0.32 | 7.1 |
| Total Year 5 Emissions[3] | 24 | 22 | 20 | 7.9 | 74 |
| Total Year 6 Emissions[3] | 49 | 54 | 47 | 19 | 168 |

**Notes:**

1. Emissions shown in this table were calculated using default values and methods from CalEEMod Version 2020.4.0. The Water Electricity Intensity, Water Treatment Types, and Wastewater Treatment Direct Emission Factors used in the calculation can be found in Tables 9.2, 9.3 and 9.4 of Appendix D of the CalEEMod user guide, respectively. These calculations were performed using water use rates, shown in Table 31, and energy emission factors, shown in Table 29.
2. Consistent with CalEEMod, indoor water use was assumed to be processed as wastewater and outdoor water use was assumed to not be processed as wastewater.
3. Partial buildout direct emissions from Septic Tank, Aerobic, and Facultative Lagoon wastewater treatment were calculated from full buildout using scaling factors by land use type and year, as shown in Table 1. For partial buildout indirect electricity emissions from water usage and wastewater treatment, usage rates rather than emission were scaled to account for year specific energy emission factors from PG&E, as shown in Table 29.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CO_2$e - carbon dioxide equivalents
MT - metric ton
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 33**
**Solid Waste Generation for Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

**Solid Waste Generation[1]**

| Land Use | Size | Units | Solid Waste Disposal Rate (ton/year) |
|---|---|---|---|
| **Existing Conditions (2019)** | | | |
| Office | 251,530 | sqft | 42 |
| Commercial | 123,870 | sqft | 10 |
| Industrial - Warehouse | 500,780 | sqft | 471 |
| Industrial - Manufacturing | 23,570 | sqft | 29 |
| Recreational | 24,060 | sqft | 137 |
| Light Industrial | 80,100 | sqft | 99 |
| Parking | 920,000 | sqft | 0 |
| **Full Buildout Conditions** | | | |
| Office | 1,600,000 | sqft | 268 |
| Retail | 207,690 | sqft | 218 |
| Residential | 1,730 | DU | 796 |
| Hotel | 0,193 | sqft | 106 |
| Parking | 1,869,240 | sqft | 0 |
| Park | 403,837 | sqft | 0.83 |

**Notes:**

1. Solid Waste Generation Rates are from Table 10.1 of Appendix D of the CalEEMod User's Guide. An 82% diversion rate, provided by the Project Applicant via email communication dated August 2, 2021, is applied to default solid waste generation rates for the existing and project office land use to account for recycling and composting. The diversion rate is generated using data from Recology with the assumption that all bins are at 100% capacity and 0% contamination.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
DU - dwelling unit
sqft - square feet

**References**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 34**
**Solid Waste Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

**Solid Waste Emissions[1]**

| Location | CalEEMod® Land Use Subtype | $CO_2$ (MT/year) | $CH_4$ (MT/year) | $CO_2e$ (MT/year) |
|---|---|---|---|---|
| **Existing Conditions (2019)** | | | | |
| Office | General Office Building | 8.5 | 0.51 | 21 |
| Commercial | Research and Development | 2.0 | 0.12 | 5.0 |
| Industrial - Warehouse | Unrefrigerated Warehouse-No Rail | 96 | 5.6 | 237 |
| Industrial - Manufacturing | Manufacturing | 5.9 | 0.35 | 15 |
| Recreational | Health Club | 28 | 1.6 | 69 |
| Light Industrial | General Light Industry | 20 | 1.2 | 50 |
| Parking | Enclosed Parking with Elevator | 0 | 0 | 0 |
| **Total Existing Emissions** | | **160** | **9.5** | **397** |
| **Full Buildout Conditions** | | | | |
| Office | | 54 | 3.2 | 135 |
| Retail | | 44 | 2.6 | 110 |
| Residential | | 162 | 9.5 | 400 |
| Hotel | | 22 | 1.3 | 53 |
| Parking | | 0 | 0 | 0 |
| Park | | 0.17 | 0.010 | 0.42 |
| **Total Full Buildout Emissions** | | **282** | **17** | **698** |
| **Partial Buildout[2]** | | | | |
| Total Year 4 Emissions[2] | | 6.3 | 0.37 | 16 |
| Total Year 5 Emissions[2] | | 92 | 5.5 | 229 |
| Total Year 6 Emissions[2] | | 220 | 13 | 544 |

**Notes:**

1. Emissions shown in this table were calculated using default values and methods from CalEEMod Version 2020.4.0. These calculations were performed using default waste use rates by land use type and an 82% diversion rate for office land use types provided by the Project Applicant, shown in Table 33, and default solid waste landfill gas emission factors from Table 10.2 of CalEEMod User's Guide Appendix D.
2. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CH_4$ - methane
$CO_2$ - carbon dioxide
$CO_2e$ - carbon dioxide equivalents
LFG - Landfill Gas
MT - metric ton

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 35**
**Unmitigated Architectural Coating Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Floor Area | Building Surface Area[1] | Application Rate[2] | Indoor Paint VOC EF[3] | Outdoor Paint VOC EF[3] | Architectural Coating VOC Emissions[4] |
|---|---|---|---|---|---|---|
| | (sqft) | (sqft) | | (g/L) | (g/L) | (lb/yr) |
| **Existing Conditions (2019)** | | | | | | |
| Office | 251,530 | 503,060 | 10% | 100 | 150 | 262 |
| Commercial | 123,870 | 247,740 | 10% | 100 | 150 | 129 |
| Industrial - Warehouse | 500,780 | 1,001,560 | 10% | 100 | 150 | 522 |
| Industrial - Manufacturing | 23,570 | 47,140 | 10% | 100 | 150 | 25 |
| Recreational | 24,060 | 48,120 | 10% | 100 | 150 | 25 |
| Light Industrial | 80,100 | 160,200 | 10% | 100 | 150 | 84 |
| Parking | 920,000 | 55,200 | 10% | 0 | 150 | 9.6 |
| | | | | | **Total Existing Conditions Emissions** | **1,057** |
| **Full Buildout** | | | | | | |
| Office | 1,600,000 | 3,200,000 | 10% | 100 | 150 | 1,669 |
| Retail | 207,690 | 415,380 | 10% | 100 | 150 | 217 |
| Residential | 1,695,976 | 4,579,135 | 10% | 100 | 150 | 2,388 |
| Hotel | 172,000 | 344,000 | 10% | 100 | 150 | 179 |
| Parking | 1,869,240 | 112,154 | 10% | 0 | 150 | 19 |
| Park | 403,837 | 0 | 10% | 0 | 0 | 0 |
| | | | | | **Total Full Buildout Emissions** | **4,473** |
| **Partial Buildout[5]** | | | | | | |
| | | | | | Total Year 4 Emissions[5] | 83 |
| | | | | | Total Year 5 Emissions[5] | 1,567 |
| | | | | | Total Year 6 Emissions[5] | 3,515 |

**Notes:**

1. Consistent with CalEEMod Appendix A, residential building surface area was assumed to be 2.7 times the floor area, and non-residential 2 times the floor area. Also consistent with CalEEMod Appendix E, the parking painted area was assumed to be 6% of the total surface area for surface lots.
2. Consistent with CalEEMod Appendix A, 10% of all surfaces were assumed to be coated each year.
3. Consistent with CalEEMod Appendix D Table 6.1, which is based on BAAQMD Regulation 8 Rule 3 paint VOC regulations, use VOC EF of 100 g/L for flat paints, generally used indoors, and 150 g/L for all other architectural coatings.
4. Uses CalEEMod Appendix A assumption that 1 gallon of paint covers 180 square feet. Building surface area is assumed to be 75% indoors and 25% outdoors, consistent with CalEEMod Appendix A. Parking garages are assumed to have no indoor surfaces.
5. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
EF - emission factor
g - grams
L - liters
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**


BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/


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**Table 36**
**Mitigated Architectural Coating Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Floor Area | Building Surface Area[1] | Application Rate[2] | Indoor Paint VOC EF[3] | Outdoor Paint VOC EF[3] | Architectural Coating VOC Emissions[4] |
|---|---|---|---|---|---|---|
| | (sqft) | (sqft) | | (g/L) | (g/L) | (lb/yr) |
| **Full Buildout** | | | | | | |
| Office | 1,600,000 | 3,200,000 | 10% | 10 | 150 | 668 |
| Retail | 207,690 | 415,380 | 10% | 10 | 150 | 87 |
| Residential | 1,695,976 | 4,579,135 | 10% | 10 | 150 | 955 |
| Hotel | 172,000 | 344,000 | 10% | 10 | 150 | 72 |
| Parking | 1,869,240 | 112,154 | 10% | 0 | 150 | 19 |
| Park | 403,837 | 0 | 10% | 0 | 0 | 0 |
| **Total Full Buildout Emissions** | | | | | | **1,801** |
| **Partial Buildout[5]** | | | | | | |
| Total Year 4 Emissions[5] | | | | | | 40 |
| Total Year 5 Emissions[5] | | | | | | 635 |
| Total Year 6 Emissions[5] | | | | | | 1,417 |

**Notes:**

1. Consistent with CalEEMod Appendix A, residential building surface area was assumed to be 2.7 times the floor area, and non-residential 2 times the floor area. Also consistent with CalEEMod Appendix E, the parking painted area was assumed to be 6% of the total surface area for surface lots.
2. Consistent with CalEEMod Appendix A, 10% of all surfaces were assumed to be coated each year.
3. Paint VOC content is consistent with or more stringent than BAAQMD Regulation 8 Rule 3 (Architectural Coatings). Emissions were estimated assuming that indoor painting will utilize "super-compliant" VOC architectural coatings that meet the more stringent limits in South Coast Air Quality Management District Rule 1113. For outdoor paint, assumed use of coatings with VOC content of 150 g/L, consistent with BAAQMD requirements. VOC was assumed to be equivalent to ROG for these purposes.
4. Uses CalEEMod Appendix A assumption that 1 gallon of paint covers 180 square feet. Building surface area is assumed to be 75% indoors and 25% outdoors, consistent with CalEEMod Appendix A. Parking garages are assumed to have no indoor surfaces.
5. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
EF - emission factor
g - grams
L - liters
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**


BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

South Coast Air Quality Management District. Super Compliant Architectural Coatings per Rule 1113. Accessed July 2021. Available at: http://www.aqmd.gov/home/programs/business/business-detail?title=super-compliant-coatings&parent=other-low-voc-products.

**Table 37**
**Consumer Product Emission Factor Refinement**
**Willow Village**
**Menlo Park, California**

| Year[1] | Consumer Products VOC inventory (tons/day)[2] | San Mateo County Population[3] | Total Building Square Footage[4] | Consumer Products VOC Emission Factor (lb/square foot/day) |
|---|---|---|---|---|
| 2010 | 4.93 | 718,451 | 537,446,060 | 1.83E-05 |
| 2020 | 5.20 | 764,442 | 571,850,190 | 1.82E-05 |

**Notes:**

1. 2010 data are used because total building square footage was available only for 2010. Building square footage for 2020 was estimated by multiplying 2010 building square footage with the ratio of population in 2020 to that in 2010.
2. VOC inventory obtained from California Air Resources Board's emission inventory for Consumer Products under Solvent Evaporation for the respective years.
3. Population estimates obtained from US Census Bureau's QuickFacts for San Mateo County for the respective years.
4. Total building square footage for 2010 obtained from FEMA HAZUS-MH software.

**Abbreviations:**

lb - pound
VOC - Volatile Organic Compound

**References:**

California Air Resources Board. Almanac Emission Projection Data. Available online at https://www.arb.ca.gov/app/emsinv/emssumcat.php. Accessed November 2021.

US Census Bureau QuickFacts. Available online at https://www.census.gov/quickfacts/fact/table/US/PST045219. Accessed November 2021.

US Federal Emergency Management Agency's Hazus software (HAZUS-MH), Version 5.1. Available online at https://msc.fema.gov/portal/resources/hazus.

**Table 38**
**Consumer Product Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Building Area | Consumer Products VOC EF[1,2] | Days per Year | Consumer Products VOC emissions |
|---|---|---|---|---|
| | (sqft) | (lb/sqft/day) | | (lb/yr) |
| **Existing Conditions (2019)** | | | | |
| Office | 251,530 | 1.8E-05 | 365 | 1,670 |
| Commercial | 123,870 | 1.8E-05 | 365 | 822 |
| Industrial - Warehouse | 500,780 | 1.8E-05 | 365 | 3,324 |
| Industrial - Manufacturing | 23,570 | 1.8E-05 | 365 | 156 |
| Recreational | 24,060 | 1.8E-05 | 365 | 160 |
| Light Industrial | 80,100 | 1.8E-05 | 365 | 532 |
| Parking | 920,000 | 3.5E-07 | 365 | 119 |
| | | | **Existing Conditions Emissions** | **6,783** |
| **Full Buildout** | | | | |
| Office | 1,600,000 | 1.8E-05 | 365 | 10,621 |
| Retail | 207,690 | 1.8E-05 | 365 | 1,379 |
| Residential | 1,695,976 | 1.8E-05 | 365 | 11,258 |
| Hotel | 172,000 | 1.8E-05 | 365 | 1,142 |
| Parking | 1,869,240 | 3.5E-07 | 365 | 242 |
| Park | 403,837 | 5.2E-08 | 365 | 7.6 |
| | | | **Total Full Buildout Emissions** | **24,649** |
| **Partial Buildout[3]** | | | | |
| | | | Total Year 4 Emissions[3] | 599 |
| | | | Total Year 5 Emissions[3] | 9,447 |
| | | | Total Year 6 Emissions[3] | 19,982 |

**Notes:**

1. The consumer products VOC EF for office, retail, and residential land uses was derived using methodology consistent with CalEEMod with adjusted parameters for San Mateo County, as described in Table 37. The default emissions factor assumes 2020 consumer products VOC inventory for San Mateo County. The default building square footage used is from 2010, which was updated to 2020 using population growth of San Mateo County, as shown in Table 37.
2. Consumer product VOC EFs for parking and open space were taken from CalEEMod 2020.4.0. These defaults take into account pesticide and fertilizer use in city parks and degreaser use in parking areas.
3. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

ARB - Air Resources Board
CalEEMod - California Emissions Estimator Model
EF - emission factor
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

**Table 39**
**Landscaping Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Year[2] | Emissions from Landscaping Equipment[1] | | | | |
|---|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ |
| | (tons/yr) | | | | (MT/yr) |
| Existing Conditions | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.063 |
| Year 4 | 0.33 | 0.13 | 0.061 | 0.061 | 19 |
| Year 5 | 0.37 | 0.14 | 0.067 | 0.067 | 20 |
| Year 6 | 0.39 | 0.15 | 0.071 | 0.071 | 22 |
| Full Buildout | 0.39 | 0.15 | 0.071 | 0.071 | 22 |

**Notes:**

1. Landscape emissions calculated using CalEEMod 2020.4.0 based on information regarding building square footage and acreage, shown in Appendix D.
2. Emissions in partial years were calculated by scaling full buildout emissions by the maximum percentage of land uses operational during that year.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CO_2e$ - carbon dioxide equivalents
MT - metric ton(s)
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 40**
**Summary of Unmitigated Operational CAP Emissions**
**Willow Village**
**Menlo Park, California**

| Emissions Source | CAP Emissions[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (ton/year) | | | | (lb/day)[2] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| **Existing Conditions (2019)[3]** | | | | | | | | |
| Architectural Coating | 0.53 | -- | -- | -- | 2.9 | -- | -- | -- |
| Consumer Products | 3.4 | -- | -- | -- | 19 | -- | -- | -- |
| Landscaping | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.016 | 1.5E-03 | 6.0E-04 | 6.0E-04 |
| Natural Gas Use | 0.16 | 1.5 | 0.11 | 0.11 | 0.89 | 8.1 | 0.61 | 0.61 |
| Mobile | 5.0 | 8.0 | 4.0 | 0.84 | 27 | 44 | 22 | 4.6 |
| Emergency Generators | 2.9E-03 | 0.051 | 2.7E-03 | 2.7E-03 | 0.016 | 0.28 | 0.015 | 0.015 |
| **Total Emissions** | **9.1** | **10** | **4.1** | **0.95** | **50** | **52** | **23** | **5.2** |
| **Full Buildout Conditions[4]** | | | | | | | | |
| Architectural Coating | 2.2 | -- | -- | -- | 12 | -- | -- | -- |
| Consumer Products | 12 | -- | -- | -- | 68 | -- | -- | -- |
| Landscaping | 0.39 | 0.15 | 0.071 | 0.071 | 2.1 | 0.81 | 0.39 | 0.39 |
| Natural Gas Use[5] | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 0.065 | 0.59 | 0.045 | 0.045 |
| Mobile | 10 | 12 | 11 | 2.1 | 55 | 64 | 58 | 11 |
| Emergency Generators | 0.15 | 1.3 | 0.047 | 0.047 | 0.79 | 7.0 | 0.26 | 0.26 |
| **Total Emissions** | **25** | **13** | **11** | **2.2** | **137** | **73** | **59** | **12** |
| **Partial Buildout Emissions[6]** | | | | | | | | |
| Total Year 4 Emissions | 1.3 | 1.1 | 0.53 | 0.16 | 7.0 | 5.9 | 2.9 | 0.90 |
| Total Year 5 Emissions | 11 | 6.7 | 5.1 | 1.1 | 60 | 37 | 28 | 6.0 |
| Total Year 6 Emissions | 21 | 11 | 9.5 | 2.0 | 116 | 63 | 52 | 11 |
| **Net Emissions[7]** | | | | | | | | |
| Net Year 4 Emissions | -7.8 | -8.5 | -3.6 | -0.79 | -43 | -46 | -20 | -4.3 |
| Net Year 5 Emissions | 1.9 | -2.8 | 1.0 | 0.14 | 10 | -16 | 5.5 | 0.76 |
| Net Year 6 Emissions | 12 | 2.0 | 5.3 | 1.0 | 66 | 11 | 29 | 5.5 |
| **Net Full Buildout Emissions** | **16** | **3.7** | **6.7** | **1.3** | **88** | **21** | **37** | **7.0** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Operational emissions shown represent activity and emissions across 365 days per year.
3. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
4. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions. Net emissions were calculated as the difference between full buildout emissions and existing condition emissions.
5. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
6. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.
7. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - Criteria Air Pollutant
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
lb - pounds
MT - metric ton
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
PM - particulate matter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod® Version 2020.4.0 Available Online at: http://www.caleemod.com

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**Table 41**
**Summary of Mitigated Operational CAP Emissions**
**Willow Village**
**Menlo Park, California**

| Emissions Source | CAP Emissions[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (ton/year) | | | | (lb/day)[2] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| **Existing Conditions (2019)[3]** | | | | | | | | |
| Architectural Coating | 0.53 | -- | -- | -- | 2.9 | -- | -- | -- |
| Consumer Products | 3.4 | -- | -- | -- | 19 | -- | -- | -- |
| Landscaping | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.016 | 1.5E-03 | 6.0E-04 | 6.0E-04 |
| Natural Gas Use | 0.16 | 1.5 | 0.11 | 0.11 | 0.89 | 8.1 | 0.61 | 0.61 |
| Mobile | 5.0 | 8.0 | 4.0 | 0.84 | 27 | 44 | 22 | 4.6 |
| Emergency Generators | 2.9E-03 | 0.051 | 2.7E-03 | 2.7E-03 | 0.016 | 0.28 | 0.015 | 0.015 |
| **Total Emissions** | **9.1** | **9.5** | **4.1** | **0.95** | **50** | **52** | **23** | **5.2** |
| **Full Buildout Conditions[4]** | | | | | | | | |
| Architectural Coating | 0.90 | -- | -- | -- | 4.9 | -- | -- | -- |
| Consumer Products | 12 | -- | -- | -- | 68 | -- | -- | -- |
| Landscaping | 0.39 | 0.15 | 0.071 | 0.071 | 2.1 | 0.81 | 0.39 | 0.39 |
| Natural Gas Use[5] | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 0.065 | 0.59 | 0.045 | 0.045 |
| Mobile | 10 | 12 | 11 | 2.1 | 55 | 64 | 58 | 11 |
| Emergency Generators | 0.15 | 1.3 | 0.047 | 0.047 | 0.79 | 7.0 | 0.26 | 0.26 |
| **Total Emissions** | **24** | **13** | **11** | **2.2** | **130** | **73** | **59** | **12** |
| **Partial Buildout Emissions[6]** | | | | | | | | |
| Total Year 4 Emissions | 1.3 | 1.1 | 0.53 | 0.16 | 6.9 | 5.9 | 2.9 | 0.90 |
| Total Year 5 Emissions | 10.5 | 6.7 | 5.1 | 1.1 | 57 | 37 | 28 | 6.0 |
| Total Year 6 Emissions | 20 | 11.5 | 9.5 | 2.0 | 110 | 63 | 52 | 11 |
| **Net Emissions[7]** | | | | | | | | |
| Net Year 4 Emissions | -7.8 | -8.5 | -3.6 | -0.79 | -43 | -46 | -20 | -4.3 |
| Net Year 5 Emissions | 1.4 | -2.8 | 1.0 | 0.14 | 7.8 | -16 | 5.5 | 0.76 |
| Net Year 6 Emissions | 11.0 | 2.0 | 5.3 | 1.0 | 60 | 10.8 | 29 | 5.5 |
| **Net Full Buildout Emissions** | **15** | **3.7** | **6.7** | **1.3** | **80** | **21** | **37** | **7.0** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0. The mitigated scenario for the Project is equivalent to the unmitigated scenario for all sources except Architectural Coating, as shown in Table 36.
2. Operational emissions shown represent activity and emissions across 365 days per year.
3. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
4. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions.
5. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
6. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.
7. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - Criteria Air Pollutant
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
lb - pounds
MT - metric ton
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
PM - particulate matter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

**Table 42**
**Summary of Operational GHG Emissions**
**Willow Village**
**Menlo Park, California**

| Emissions Source | GHG Emissions[1] (MT/yr) $CO_2e$ | |
|---|---|---|
| | Existing Conditions (2019)[2] | Full Buildout Conditions[3] |
| Landscaping | 0.063 | 22 |
| Electricity Use | 0 | 0 |
| Natural Gas Use[4] | 1613 | 118 |
| Water Use | 492 | 217 |
| Waste Disposed | 397 | 698 |
| Emergency Generators | 8.5 | 399 |
| **Total Emissions** | **2,509** | **1,453** |
| | **Net Emissions[5]** | **-1,056** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
3. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions.
4. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
5. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

CalEEMod® - California Emissions Estimator Model
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
MT - metric ton
yr - year

**References:**

CalEEMod® Version 2020.4.0 Available Online at: http://www.caleemod.com

**Table 43**
**Unmitigated Construction and Net New Operational CAP Emissions by Year**
**Willow Village**
**Menlo Park, California**

| Year | Average Daily CAP Emissions[1,2] (lb/day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction Emissions Only | | | | Net Operational Emissions[3] | | | | Construction and Net Operational Emissions[3] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| Year 1 | 0.12 | 2.4 | 0.053 | 0.050 | -50 | -52 | -23 | -5.2 | -50 | -50 | -23 | -5.2 |
| Year 2 | 4.5 | 64 | 1.4 | 1.3 | -50 | -52 | -23 | -5.2 | -45 | 11 | -21 | -3.9 |
| Year 3 | 19 | 124 | 5.8 | 5.4 | -50 | -52 | -23 | -5.2 | -31 | 72 | -17 | 0.15 |
| Year 4 | 52 | 53 | 2.3 | 2.1 | -43 | -46 | -20 | -4.3 | 9.3 | 7.2 | -17 | -2.2 |
| Year 5 | 63 | 45 | 2.1 | 2.0 | 10 | -16 | 5.5 | 0.76 | 73 | 29 | 7.7 | 2.7 |
| Year 6 | 31 | 11 | 0.60 | 0.55 | 66 | 11 | 29 | 5.5 | 97 | 21 | 30 | 6.1 |
| Full Buildout | -- | -- | -- | -- | 88 | 21 | 37 | 7.0 | 88 | 21 | 37 | 7.0 |
| BAAQMD Significance Threshold | | | | | | | | | 54 | 54 | 82 | 54 |

**Notes:**
1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Net new operational emissions are scaled for partial years of phased operations by the percent that each parcel is operational for each year relative to full buildout, as shown in Table 16.
3. Unmitigated construction emissions can be found in Table 13. Net unmitigated operational emissions were calculated by subtracting the emissions from the existing conditions from the project emissions, as reported in Table 42.

**Abbreviations:**
CalEEMod - California Emissions Estimator Model
CAP - Criteria Air Pollutant
lb - pounds
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**
CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

## Table 44
## Mitigated Construction and Net New Operational CAP Emissions by Year
## Willow Village
## Menlo Park, California

| Year | Average Daily CAP Emissions[1,2] (lb/day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction Emissions Only[3] | | | | Net Operational Emissions Only[3] | | | | Construction and Net Operational Emissions[3] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| Year 1 | 0.064 | 1.9 | 0.019 | 0.019 | -50 | -52 | -23 | -5.2 | -50 | -50 | -23 | -5.2 |
| Year 2 | 2.7 | 45 | 0.49 | 0.48 | -50 | -52 | -23 | -5.2 | -47 | -7.6 | -22 | -4.7 |
| Year 3 | 10 | 47 | 0.78 | 0.77 | -50 | -52 | -23 | -5.2 | -39 | -5.1 | -22 | -4.4 |
| Year 4 | 24 | 29 | 0.38 | 0.37 | -43 | -46 | -20 | -4.3 | -19 | -17 | -19 | -3.9 |
| Year 5 | 28 | 22 | 0.26 | 0.25 | 8 | -16 | 5.5 | 0.76 | 36 | 6.3 | 5.8 | 1.0 |
| Year 6 | 13 | 4.8 | 0.060 | 0.058 | 60 | 10.8 | 29 | 5.5 | 74 | 16 | 29 | 5.6 |
| Full Buildout | -- | -- | -- | -- | 80 | 20.5 | 37 | 7.0 | 80 | 21 | 37 | 7.0 |
| BAAQMD Significance Threshold | | | | | | | | | 54 | 54 | 82 | 54 |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Net new operational emissions are scaled for partial years of phased operations by the percent that each parcel is operational for each year relative to full buildout, as shown in Table 16.
3. Mitigated construction emissions can be found in Table 14. Net mitigated operational emissions were calculated by subtracting the emissions from the existing conditions from the project emissions, as reported in Table 43.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
CAP - Criteria Air Pollutant
lb - pounds
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

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**Table 45**
**Speciation Profiles**
**Willow Village**
**Menlo Park, California**

| TAC | CAS | Weight Fraction of Emissions by Pollutant[1] | |
|---|---|---|---|
| | | TOG | |
| | | Evaporate | Exhaust |
| Ethylbenzene | 100414 | 0.0012 | 0.011 |
| Toluene | 108883 | 0.017 | 0.058 |
| Hexane | 110543 | 0.015 | 0.016 |
| Xylenes | 1330207 | 0.0058 | 0.048 |
| Benzene | 71432 | 0.0036 | 0.025 |
| Styrene | 100425 | -- | 0.0012 |
| 1,3-Butadiene | 106990 | -- | 0.0055 |
| Acrolein | 107028 | -- | 0.0013 |
| Propylene | 115071 | -- | 0.031 |
| Formaldehyde | 50000 | -- | 0.016 |
| Methanol | 67561 | -- | 0.0012 |
| Acetaldehyde | 75070 | -- | 0.0028 |
| Methyl Ethyl Ketone | 78933 | -- | 0.0002 |
| Naphthalene | 91203 | -- | 0.0005 |

**Notes:**

1. Speciation profiles are taken from the BAAQMD's guidance on Recommended Methods for Screening and Modeling Local Risks and Hazards. Speciation profiles for Gasoline Exhaust are located in Table 14 and Gasoline Evaporative are located in Table 15 of the BAAQMD's guidance.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CAS - chemical abstract services
TAC - toxic air contaminant
TOG - total organic gases

**Reference:**

BAAQMD. 2011. Recommended Methods for Screening and Modeling Local Risks and Hazards. Table 14 and Table 15. Available at: https://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx

**Table 46**
**Toxicity Values**
**Willow Village**
**Menlo Park, California**

| Source | Chemical[1] | CAS Number | Cancer Potency Factor | Chronic Noncancer Reference Exposure Level |
|---|---|---|---|---|
| | | | $(mg/kg\text{-}day)^{-1}$ | $(\mu g/m^3)$ |
| $PM_{10}$ | Diesel PM | 9-90-1 | 1.1 | 5.0 |
| TOG | Acetaldehyde | 75-07-0 | 0.010 | 140 |
| | Acrolein | 107-02-8 | -- | 0.35 |
| | Benzene | 71-43-2 | 0.1 | 3.0 |
| | 1,3-Butadiene | 106-99-0 | 0.6 | 2.0 |
| | Ethylbenzene | 100-41-4 | 0.0087 | 2000 |
| | Formaldehyde | 50-00-0 | 0.021 | 9.0 |
| | Hexane | 110-54-3 | -- | 7000 |
| | Methanol | 67-56-1 | -- | 4000 |
| | Methyl Ethyl Ketone | 78-93-3 | -- | -- |
| | Naphthalene | 91-20-3 | 0.12 | 9.0 |
| | Propylene | 115-07-1 | -- | 3000 |
| | Styrene | 100-42-5 | -- | 900 |
| | Toluene | 108-88-3 | -- | 420 |
| | Xylenes | 1330-20-7 | -- | 700 |

**Notes:**

1. Toxicity values are taken from ARB's Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values.

**Abbreviations:**

ARB - Air Resources Board
Cal/EPA - California Environmental Protection Agency
CAS - chemical abstract services
mg/kg-day - milligrams per kilogram per day
OEHHA - Office of Environmental Health Hazard Assessment
$\mu g/m^3$ - micrograms per cubic meter

**Reference:**

Cal/EPA. 2020. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. March. Available at: http://www.arb.ca.gov/toxics/healthval/contable.pdf.

**Table 47**
**Summary of Full Buildout Traffic Volumes by Roadway Segment**
**Willow Village**
**Menlo Park, CA**

**Offsite Roadways[1]**

| Source Group Name | Distance (m) | Campus District | | | | | | Town Square and Residential/Shopping District | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cars | | On-Demand | | Trucks | | San Mateo Default Fleet | |
| | | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) |
| ADAMS_CT | 223 | 62 | 8.6 | 4 | 0.58 | 1 | 0.19 | 87 | 12 |
| ADAMSD01 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 2.9 |
| ADAMSD02 | 160 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 8.0 |
| ADAMSD03 | 76 | 66 | 3.1 | 5 | 0.21 | 2 | 0.071 | 8 | 0.35 |
| ADAMSD04 | 83 | 66 | 3.4 | 5 | 0.23 | 2 | 0.077 | 8 | 0.38 |
| ADAMSD05 | 147 | 66 | 6.0 | 5 | 0.41 | 2 | 0.14 | 8 | 0.68 |
| ADAMSD06 | 81 | 66 | 3.3 | 5 | 0.23 | 2 | 0.076 | 8 | 0.38 |
| BAY_EAST | 1185 | 657 | 484 | 45 | 33 | 15 | 11 | 1,536 | 1,131 |
| BAY_EFB | 718 | 0 | 0 | 0 | 0 | 0 | 0 | 1,566 | 698 |
| BAY_M01 | 110 | 525 | 36 | 36 | 2.4 | 12 | 0.81 | 1,557 | 106 |
| BAY_M02 | 135 | 525 | 44 | 36 | 3.0 | 12 | 1.0 | 1,557 | 131 |
| BAY_M03 | 117 | 525 | 38 | 36 | 2.6 | 12 | 0.86 | 1,557 | 113 |
| BAY_M04 | 143 | 525 | 47 | 36 | 3.2 | 12 | 1.1 | 1,557 | 138 |
| BAY_M05 | 350 | 525 | 114 | 36 | 7.8 | 12 | 2.6 | 1,557 | 338 |
| BAY_WFB1 | 419 | 0 | 0 | 0 | 0 | 0 | 0 | 1,284 | 334 |
| BAY_WFB2 | 210 | 0 | 0 | 0 | 0 | 0 | 0 | 1,284 | 168 |
| BAY_WFB3 | 124 | 0 | 0 | 0 | 0 | 0 | 0 | 1,284 | 99 |
| BAY_WFB4 | 328 | 0 | 0 | 0 | 0 | 0 | 0 | 1,284 | 262 |
| BAY_WFB5 | 113 | 0 | 0 | 0 | 0 | 0 | 0 | 1,566 | 110 |
| BAY_WFB6 | 542 | 0 | 0 | 0 | 0 | 0 | 0 | 1,566 | 527 |
| BAY_WFB7 | 136 | 0 | 0 | 0 | 0 | 0 | 0 | 1,566 | 132 |
| OBRIEN01 | 320 | 1,480 | 294 | 101 | 20 | 34 | 6.7 | 991 | 197 |
| OBRIEN02 | 138 | 1,480 | 127 | 101 | 8.7 | 34 | 2.9 | 991 | 85 |
| OBRIEN03 | 35 | 1,480 | 33 | 101 | 2.2 | 34 | 0.74 | 991 | 22 |
| OBRIEN04 | 29 | 1,480 | 27 | 101 | 1.8 | 34 | 0.61 | 991 | 18 |
| OBRIEN05 | 28 | 1,480 | 26 | 101 | 1.8 | 34 | 0.59 | 991 | 17 |
| OBRIEN06 | 52 | 1,480 | 48 | 101 | 3.3 | 34 | 1.1 | 991 | 32 |
| OBRIEN07 | 43 | 3,842 | 103 | 262 | 7.0 | 87 | 2.3 | 2,398 | 64 |
| OBRIEN08 | 20 | 3,842 | 49 | 262 | 3.3 | 87 | 1.1 | 2,398 | 30 |
| OBRIEN09 | 20 | 3,842 | 47 | 262 | 3.2 | 87 | 1.1 | 2,398 | 30 |
| OBRIEN10 | 21 | 3,842 | 50 | 262 | 3.4 | 87 | 1.1 | 2,398 | 31 |
| OBRIEN11 | 44 | 3,842 | 105 | 262 | 7.2 | 87 | 2.4 | 2,398 | 66 |
| OBRIEN12 | 102 | 3,842 | 243 | 262 | 17 | 87 | 5.5 | 2,398 | 151 |
| OBRIEN13 | 32 | 3,842 | 76 | 262 | 5.2 | 87 | 1.7 | 2,398 | 47 |
| OBRIEN14 | 112 | 3,842 | 268 | 262 | 18 | 87 | 6.1 | 2,398 | 167 |
| OBRIEN15 | 242 | 3,870 | 581 | 263 | 40 | 88 | 13 | 2,325 | 349 |
| OBRIEN16 | 48 | 3,870 | 115 | 263 | 7.8 | 88 | 2.6 | 2,325 | 69 |
| OBRIEN17 | 54 | 3,870 | 130 | 263 | 8.8 | 88 | 2.9 | 2,325 | 78 |
| UNIV_01 | 110 | 339 | 23 | 23 | 1.6 | 8 | 0.53 | 309 | 21 |
| UNIV_02 | 91 | 339 | 19 | 23 | 1.3 | 8 | 0.43 | 309 | 17 |
| UNIV_03 | 222 | 339 | 47 | 23 | 3.2 | 8 | 1.1 | 309 | 43 |
| UNIV_04 | 121 | 339 | 26 | 23 | 1.7 | 8 | 0.58 | 309 | 23 |
| UNIV_05 | 80 | 339 | 17 | 23 | 1.2 | 8 | 0.38 | 309 | 15 |
| UNIV_06 | 69 | 339 | 15 | 23 | 0.99 | 8 | 0.33 | 309 | 13 |
| UNIV_07 | 258 | 339 | 54 | 23 | 3.7 | 8 | 1.2 | 309 | 49 |
| UNIV_08 | 185 | 410 | 47 | 28 | 3.2 | 9 | 1.1 | 516 | 59 |
| UNIV_09 | 142 | 3,255 | 287 | 222 | 20 | 74 | 6.5 | 1,707 | 150 |
| UNIV_10 | 310 | 3,243 | 624 | 221 | 42 | 74 | 14 | 1,737 | 334 |
| UNIV_11 | 115 | 3,243 | 232 | 221 | 16 | 74 | 5.3 | 1,737 | 124 |
| UNIV_12 | 63 | 3,243 | 232 | 221 | 16 | 74 | 5 | 1,737 | 124 |
| UNIV_13 | 128 | 3,243 | 232 | 221 | 16 | 74 | 5 | 1,737 | 124 |
| UNIV_14 | 201 | 3,243 | 232 | 221 | 16 | 74 | 5 | 1,737 | 124 |
| UNIV_15 | 647 | 3,243 | 232 | 221 | 16 | 74 | 5 | 1,737 | 124 |
| WILLOW01 | 97 | 89 | 5.3 | 6 | 0.36 | 2 | 0.12 | 2,976 | 179 |
| WILLOW02 | 174 | 89 | 10 | 6 | 0.65 | 2 | 0.22 | 2,976 | 321 |
| WILLOW03 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WILLOW04 | 185 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WILLOW05 | 201 | 0 | 0 | 0 | 0 | 0 | 0 | 6,362 | 796 |
| WILLOW06 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 6,362 | 436 |
| WILLOW07 | 281 | 580 | 101 | 39 | 6.9 | 13 | 2.3 | 6,875 | 1,201 |
| WILLOW08 | 93 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |
| WILLOW09 | 39 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |
| WILLOW10 | 31 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |
| WILLOW11 | 180 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |
| WILLOW12 | 256 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |
| WILLOW13 | 216 | 580 | 101 | 39 | 7 | 13 | 2 | 6,875 | 1,201 |

**Onsite Roadways[2]**

| Source Group Name | Distance (m) | Volume (vehicles/day) | VMT (mi/day) |
|---|---|---|---|
| ONSITE | 2570 | 10,782 | 17,217 |

**Intercampus Shuttles[3]**

| Source Group Name | Distance (m) | Volume (vehicles/day) | VMT (mi/day) |
|---|---|---|---|
| SHUTTLES | 7278 | 361 | 1,633 |

**Notes:**

1. Net new offsite traffic volumes for both the Campus District and the Town Square were provided by Hexagon in the data request received in October 2021. Offsite traffic for the Campus District was modeled using a percent breakdown of the fleet (88% cars, 6% on-demand, 2% trucks), provided by Hexagon. Offsite traffic for the Town Square and Residential/Shopping District was modeled as the default San Mateo fleet. A summary of fleet mix categories can be found in Table 19. Modeled offsite roadway segments can be found in Figure 8.

2. Net new onsite traffic volumes were provided by Hexagon in the data request received in October 2021. Onsite traffic volumes were taken as the sum of all net new onsite traffic volumes divided by two to account for round trips. Onsite traffic was modeled exclusively as the cars fleet type. A summary of the cars fleet mix can be found in Table 19. Modeled onsite roadway segments can be found in Figure 7.

3. Shuttle traffic volumes, which account for the remaining 4% of the offsite fleet mix, were conservatively modeled as the sum of all inbound and outbound vehicle trips across all regions and routes, divided by two to account for round trips. Inbound and outbound vehicle trips were provided by the Project Applicant in June 2021. A summary of the shuttles fleet mix can be found in Table 19. Modeled shuttle roadway segments can be found in Figure 9.

**Abbreviations:**

VMT - Vehicle Miles Traveled
m - meter
mi - mile

**Table 48**
**Traffic Emission Factors**
**Willow Village**
**Menlo Park, California**

| Vehicle Type | % Diesel[1] | DPM[1,2] | $PM_{2.5}$[2] | TOG[2] | |
|---|---|---|---|---|---|
| | | | | Evaporate | Exhaust |
| | | g/mi | | | |
| San Mateo Default Fleet | 41% | 7.4E-04 | 0.019 | 0.033 | 0.021 |
| Cars | 2% | 1.9E-05 | 0.017 | 0.037 | 0.017 |
| Trucks | 94% | 0.011 | 0.051 | 0.033 | 0.089 |
| Shuttles | 100% | 0.0043 | 0.024 | -- | -- |
| On-Demand | 2% | 2.0E-05 | 0.017 | 0.032 | 0.0091 |

**Notes:**

1. The DPM emission factor for Cars, On-Demand, Trucks, and the San Mateo Default Fleet vehicle types is reduced by the the fraction of total $PM_{10}$ emissions that are from diesel for each fleet type. This fraction was calculated as the sum of $PM_{10}$ running and idling exhaust emissions from all diesel vehicles in the fleet over the sum of all $PM_{10}$ running and idling exhaust emissions for all vehicles in the fleet.
2. A detailed description of mobile emission factors can be found in Table 20. DPM emissions are represented by the running exhaust $PM_{10}$ emission factor for 2026; $PM_{2.5}$ emissions are represented by the sum of the running exhaust, brake wear, tire wear, and controlled resuspended road dust emission factors for 2026; TOG exaporate emissions are represented by the TOG running loss emission factor for 2026; and TOG exhaust emissions are represented by the TOG running exhaust emission factor for 2026.

**Abbreviations:**

DPM - diesel particulate matter
g - gram
mi - mile
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter
$PM_{10}$ - particulate matter less than 10 microns in diameter
TOG - total organic gases

**Table 49**
**Diurnal Traffic Patterns for San Mateo Fleet and Shuttles**
**Willow Village**
**Menlo Park, California**

| Hour of Day | Percent of Total Daily San Mateo Fleet VMT[1] | Shuttle Schedule[2] (number of shuttles) |
|---|---|---|
| 1 | 1.1% | 0 |
| 2 | 0.5% | 0 |
| 3 | 0.6% | 0 |
| 4 | 0.2% | 0 |
| 5 | 0.5% | 16 |
| 6 | 0.9% | 44 |
| 7 | 3.7% | 130 |
| 8 | 7.7% | 115 |
| 9 | 7.1% | 52 |
| 10 | 4.4% | 2 |
| 11 | 4.7% | 0 |
| 12 | 5.9% | 0 |
| 13 | 6.1% | 0 |
| 14 | 6.0% | 2 |
| 15 | 7.0% | 41 |
| 16 | 7.1% | 92 |
| 17 | 7.5% | 102 |
| 18 | 8.2% | 83 |
| 19 | 5.7% | 36 |
| 20 | 4.3% | 6 |
| 21 | 3.2% | 1 |
| 22 | 3.2% | 0 |
| 23 | 2.4% | 0 |
| 24 | 1.9% | 0 |

**Notes:**

1. The percent of total daily VMT is calculated using EMFAC2021 data for all vehicle types in San Mateo County in 2026. It is equal to the hourly VMT divided by total daily VMT.

2. Daily shuttle schedule was provided by the Project Applicant in June 2021.

**Abbreviations:**

VMT - Vehicle Miles Traveled

**References:**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 50**
**Construction Source Parameters**
**Willow Village**
**Menlo Park, California**

| Source | Source Type | Number of Sources[1] | Release Height[2] | Source Width | Initial Horizontal Dimension | Initial Vertical Dimension[3] |
|---|---|---|---|---|---|---|
| | | | (m) | (m) | (m) | (m) |
| Construction Equipment | Area | Multiple | 5.0 | -- | -- | 1.16 |
| On-Road Trucks | Line | Multiple | 2.55 | Width of Road + 6 | -- | 2.37 |
| Feeder Line Equipment | Volume | Multiple | 5.0 | 2.0 | 0.93 | 1.16 |

**Notes:**

1. The number of modeled construction equipment sources is based on the number of distinct construction work areas. The number of on-road vehicle sources is based on the geometry of the truck or traffic routes.
2. BAAQMD does not have guidance on construction modeling, therefore construction equipment parameters used are based on BAAQMD's San Francisco Citywide Health Risk Assessment (SFDPH). According to the SFDPH methodology, release height of a modeled area source representing construction equipment is set to 5 meters. On-road truck release height will be based on USEPA haul road guidance, assuming vehicle heights of 3 meters for heavy-duty vehicles and 2 meters for light-duty vehicles.
3. According to USEPA's AERMOD guidance, initial vertical dimension of the modeled construction equipment area sources is the release height divided by 4.3. According to the USEPA Haul Road Guidance, the initial vertical dimension for line sources is the top of plume height divided by 2.15, where the top of the plume is equal to 2*Release Height. According to USEPA's AERMOD guidance, the initial horizontal dimension for construction volume sources is the source width divided by 2.15.

**Abbreviations:**

AERMOD - Atmospheric Dispersion MODeling
BAAQMD - Bay Area Air Quality Management District
m - meter
SFDPH - San Francisco Department of Public Health
USEPA - United States Environmental Protection Agency

**References:**


San Francisco Department of Public Health. February 2020. San Francisco Citywide Health Risk Assessment: Technical Support Documentation. Available online at: https://www.sfdph.org/dph/files/EHSdocs/AirQuality/Air_Pollutant_Exposure_Zone_Technical_Documentation_2020.pdf

BAAQMD. 2017. California Environmental Quality Act: Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en. Accessed November 2018.

United States Environmental Protection Agency (USEPA). 2012. Haul Road Workgroup Final Report Submission to EPA-OAQPS. U.S. EPA Office of Air Quality and Planning Standards, Research Triangle Park, North Carolina. Available at: https://www3.epa.gov/scram001/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf

USEPA. 2012. Haul Road Workgroup Final Report Submission to EPA-OAQPS. U.S. EPA Office of Air Quality and Planning Standards, Research Triangle Park, North Carolina. Available at: https://www3.epa.gov/scram001/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf

USEPA. 2019. User's Guide for the AMS/EPA Regulatory Model (AERMOD). U.S. EPA Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. Available at: https://www3.epa.gov/ttn/scram/models/aermod/aermod_userguide.pdf

## Table 51
## Operational Source Parameters
## Willow Village
## Menlo Park, California

| Source[1,2,3] | Source Type | Number of Sources | Release Height | Exit Temperature | Exit Velocity | Exit Diameter | Initial Vertical Dimension |
|---|---|---|---|---|---|---|---|
| | | | (m) | (K) | (m/s) | (m) | (m) |
| On-Road Passenger Vehicles | Line | Multiple | 1.7 | -- | -- | -- | 1.58 |
| Shuttles | Line | Multiple | 3.39 | -- | -- | -- | 3.15 |
| Existing Generator | Point | 1 | 3.7 | 804 | 26 | 0.19 | -- |
| North Garage Generators | Point | 2 | 27.74 | 739.82 | 45.3 | 0.18 | -- |
| Parcel 2 and 5 Generators | Point | 2 | 23.47 | 739.82 | 45.3 | 0.18 | -- |
| Parcel 3 Generator | Point | 1 | 26.82 | 739.82 | 45.3 | 0.18 | -- |
| Parcel 4 Generator | Point | 1 | 23.77 | 739.82 | 45.3 | 0.18 | -- |
| Parcel 6 Generator | Point | 1 | 24.38 | 739.82 | 45.3 | 0.18 | -- |
| Parcel 7 Generator | Point | 1 | 23.16 | 739.82 | 45.3 | 0.18 | -- |
| South Garage Generators | Point | 2 | 24.69 | 739.82 | 45.3 | 0.18 | -- |
| Pumping Station Generator | Point | 1 | 3.78 | 739.82 | 45.3 | 0.18 | -- |
| Hamilton Avenue Generator | Point | 1 | 2.99 | 739.82 | 45.3 | 0.18 | -- |
| Town Square Generator | Point | 1 | 25.91 | 739.82 | 45.3 | 0.18 | -- |

**Notes:**

1. Since passenger vehicles occupy the majority of offsite and onsite vehicle traffic, the on-road passenger vehicle source parameters were used to model cars, trucks and on-demand vehicle traffic. The source parameters are consistent with the San Francisco Citywide Health Risk Assessment Technical Support Document (SFDPH) and a vehicle height of 2 meters and USEPA Haul Road Guidance. The source width is the width of the road plus 6 meters to account for the turbulent mixing of air behind vehicles.
2. Intercampus shuttles were modeled using the actual vehicle height of 4 meters as provided by the Project Applicant and USEPA Haul Road Guidance. The source width is the width of the road plus 6 meters to account for the turbulent mixing of air behind vehicles.
3. Project generators were modeled using default values for exit temperature, velocity, and diameter from the San Francisco Citywide Health Risk Assessment Technical Support Document, which are consistent with median stack parameters from the BAAQMD technical memorandum. Release heights of the exhaust are assumed to be the height of the building.

**Abbreviations:**

AERMOD - Atmospheric Dispersion MODeling
BAAQMD - Bay Area Air Quality Management District
K - Kelvin
m - meter
s - second
USEPA - United States Environmental Protection Agency

**References:**

BAAQMD. 2012. San Francisco Community Risk Reduction Plan (SFCRRP). Available at: https://www.gsweventcenter.com/Appeal_Response_References/2012_1201_BAAQMD.pdf

SFDPH. 2020. San Francisco Citywide Health Risk Assessment Technical Support Document. February. Available at: https://www.sfdph.org/dph/files/EHSdocs/AirQuality/Air_Pollutant_Exposure_Zone_Technical_Documentation_2020.pdf

Sonoma Technology, Inc. 2011. Default modeling Parameters for Stationary Sources. Technical Memorandum. April 1.

USEPA. 2012. Haul Road Guidance. Available at: https://www.epa.gov/sites/default/files/2020-10/documents/haul_road_workgroup-final_report_package-20120302.pdf

**Table 52**
**Modeling Adjustment Factor**
**Willow Village**
**Menlo Park, California**

| Receptor Type | Modeling Adjustment Factor |
|---|---|
| Residential | 1 |
| Recreational | 2.55 |
| Daycare Child | 2.55 |
| Daycare Child (18 months +) | 2.55 |
| Elementary School | 2.55 |
| High School | 2.55 |

**Notes:**

1. Modeling adjustment factors are calculated based on the methodology from BAAQMD's Health Risk Assessment Modeling Protocol (2020).
2. The MAF for all non-residential receptor types is calculated to adjust from 24 hours/day to 11 hours/day and from 7 days/week to 6 days/week ([24 hours/11 hours] * [7 days/6 days] = 2.55).

**References:**

BAAQMD. 2020. Health Risk Assessment Modeling Protocol. Available at: https://www.baaqmd.gov/~/media/files/ab617-community-health/facility-risk-reduction/documents/baaqmd_hra_modeling_protocol_august_2020-pdf.pdf?la=en

**Table 53**
**Summary of Construction Source Groups**
**Willow Village**
**Menlo Park, California**

**Off-Road Emissions:**

| Construction Area[1] | Subphase | Off-Road Source Group[2,3,4,5] |
|---|---|---|
| Area 1 | Demolition | PHS_1A |
| | Grading and Utilities | PHS_1A |
| Area 1 Campus District | North Garage | NG |
| | Office Building 4 | O4 |
| | Meeting, Collaboration, Park | MCP |
| | Hotel Excavation | EXCAVATE |
| | Hotel Construction | HTL |
| | Town Square | TS |
| Area 1 Town Square and Residential/Shopping District | Parcel 2 Foundations | RS2 |
| | Parcel 2 Core and Shell | RS2 |
| | Parcel 2 Tenant Improvements | RS2 |
| | Parcel 2 Landscaping | RS2 |
| | Parcel 3 Foundations | RS3 |
| | Parcel 3 Core and Shell | RS3 |
| | Parcel 3 Tenant Improvements | RS3 |
| | Parcel 3 Landscaping | RS3 |
| Area 2 | Demolition | PHS_1B |
| | Grading and Utilities | PHS_1B |
| Area 2 Campus District | South Garage | SG |
| | Office Building 3 | O3 |
| | Office Building 1 | O1 |
| | Office Building 2 | O2 |
| | Office Building 5 | O5 |
| | Office Building 6 | O6 |
| Area 2 Town Square and Residential/Shopping District | Parcel 7 Foundations | RS7 |
| | Parcel 7 Core and Shell | RS7 |
| | Parcel 7 Tenant Improvements | RS7 |
| | Parcel 7 Landscaping | RS7 |
| | Parcel 6 Foundations | RS6 |
| | Parcel 6 Core and Shell | RS6 |
| | Parcel 6 Tenant Improvements | RS6 |
| | Parcel 6 Landscaping | RS6 |
| Area 3 | Grading and Utilities | PHS_2X |
| | Tunnel Construction | TUNNEL |
| | Foundations | RS45 |
| | Core and Shell | RS45 |
| | Tenant Improvements | RS45 |
| | Landscaping | RS45 |
| Hamilton Avenue Parcels North and South | Demolition | RETAIL |
| | Grading and Utilities | RETAIL |
| | Foundations | RETAIL |
| | Core and Shell | RETAIL |
| | Tenant Improvements | RETAIL |
| Substation Upgrade | PG&E Substation Work | RVWSS |
| Feeder Line | PG&E Offsite Work | ROUTE1/ROUTE2 |
| | Surface Improvements | ROUTE1/ROUTE2 |
| Intersection Improvements | O'Brien and Kavanaugh | CCODKD |
| | Adams and O'Brien | ADOD |
| | Willow Road and Ivy Drive | WRID |

**On-Road Emissions:**

| Construction Area | Subphase | Off-Road Source Group[1,3,5] | On-Road Source Group[1,3,5] | Trip Type[6] |
|---|---|---|---|---|
| Area 1 | Demolition | PHS_1A | TRUCKS | Hauling trips |
| | Grading and Utilities | PHS_1A | TRUCKS | Hauling trips |
| Area 1 Campus District | Foundations + Core and Shell | PHS_1A | TRUCKS | Vendor trips |
| | Tenant Improvements | PHS_1A | TRUCKS | Vendor trips |
| | O4 and NG Worker Mobile Trips | -- | TRUCKS | Worker trips |
| | MCS Worker Mobile Trips | -- | TRUCKS | Worker trips |
| Area 1 Town Square and Residential/Shopping District | Foundations | PHS_1A | TRUCKS | Vendor trips |

**Table 53**
**Summary of Construction Source Groups**
**Willow Village**
**Menlo Park, California**

| Construction Area[1] | Subphase | Off-Road Source Group[1,3,5] | On-Road Source Group[1,3,5] | Trip Type[6] |
|---|---|---|---|---|
| Area 1 Town Square and Residential/Shopping District | Core and Shell | PHS_1A | TRUCKS | Vendor trips |
| | Tenant Improvements | PHS_1A | TRUCKS | Vendor trips |
| | Landscaping | PHS_1A | TRUCKS | Vendor trips |
| | Town Square and Residential/Shopping District Worker Mobile Trips | -- | TRUCKS | Worker trips |
| | Landscaping Worker Mobile Trips | -- | TRUCKS | Worker trips |
| Area 2 | Demolition | PHS_1B | TRUCKS | Hauling trips |
| | Grading and Utilities | PHS_1B | TRUCKS | Hauling trips |
| Area 2 Campus District | Foundations + Core and Shell | PHS_1B | TRUCKS | Vendor trips |
| | Tenant Improvements | PHS_1B | TRUCKS | Vendor trips |
| | Worker Mobile Trips | -- | TRUCKS | Worker trips |
| Area 2 Town Square and Residential/Shopping District | Foundations | PHS_1B | TRUCKS | Vendor trips |
| | Core and Shell | PHS_1B | TRUCKS | Vendor trips |
| | Tenant Improvements | PHS_1B | TRUCKS | Vendor trips |
| | Landscaping | PHS_1B | TRUCKS | Vendor trips |
| | Town Square and Residential/Shopping District Worker Mobile Trips | -- | TRUCKS | Worker trips |
| | Landscaping Worker Mobile Trips | -- | TRUCKS | Worker trips |
| Area 3 | Grading and Utilities | PHS_2X | TRUCKS | Hauling trips |
| | Tunnel Construction | PHS_2X | TRUCKS | Vendor trips and Worker trips |
| | Foundations | PHS_2X | TRUCKS | Vendor trips and Worker trips |
| | Core and Shell | PHS_2X | TRUCKS | Vendor trips and Worker trips |
| | Tenant Improvements | PHS_2X | TRUCKS | Vendor trips and Worker trips |
| | Landscaping | PHS_2X | TRUCKS | Vendor trips and Worker trips |
| Hamilton Avenue Parcels North and South | Demolition | RETAIL | TRUCKS | Hauling trips and Worker trips |
| | Grading and Utilities | RETAIL | TRUCKS | Hauling trips and Worker trips |
| | Foundations | RETAIL | TRUCKS | Vendor trips |
| | Core and Shell | RETAIL | TRUCKS | Vendor trips |
| | Tenant Improvements | RETAIL | TRUCKS | Vendor trips |
| | Worker Mobile Trips | RETAIL | TRUCKS | Worker trips |
| Substation Upgrade | PG&E Substation Work | -- | TRUCKS | Vendor trips and Worker trips |
| Feeder Line | PG&E Offsite Work | -- | TRUCKS | Vendor trips and Worker trips |
| | Surface Improvements | -- | TRUCKS | Vendor trips and Worker trips |
| Intersection Improvements | O'Brien and Kavanaugh | -- | TRUCKS | Vendor trips and Worker trips |
| | Adams and O'Brien | -- | TRUCKS | Vendor trips and Worker trips |
| | Willow Road and Ivy Drive | -- | TRUCKS | Vendor trips and Worker trips |

**Notes:**

1. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
2. Source group locations are presented in Figures 3, 4, and 5.
3. Source groups RS4 and RS5 are modeled together as RS45.
4. All on-road source groups are modeled as On-Road Trucks and all off-road source groups are modeled as Construction Equipment.
5. The EXCAVATE source group is modeled as the HTL and TS source groups combined, as excavation will occur near the proposed Hotel and Town Square. This is shown as the Specific Hotel Excavation Area in Figure 3.
6. On-road emissions from hauling and vendor trips are allocated to an on-road source group and off-road source group. Any emissions derived from a g/mile process (e.g., running, brakewear, tirewear, runloss) are allocated to the phase's corresponding on-road source group. Any emissions derived from a g/trip process (e.g., idling, startup, etc.) are allocated to the phase's corresponding off-road source group. This allocation allows for a more accurate representation of where emissions from the g/trip processes occur, since they would be happening on-site.
7. On-road construction worker trips were expected to have negligible impact and were therefore not included in the HRA analysis for excess lifetime cancer risk and chronic HI. $PM_{2.5}$ emissions associated with on-road construction worker trips were included in the construction HRA analysis for $PM_{2.5}$ concentration modeling.

**Abbreviations:**

HI - hazard index
HRA - health risk assessment
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter

**Table 54**
**Exposure Parameters**
**Willow Village**
**Menlo Park, California**

| Receptor Type | Receptor Age Group[1] | Exposure Parameters | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Daily Breathing Rate (DBR)[2,3,4,5] | Annual Exposure Duration (ED)[6] | Fraction of Time at Home (FAH)[7] | Exposure Frequency (EF)[8] | Averaging Time (AT) | Intake Factor, Inhalation ($If_{inh}$) | Age Sensitivity Factor (ASF)[9,10] |
| | | (L/kg-day) | (years) | (unitless) | (days/year) | (days) | ($m^3$/kg-day) | (unitless) |
| Resident | 3rd Trimester | 361 | 1 | 1 | 350 | 25,550 | 0.0049 | 10 |
| | Age 0-<2 Years | 1090 | 1 | 1 | | | 0.015 | 10 |
| | Age 2-<9 Years | 631 | 1 | 1 | | | 0.0086 | 3 |
| | Age 2-<16 Years | 572 | 1 | 1 | | | 0.0078 | 3 |
| | Age 16-30 Years | 261 | 1 | 0.73 | | | 0.0026 | 1 |
| Daycare Child | Age 0-<2 Years | 750 | 1 | 1 | 250 | | 0.0073 | 10 |
| | Age 2-<9 Years | 415 | 1 | 1 | | | 0.0041 | 3 |
| Daycare Child (18 months +) | Age 0-<2 Years | 750 | 1 | 1 | 250 | | 0.0073 | 10 |
| | Age 2-<9 Years | 415 | 1 | 1 | | | 0.0041 | 3 |
| Elementary School Child | Age 2-<9 Years | 640 | 1 | 1 | 180 | | 0.0045 | 3 |
| High School Child | Age 2-<16 Years | 520 | 1 | 1 | 180 | | 0.0037 | 3 |
| Recreational | Age 0-<2 Years | 300 | 1 | 1 | 180 | | 0.0021 | 10 |
| | Age 2-<9 Years | 160 | 1 | 1 | | | 0.0011 | 3 |
| | Age 2-<16 Years | 130 | 1 | 1 | | | 9.2E-04 | 3 |
| | Age 16-30 Years | 60 | 1 | 0.73 | | | 3.1E-04 | 1 |

**Notes:**

1. Age bin 2-<9 Years will be used where applicable, and age bin 2-<16 Years will be conservatively used for ages 9-<16 Years.
2. Daily breathing rates for residents reflect default breathing rates from Cal/EPA 2015 as follows:
   95th percentile 24-hour daily breathing rate for age 3rd trimester and 0-<2 years
   80th percentile 24-hour daily breathing rate for age 2-<9 years
   80th percentile 24-hour daily breathing rate for age 2-<16 years
   80th percentile 24-hour daily breathing rate for age 16-30 years
3. Daily breathing rates for daycare children assumes 2 hour moderate intensity and 6 hour light intensity activity.
4. Daily breathing rates for elementary and high school children assume 95th Percentile Eight-Hour Breathing Rates for Moderate Intensity Activities.
5. Daily breathing rates for recreational receptors assume 95th Percentile Eight-Hour Breathing Rates for Moderate Intensity Activities, scaled to 2 hours per day.
6. Annual exposure duration represents one full year. Specific exposure durations in each age bin are given in Tables 55, 56, 57, and 58.
7. Fraction of time spent at home is conservatively assumed to be 1 (i.e. 24 hours/day) for all age bins except Age 16-30 Years. Fraction of time spent at home is assumed to be 0.73 for Ages 16-30 Years.
8. Exposure frequency was determined as follows:
   Residents: reflects default residential exposure frequency from Cal/EPA 2015.
   Daycare: reflects default worker exposure frequency from Cal/EPA 2015, assuming a daycare child is at the daycare center when the parents are at work.
   School: reflects default number of school days per year.
   Recreational: reflects default number of school days per year, assuming 2 hours of exposure each day.
9. Age sensitivity factors account for an "anticipated special sensitivity to carcinogens" of infants and children as recommended in the OEHHA Technical Support Document (Cal/EPA 2009) and current OEHHA guidance (Cal/EPA 2015). This approach is consistent with the cancer risk adjustment factor calculations recommended by BAAQMD (BAAQMD 2016).
10. Adjustment factor is applicable to each receptor type listed for the age group relevant to that receptor type.

**Abbreviations:**

AT - averaging time
Cal/EPA - California Environmental Protection Agency
DBR - daily breathing rate
EF - exposure frequency
FAH - fraction of time at home
kg - kilogram
L - liter

**Reference:**

Cal/EPA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

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**Table 55**
**Age Sensitivity Weighted Intake Factors by Year and Age Bin for Scenario 1**
**Willow Village**
**Menlo Park, California**

| Year[1] | Resident | | | | | | Recreational | | | | | Daycare Child | | | Daycare Child (18 months +) | | | Elementary School | | High School | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fraction of Year in Age Bin[2,3] | | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin[6] | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] |
| | 3rd Trimester | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 2-9 | ($m^3$/kg-day) | 2-16 | ($m^3$/kg-day) |
| Year 1 | 1 | | | | | 0.049 | 1 | | | | 0.021 | 1 | | 0.073 | 1 | | 0.073 | 1 | 0.014 | 1 | 0.011 |
| Year 2 | 0.20 | 0.80 | | | | 0.13 | 1 | | | | 0.021 | 1 | | 0.073 | 0.45 | 0.55 | 0.040 | 1 | 0.014 | 1 | 0.011 |
| Year 3 | | 1 | | | | 0.15 | 0.95 | 0.05 | | | 0.020 | 0.95 | 0.05 | 0.071 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 4 | | 0.20 | 0.80 | | | 0.051 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 5 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 6 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 7 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 8 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 9 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.0122 | | | | |
| Year 10 | | | 1 | | | 0.026 | | 0.95 | 0.05 | | 0.0034 | | 1 | 0.012 | | | | | | | |
| Year 11 | | | 0.20 | 0.80 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 12 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 13 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 14 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 15 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 16 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 17 | | | | 1 | | 0.0235 | | | 0.95 | 0.05 | 0.00263 | | | | | | | | | | |
| Year 18 | | | | 0.20 | 0.80 | 0.0069 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 19 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 20 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 21 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 22 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 23 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 24 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 25 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 26 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 27 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 28 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 29 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 30 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 31 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 32 | | | | | 1 | 0.0026 | | | | | | | | | | | | | | | |

**Notes:**

1. Exposure Scenario 1 begins at the start of construction in Year 1.
2. The exposure duration for all years is 1, as the health risk assessment is based on annual emissions. While the 3rd Trimester is only 3 months, the exposure duration for the first year is set to 1 since annual average concentrations are used to calculate risks.
3. Age bin 2-16 Years was selected to conservatively represent ages 9-16.
4. The Intake Factors have been multiplied by the Age Sensitivity Factors and weighted by the exposure duration for each age bin.
5. Intake Factors are based on exposure assumptions in Table 44.
6. Exposure for High School receptors is conservatively included in the 2-16 age bin.

**Abbreviations:**

IF - intake factor
$m^3$ - cubic meter
kg - kilogram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

## Table 56
## Age Sensitivity Weighted Intake Factors by Year and Age Bin for Scenario 2
## Willow Village
## Menlo Park, California

| Year[1] | Resident | | | | | | Recreational | | | | | Daycare Child | | | Daycare Child (18 months +) | | | Elementary School | | High School | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fraction of Year in Age Bin[2,3] | | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin[6] | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] |
| | 3rd Trimester | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 2-9 | ($m^3$/kg-day) | 2-16 | ($m^3$/kg-day) |
| Year 2 | 0.99 | 0.0082 | | | | 0.050 | 1 | | | | 0.021 | 1 | | 0.073 | 1 | | 0.073 | 1 | 0.014 | 1 | 0.011 |
| Year 3 | | 1 | | | | 0.15 | 1 | | | | 0.021 | 1 | | 0.073 | 0.25 | 0.75 | 0.027 | 1 | 0.014 | 1 | 0.011 |
| Year 4 | | 0.998 | 0.0021 | | | 0.15 | 0.75 | 0.25 | | | 0.017 | 0.75 | 0.25 | 0.058 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 5 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 6 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 7 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 8 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 9 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 10 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | | | | |
| Year 11 | | | 0.998 | 0.0021 | | 0.026 | | 0.75 | 0.25 | | 0.0032 | | 1 | 0.012 | | | | | | | |
| Year 12 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 13 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 14 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 15 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 16 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 17 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 18 | | | | 0.998 | 0.0021 | 0.023 | | | 0.75 | 0.25 | 0.0021 | | | | | | | | | | |
| Year 19 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 20 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 21 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 22 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 23 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 24 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 25 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 26 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 27 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 28 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 29 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 30 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 31 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 32 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |

**Notes:**
1. Exposure Scenario 2 begins at the start of Grading and Utilities for Area 2 construction in Year 2.
2. The exposure duration for all years is 1, as the health risk assessment is based on annual emissions. While the 3rd Trimester is only 3 months, the exposure duration for the first year is set to 1 since annual average concentrations are used to calculate risks.
3. Age bin 2-16 Years was selected to conservatively represent ages 9-16.
4. The Intake Factors have been multiplied by the Age Sensitivity Factors and weighted by the exposure duration for each age bin.
5. Intake Factors are based on exposure assumptions in Table 44.
6. Exposure for High School receptors is conservatively included in the 2-16 age bin.

**Abbreviations:**
IF - intake factor
$m^3$ - cubic meter
kg - kilogram

**References:**
OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

**Table 57**
**Age Sensitivity Weighted Intake Factors by Year and Age Bin for Scenario 3**
**Willow Village**
**Menlo Park, California**

| Year[1] | Resident | | | | | | Recreational | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fraction of Year in Age Bin[2,3] | | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] |
| | 3rd Trimester | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) |
| Year 5 | 0.37 | 0.63 | | | | 0.11 | 1 | | | | 0.021 |
| Year 6 | | 1 | | | | 0.15 | 1 | | | | 0.021 |
| Year 7 | | 0.58 | 0.42 | | | 0.097 | 0.33 | 0.67 | | | 0.0093 |
| Year 8 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 9 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 10 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 11 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 12 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 13 | | | 1 | | | 0.026 | | 1 | | | 0.0034 |
| Year 14 | | | 0.58 | 0.42 | | 0.025 | | 0.33 | 0.67 | | 0.0030 |
| Year 15 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 16 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 17 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 18 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 19 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 20 | | | | 1 | | 0.024 | | | 1 | | 0.0027 |
| Year 21 | | | | 0.58 | 0.42 | 0.015 | | | 0.33 | 0.67 | 0.0011 |
| Year 22 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 23 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 24 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 25 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 26 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 27 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 28 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 29 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 30 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 31 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 32 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 33 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 34 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 |
| Year 35 | | | | | 0.58 | 0.0015 | | | | 1 | 0.00031 |

**Notes:**

1. Exposure Scenario 3 begins at the conclusion of Town Center and Residential/Shopping District construction when residents move onsite in 2025.
2. The exposure duration for all years is 1, as the health risk assessment is based on annual emissions. While the 3rd Trimester is only 3 months, the exposure duration for the first year is set to 1 since annual average concentrations are used to calculate risks.
3. Age bin 2-16 Years was selected to conservatively represent ages 9-16.
4. The Intake Factors have been multiplied by the Age Sensitivity Factors and weighted by the exposure duration for each age bin.
5. Intake Factors are based on exposure assumptions in Table 44.

**Abbreviations:**

IF - intake factor
$m^3$ - cubic meter
kg - kilogram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

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**Table 58**
**Age Sensitivity Weighted Intake Factors by Year and Age Bin for Scenario 4**
**Willow Village**
**Menlo Park, California**

| Year[1] | Resident | | | | | | Recreational | | | | | Daycare Child | | | Daycare Child (18 months +) | | | Elementary School | | High School | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fraction of Year in Age Bin[2,3] | | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] | Fraction of Year in Age Bin[6] | Age Sensitivity Weighted Intake Factor by Year, Inhalation[4,5] |
| | 3rd Trimester | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | 2-16 | 16-30 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 0-2 | 2-9 | ($m^3$/kg-day) | 2-9 | ($m^3$/kg-day) | 2-16 | ($m^3$/kg-day) |
| Year 7 | 0.25 | 0.75 | | | | 0.12 | 1 | | | | 0.021 | 1 | | 0.073 | 0.5 | 0.5 | 0.043 | 1 | 0.014 | 1 | 0.011 |
| Year 8 | | 1 | | | | 0.15 | 1 | | | | 0.0211 | 1 | | 0.073 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 9 | | 0.25 | 0.75 | | | 0.057 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 10 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | 1 | 0.011 |
| Year 11 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 12 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 13 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | 1 | 0.014 | | |
| Year 14 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | 1 | 0.012 | | | | |
| Year 15 | | | 1 | | | 0.026 | | 1 | | | 0.0034 | | 1 | 0.012 | | | | | | | |
| Year 16 | | | 0.25 | 0.75 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 17 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 18 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 19 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 20 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 21 | | | | 1 | | 0.024 | | | 1 | | 0.0027 | | | | | | | | | | |
| Year 22 | | | | 1 | | 0.0235 | | | 1 | | 0.00275 | | | | | | | | | | |
| Year 23 | | | | 0.25 | 0.75 | 0.0078 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 24 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 25 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 26 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 27 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 28 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 29 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 30 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 31 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 32 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 33 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 34 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 35 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 36 | | | | | 1 | 0.0026 | | | | 1 | 0.00031 | | | | | | | | | | |
| Year 37 | | | | | 0.25 | 0.00065 | | | | | | | | | | | | | | | |

**Notes:**
1. Scenario 4 begins at the conclusion of Project construction when the Project is fully operational in 2027.
2. The exposure duration for all years is 1, as the health risk assessment is based on annual emissions. While the 3rd Trimester is only 3 months, the exposure duration for the first year is set to 1 since annual average concentrations are used to calculate risks.
3. Age bin 2-16 Years was selected to conservatively represent ages 9-16.
4. The Intake Factors have been multiplied by the Age Sensitivity Factors and weighted by the exposure duration for each age bin.
5. Intake Factors are based on exposure assumptions in Table 44.
6. Exposure for High School receptors is conservatively included in the 2-16 age bin.

**Abbreviations:**
IF - intake factor
$m^3$ - cubic meter
kg - kilogram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

**Table 59**
**Project Cancer Risk at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, California**

| **Source Category** | **Lifetime Excess Cancer Risk[1] (in a million)** | | | | | |
|---|---|---|---|---|---|---|
| | **Construction + Operations** | | | | **Operations Only** | |
| | **Unmitigated[2]** | | **Mitigated[2]** | | | |
| **Project Contribution** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** |
| | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 4** |
| Construction | 83 | 57 | 0 | 7.6 | -- | -- |
| Operational Generators | 1.6 | 0.99 | 7.3 | 0.99 | 7.3 | 1.8 |
| Operational Traffic | 1.1 | 0.89 | 0.19 | 0.89 | 0.19 | 1.6 |
| **Total Project Contribution** | **86** | **59** | **7.5** | **9.5** | **7.5** | **3.4** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (µg/m3)
   CF = Conversion Factor (mg/µg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

**Table 59**
**Project Cancer Risk at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, California**

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,215 | 575,500 | 575,275 | 575,500 | 575,275 | 575,500 |
| UTMy (m) | 4,148,075 | 4,147,960 | 4,148,145 | 4,147,960 | 4,148,145 | 4,147,960 |
| Receptor Height (m) | 4.8 | 1.8 | 22.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 60**
**Project Chronic Hazard Index at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, California**

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 0.23 | 0.11 | 8.8E-03 | 0.011 | -- | -- |
| Operational Generators | 4.0E-04 | 5.8E-04 | 3.9E-04 | 7.0E-04 | 8.8E-04 | 8.1E-04 |
| Operational Traffic | 2.1E-03 | 1.4E-03 | 2.3E-03 | 3.3E-03 | 6.0E-03 | 3.9E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.011** | **0.015** | **6.9E-03** | **4.7E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$

   Where:

   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)

   $C_i$ = Annual Average Air Concentration for Chemical "i" ($\mu g/m^3$)

   cREL = Chronic Reference Exposure Level ($\mu g/m^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

5. On-site and off-site MEIR locations are documented below:

## Table 60
## Project Chronic Hazard Index at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,245 | 575,400 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 61**
**Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, California**

| Source Category | $PM_{2.5}$ Concentration[1] ($\mu g/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 |
| Construction | 1.1 | 0.52 | 0.038 | 0.063 | -- | -- |
| Operational Generators | 2.0E-03 | 2.9E-03 | 2.2E-03 | 4.1E-03 | 4.4E-03 | 4.1E-03 |
| Operational Traffic | 0.040 | 0.030 | 0.092 | 0.12 | 0.11 | 0.12 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.13** | **0.18** | **0.11** | **0.12** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

   The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

   $C_i = E \times D_i$
   Where:
   C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)
   $D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($\mu g/m^3$)/(g/s)
   E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 61
## Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 62**
**Summary of Nearby Stationary Source Impacts at Project MEIR**
**Willow Village**
**Menlo Park, California**

**Off-Site MEIR**

| Facility ID (Plant Number)[1] | Facility Name[1] | Unscaled Values[2] | | | Distance from MEIR (ft) | | | Decay Type[2] | Decay Factor[2] | | | Scaled Values[2] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cancer Risk | Hazard Risk | $PM_{2.5}$ | Cancer Risk MEIR | Hazard Risk MEIR | $PM_{2.5}$ MEIR | | Cancer Risk MEIR | Hazard Risk MEIR | $PM_{2.5}$ MEIR | Cancer Risk | Hazard Risk | $PM_{2.5}$ |
| | | in a million | -- | μg/m³ | feet | | | | unitless | | | in a million | unitless | μg/m³ |
| 18066 | Menlo Business Park | 0.58 | 3.6 | 0 | 1,327 | 1,469 | 1,503 | Diesel ICE | 0 | 0 | 0 | 0 | 0 | 0 |
| 20079 | Pacific Biosciences | 1.5 | 0.057 | 0.54 | 1,759 | 1,339 | 1,520 | Diesel ICE | 0 | 0 | 0 | 0 | 0 | 0 |
| 21312 | West Bay Sanitary District | 0.033 | 0.0013 | 0 | 1,988 | 1,696 | 1,731 | Diesel ICE | 0 | 0 | 0 | 0 | 0 | 0 |
| 22664 | CS Bio Company | 0.13 | 0.0052 | 0 | 980 | 677 | 715 | Diesel ICE | 0.040 | 0.080 | 0.080 | 5.3E-03 | 4.2E-04 | 0 |
| 100092 | Chevron | 15 | 0.073 | 0 | 2,150 | 1,730 | 1,908 | Generic Decay | 0 | 0 | 0 | 0 | 0 | 0 |
| 108593 | United Parcel Service | 4.7 | 0.023 | 0 | 1,460 | 1,379 | 1,509 | Generic Decay | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | **Total:** | **5.3E-03** | **4.2E-04** | **0** |

**On-Site MEIR**

| Facility ID (Plant Number)[1] | Facility Name[1] | Unscaled Values[2] | | | Distance from MEIR (ft) | | | Decay Type[2] | Decay Factor[2] | | | Scaled Values[2] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cancer Risk | Hazard Risk | $PM_{2.5}$ | Cancer Risk MEIR | Hazard Risk MEIR | $PM_{2.5}$ MEIR | | Cancer Risk MEIR | Hazard Risk MEIR | $PM_{2.5}$ MEIR | Cancer Risk | Hazard Risk | $PM_{2.5}$ |
| | | in a million | -- | μg/m³ | feet | | | | unitless | | | in a million | unitless | μg/m³ |
| 18066 | Menlo Business Park | 0.58 | 3.6 | 0 | 1,773 | 1,923 | 1,822 | Diesel ICE | 0 | 0 | 0 | 0 | 0 | 0 |
| 20079 | Pacific Biosciences | 1.5 | 0.057 | 0.54 | 803 | 938 | 848 | Diesel ICE | 0.060 | 0.040 | 0.060 | 0.09 | 2.3E-03 | 0.033 |
| 21312 | West Bay Sanitary District | 0.033 | 0.0013 | 0 | 1,432 | 1,231 | 1,357 | Diesel ICE | 0 | 0 | 0 | 0 | 0 | 0 |
| 22664 | CS Bio Company | 0.13 | 0.0052 | 0 | 587 | 308 | 484 | Diesel ICE | 0.10 | 0.25 | 0.14 | 0.013 | 1.3E-03 | 0 |
| 100092 | Chevron | 15 | 0.073 | 0 | 1,195 | 1,308 | 1,234 | Generic Decay | 0 | 0 | 0 | 0 | 0 | 0 |
| 108593 | United Parcel Service | 4.7 | 0.023 | 0 | 1,444 | 1,676 | 1,525 | Generic Decay | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | **Total:** | **0.10** | **3.6E-03** | **0.033** |

**Notes:**

1. Consistent with BAAQMD guidance, Ramboll included all facilities within 1,000 feet of the Project boundary as per the BAAQMD Permitted Stationary Sources Risks and Hazards Map. Facility information was obtained from the Permitted Stationary Sources Risks and Hazards Map with additional details provided by BAAQMD.

2. Unscaled health risk values were estimated using facility emissions provided by BAAQMD and BAAQMD's Health Risk Calculator Tool. These values were scaled by distance using the diesel IC engines multiplier tool or the BAAQMD's generic distance decay curve, as indicated above. If a stationary source is located over 1,000 feet away from the MEIR, the decay factor is zero (i.e., the impact of the stationary source is zero at the MEIR).

**Abbreviations:**

IC - internal combustion
ICE - internal combustion engine
MEIR - maximally exposed individual receptor
μg/m³ - micrograms per cubic meters
$PM_{2.5}$ - particulate matter less than 2.5 micrometers in diameter

**References**


Bay Area Air Quality Management District (BAAQMD). 2020. Permitted Sources Risk and Hazards Map. June. Available at: https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65

Bay Area Air Quality Management District (BAAQMD). 2020. Health Risk Calculator Beta 4.0. March. Available at: https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/tools/baaqmd-health-risk-calculator-beta-4-0-xlsx.xlsx?la=en&rev=dab7d85a772d45caa9c99e59395bf12d

**Table 63**
**Background Traffic Volumes**
**Willow Village**
**Menlo Park, California**

| Source Group Name | Distance (m) | San Mateo Default Fleet | |
|---|---|---|---|
| | | Volume (vehicles/day) | VMT (mi/day) |
| OBRIEN01 | 320 | 14,729 | 2,929 |
| OBRIEN02 | 138 | 14,729 | 1,265 |
| OBRIEN03 | 35 | 14,729 | 324 |
| OBRIEN04 | 29 | 14,729 | 266 |
| OBRIEN05 | 28 | 14,729 | 259 |
| OBRIEN06 | 52 | 14,729 | 476 |
| OBRIEN07 | 43 | 14,729 | 394 |
| OBRIEN08 | 20 | 14,729 | 186 |
| OBRIEN09 | 20 | 14,729 | 182 |
| OBRIEN10 | 21 | 14,729 | 191 |
| OBRIEN11 | 44 | 14,729 | 403 |
| OBRIEN12 | 102 | 14,729 | 930 |
| OBRIEN13 | 32 | 14,729 | 290 |
| OBRIEN14 | 112 | 14,729 | 1,026 |
| OBRIEN15 | 242 | 14,729 | 2,211 |
| OBRIEN16 | 48 | 14,729 | 438 |
| OBRIEN17 | 54 | 14,729 | 493 |

**Notes:**

1. The background traffic volumes were provided by Hexagon in the data request received in October 2021.
2. Modeled roadway segments are shown in Figures 7.

**Abbreviations:**

VMT - Vehicle Miles Traveled

m - meter

mi - mile

**Table 64**
**Summary of Cumulative Impacts at Project MEIR**
**Willow Village**
**Menlo Park, California**

| **Nearby Sources[1]** | **Offsite MEIR** | | | **Onsite MEIR** | | |
|---|---|---|---|---|---|---|
| | **Excess Lifetime Cancer Risk** | **Noncancer Chronic HI** | **$PM_{2.5}$ Concentration** | **Excess Lifetime Cancer Risk** | **Noncancer Chronic HI** | **$PM_{2.5}$ Concentration** |
| | (in a million) | (unitless) | ($\mu g/m^3$) | (in a million) | (unitless) | ($\mu g/m^3$) |
| Existing Stationary Sources[2] | 5.3E-03 | 4.2E-04 | 0.0 | 0.10 | 3.6E-03 | 0.033 |
| Roadways[3] | 1.3 | 8.5E-04 | 0.20 | 0.043 | 2.3E-04 | 7.6E-03 |
| Highways[4] | 8.0 | -- | 0.21 | 8.9 | -- | 0.19 |
| Major Streets[4,5] | 2.1 | -- | 0.086 | 3.5 | -- | 0.077 |
| Railways[4] | 2.5 | -- | 4.6E-03 | 2.4 | -- | 4.6E-03 |
| Project Construction | 7.6 | 0.011 | 0.063 | 0.0 | 8.8E-03 | 0.038 |
| Project Operational Generators | 0.99 | 7.0E-04 | 4.1E-03 | 7.3 | 3.9E-04 | 2.2E-03 |
| Project Operational Traffic | 0.89 | 3.3E-03 | 0.12 | 0.19 | 2.3E-03 | 0.092 |
| **Total** | **23** | **0.016** | **0.69** | **22** | **0.015** | **0.44** |
| **BAAQMD Threshold** | **100** | **10** | **0.80** | **100** | **10** | **0.80** |

**Notes:**

1. Details for existing stationary sources are shown in the preceeding table. If the cell is marked with "--", no risk was calculated. For roadways, highways, major streets, and railways, chronic HI is not calculated in the BAAQMD screening tools.

2. Consistent with BAAQMD guidance, Ramboll included all facilities within 1,000 feet of the Project boundary as per the BAAQMD Permitted Stationary Sources Risks and Hazards Map. Facility information was obtained from the Permitted Stationary Sources Risks and Hazards Map with additional details provided by BAAQMD. Values have been adjusted accordingly for distance from the MEIRs using BAAQMD guidance.

3. BAAQMD recommends evaluating roadways in the area where existing traffic is over 10,000 vehicles per day and under 30,000 vehicles per day, which is the limit for roadways to consider in their raster tool. Hexagon provided background trip volumes for nearby roadways with volumes between 10,000 and 30,000 vehicles per day. Of the roadways with background traffic in this range, only O'Brien Drive was located within the zone of influence. The impacts associated with background traffic on O'Brien Drive were quantified and included in the cumulative analysis.

4. Nearby major streets, highway, and railway cancer and $PM_{2.5}$ impacts were taken from BAAQMD raster files for the Project area. The BAAQMD's raster screening tools do not estimate chronic hazards since the screening levels were found to be extremely low. Thus, there are no chronic hazard values associated with highways, railways, or major streets.

5. Major streets, as evaluated in the BAAQMD raster screening tools, include all streets with average daily traffic above 30,000 vehicles per day.

**Abbreviations:**

µg - microgram
HI - hazard index
$m^3$ - cubic meter
MEIR - maximum exposed individual receptor
$PM_{2.5}$ - fine particulate matter less than 2.5 micrometers in diameter

**References**


Bay Area Air Quality Management District (BAAQMD). 2020. Permitted Sources Risk and Hazards Map. June. Available at: https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65

City of Menlo Park. Traffic volume data. Available at: https://www.menlopark.org/1543/Traffic-volume-data


RAMBOLL

# FIGURES

PROJECT: 1690010687-004| DATED: 9/15/2021 | DESIGNER: MMCCARTHY

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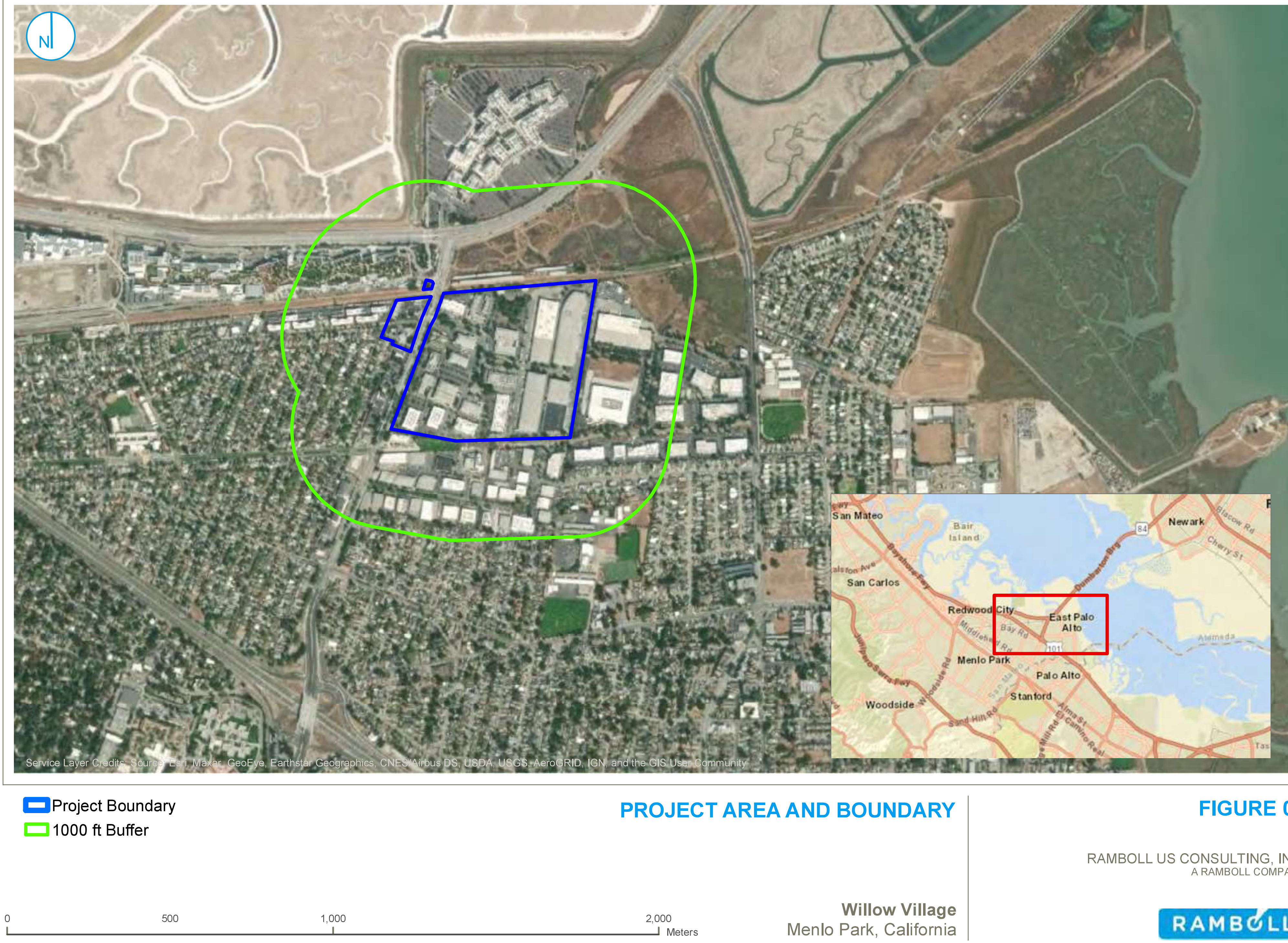



Project Boundary

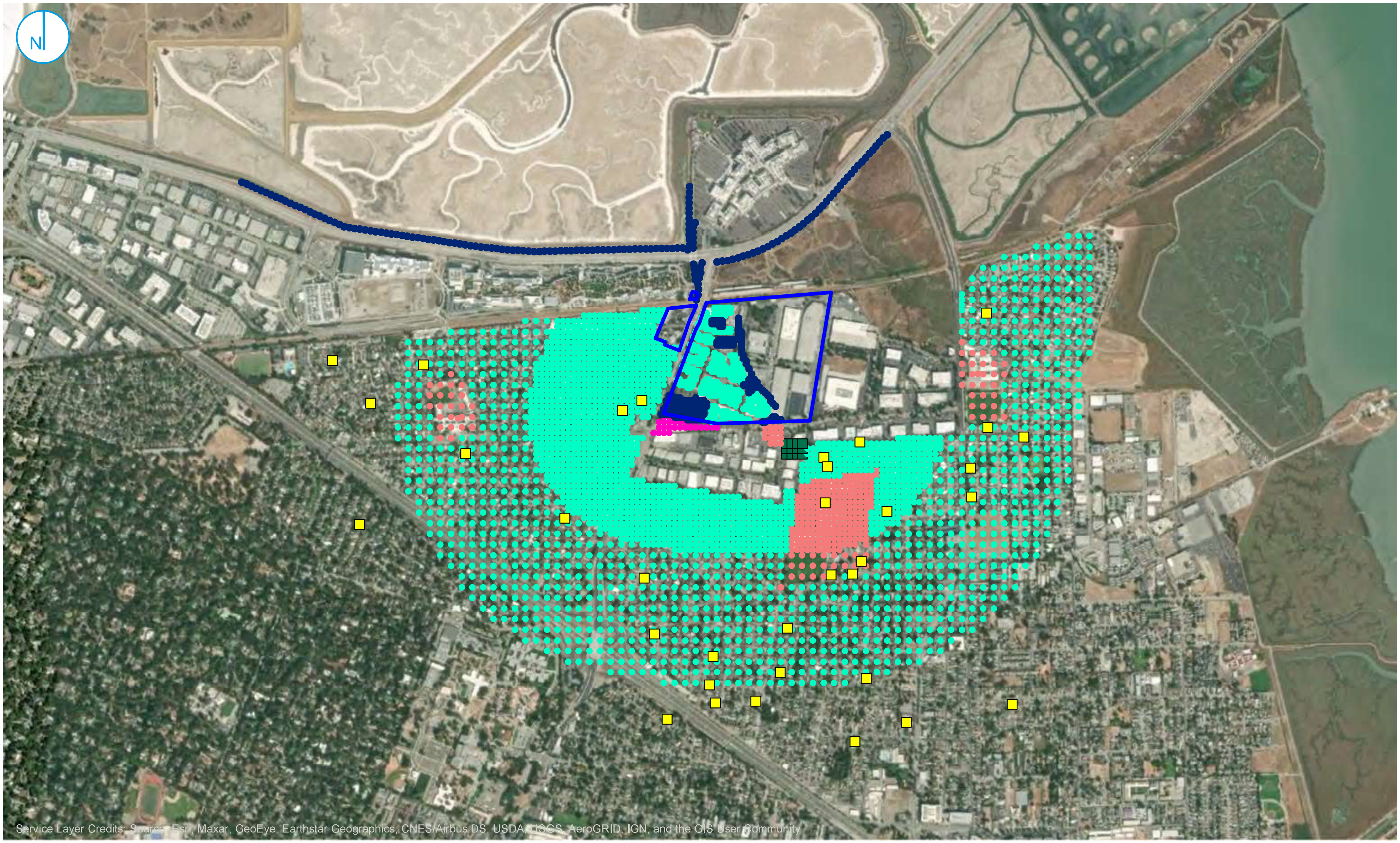
1000 ft Buffer

## PROJECT AREA AND BOUNDARY

**Willow Village**
Menlo Park, California

## FIGURE 01

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

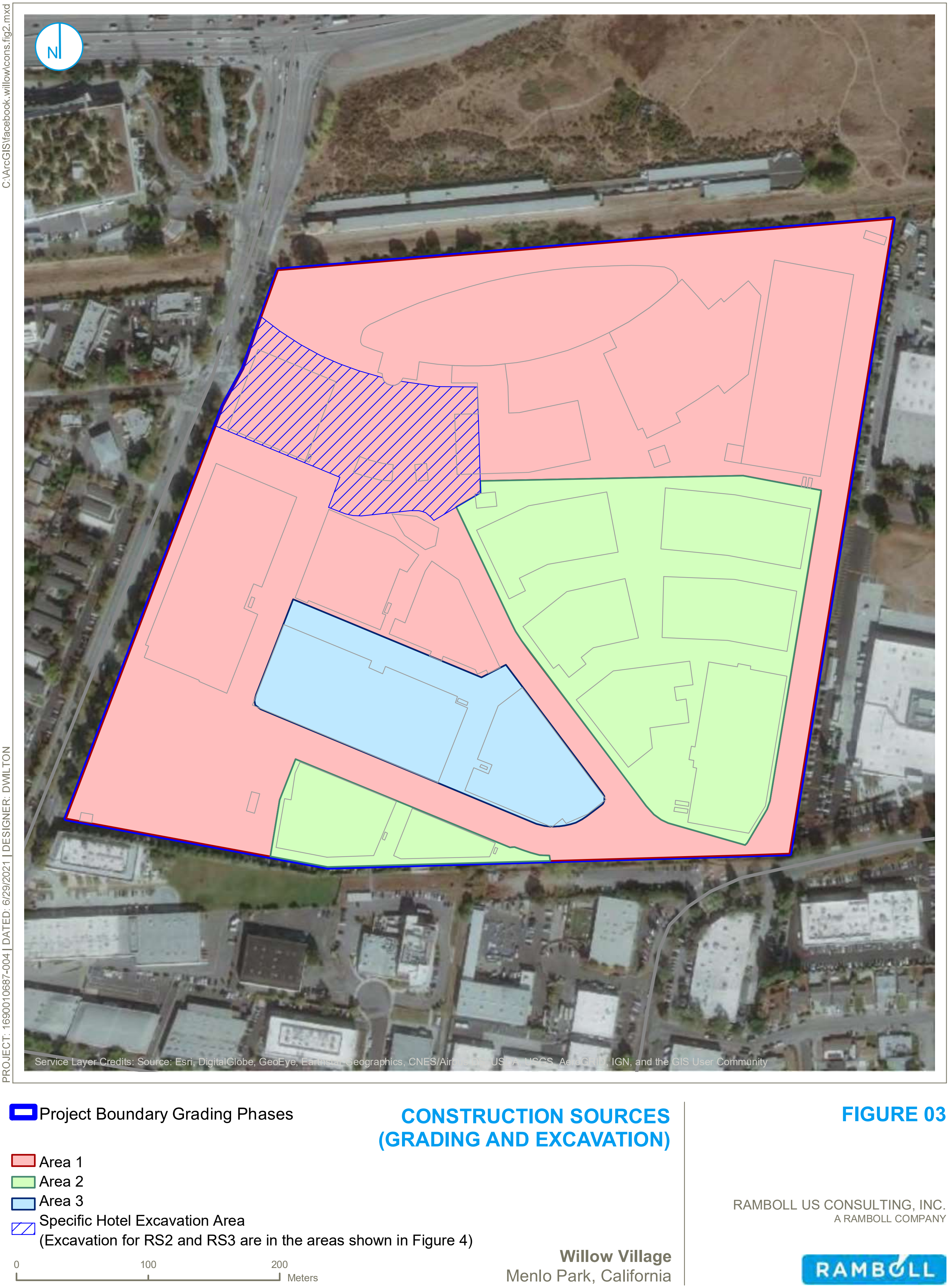



## MODELED RECEPTOR LOCATIONS

**Willow Village**
Menlo Park, California

## FIGURE 02

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

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PROJECT: 1690010687-004 | DATED: 6/29/2021 | DESIGNER: DWILTON

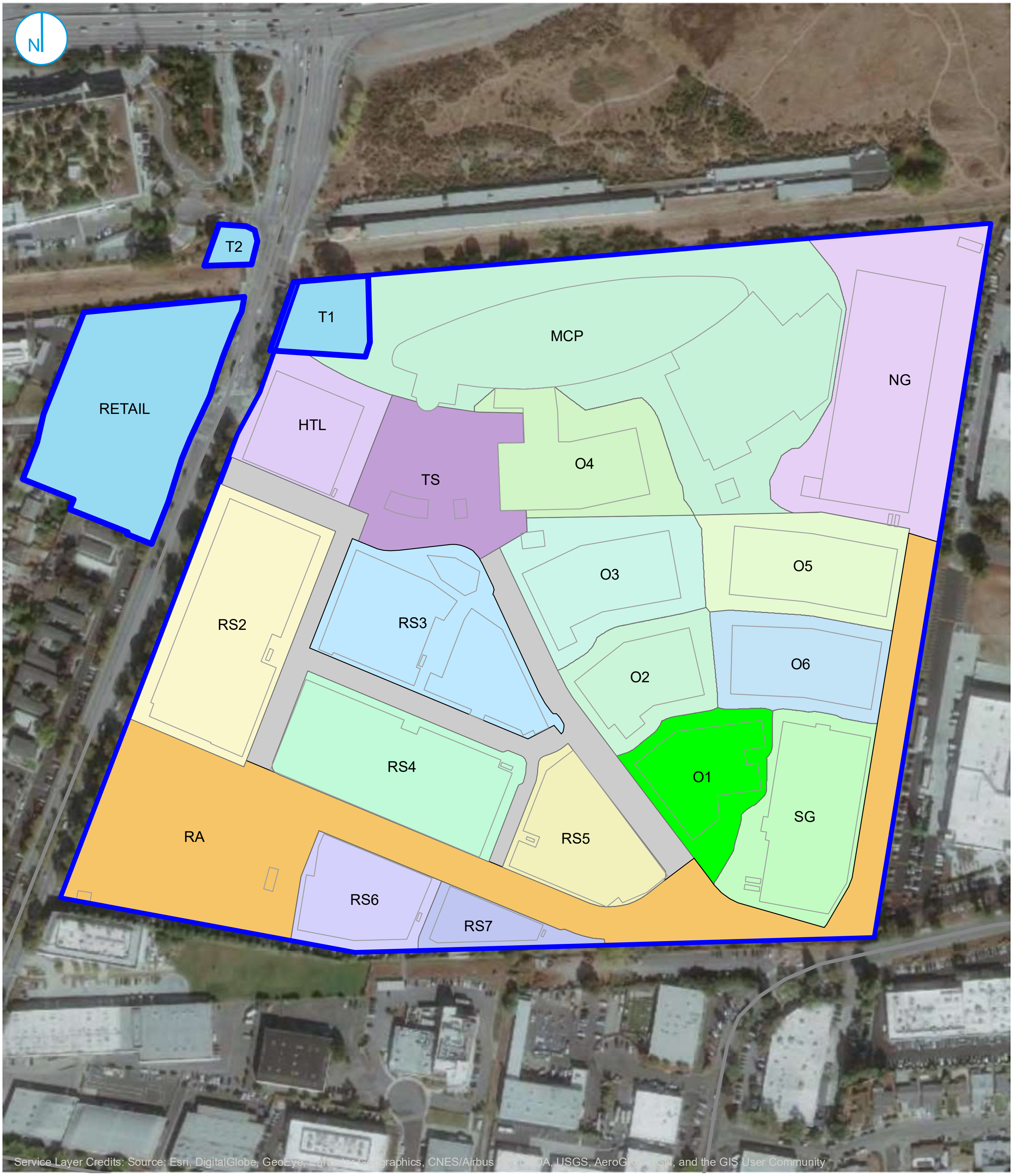
**CONSTRUCTION SOURCES (GRADING AND EXCAVATION)**

**Willow Village**
Menlo Park, California

**FIGURE 03**

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

RAMBOLL




PROJECT: 1690010687-004 | DATED: 6/29/2021 | DESIGNER: DWILTON

Project Boundary

Buildings & Structures

Area source abbreviations are defined in Table 46 of the report.

0 100 200 Meters

## CONSTRUCTION SOURCES

**Willow Village**
Menlo Park, California

## FIGURE 04

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY


PROJECT: 169000XXXX | DATED: 6/29/2021 | DESIGNER: DWILTON

Project Boundary
Haul Roads

0 250 500 Meters

# CONSTRUCTION SOURCES HAUL ROADS

**FIGURE 05**

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

**Willow Village**
Menlo Park, California

RAMBOLL


PROJECT: 169000XXXX | DATED: 6/17/2022 | DESIGNER: SBISOGNO C:\Users\sbisogno\OneDrive - Ramboll\Documents\Facebook Willow Village\Pumping Station\Pumping Station\Pumping Station.aprx\Ramboll_ANSI_A_Portrait

PMP Location 1

PMP Location 2

Generator Locations

Project Buildings

## GENERATOR LOCATIONS

## FIGURE 6a

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

**Willow Village**
Menlo Park, California

RAMBOLL

PROJECT: 1690010687-004 | DATED: 11/11/2021 | DESIGNER: SBISOGNO

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Project Boundary

1000 ft Buffer

Onsite Vehicle Routes

0 500 1,000 Meters

## MODELED ONSITE TRAFFIC ROUTES

**Willow Village**
Menlo Park, California

## FIGURE 6b

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

PROJECT: 1690010687-004 | DATED: 11/11/2021 | DESIGNER: SBISOGNO

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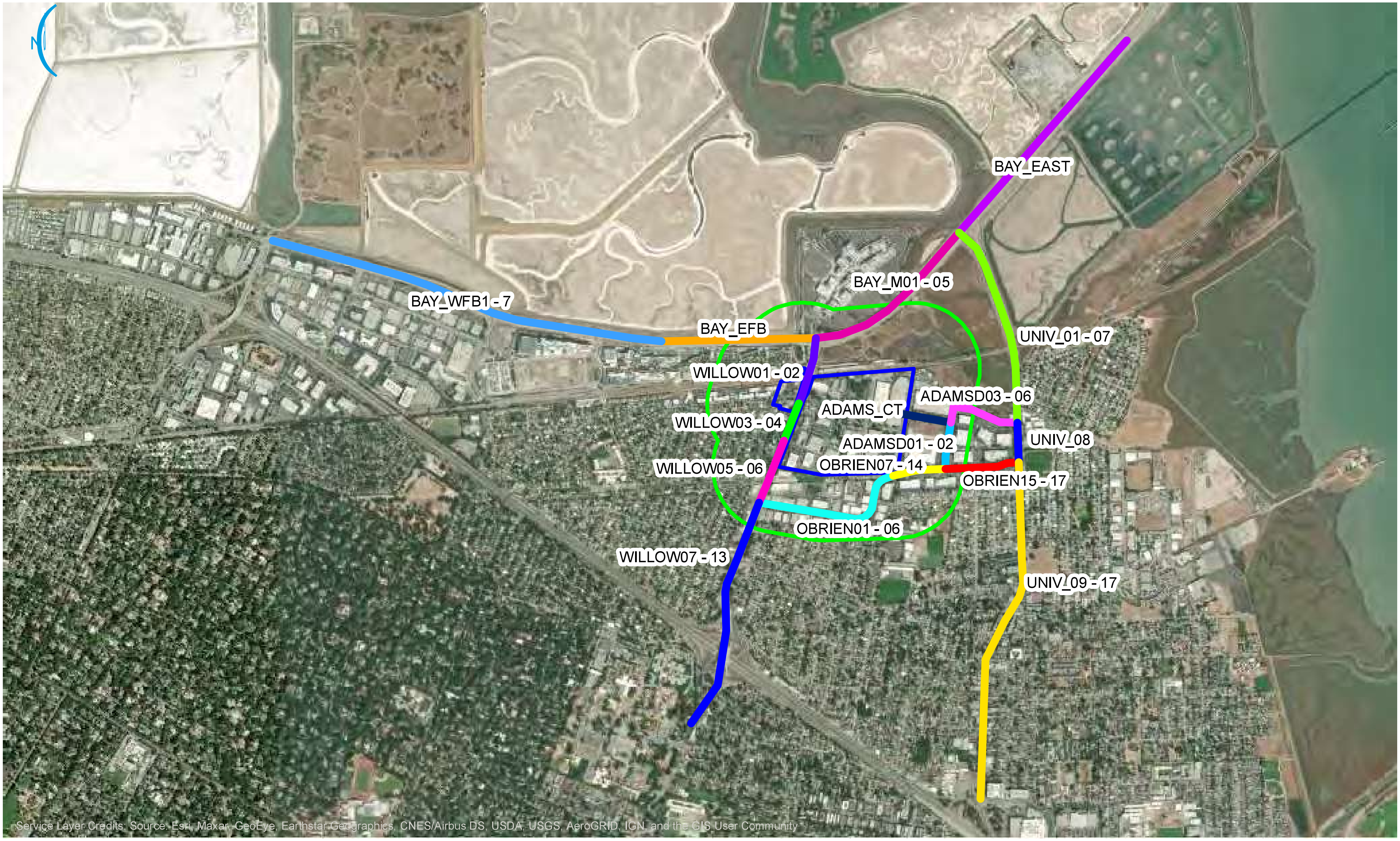



Project Boundary
1000 ft Buffer

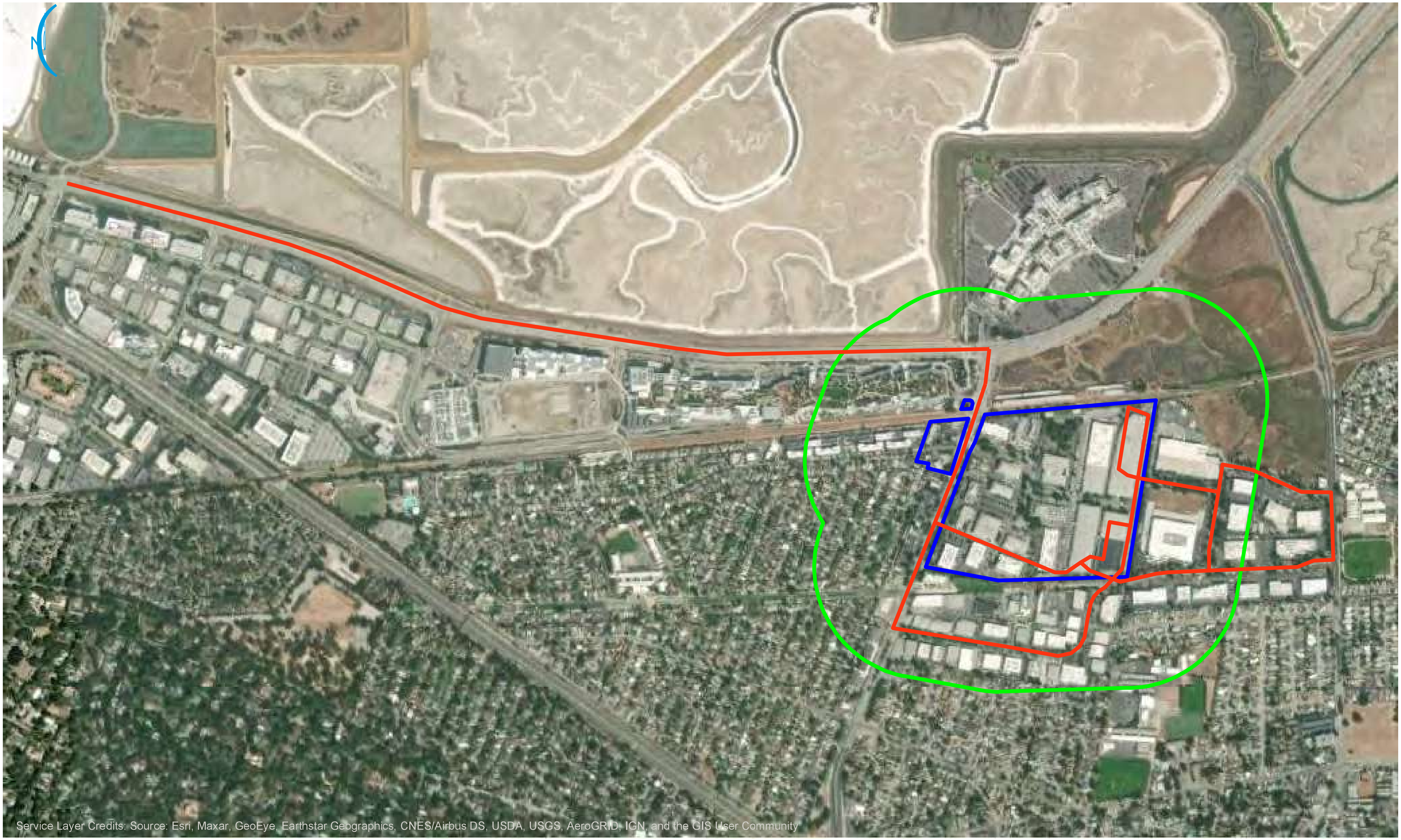
0 500 1,000 Meters

# MODELED OFFSITE TRAFFIC ROUTES

**Willow Village**
Menlo Park, California

**FIGURE 07**

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY




Shuttles
Project Boundary
1000 ft Buffer

0 500 1,000 Meters

# MODELED SHUTTLE ROUTES

**Willow Village**
Menlo Park, California

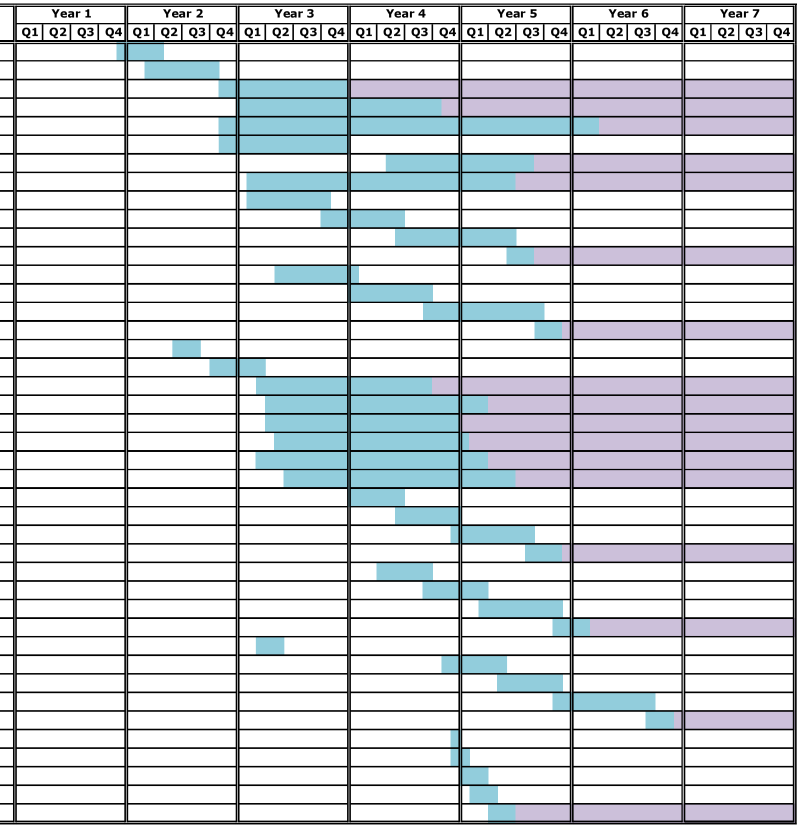
## FIGURE 08

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

**Figure 9**

**Exposure Scenarios**
**Willow Village**
**Menlo Park, CA**

| Area | Subphase | Construction Schedule: Start Month | Construction Schedule: End Month | Number of Days | Operational Year |
|---|---|---|---|---|---|
| Area 1 | Demolition | Month 1 | Month 5 | 97 | -- |
| | Grading and Utilities | Month 4 | Month 11 | 143 | -- |
| Area 1 Campus District | North Garage | Month 12 | Month 25 | 300 | Year 3 |
| | Office Building 4 | Month 14 | Month 35 | 449 | Year 4 |
| | Meeting, Collaboration, Park | Month 12 | Month 52 | 871 | Year 6 |
| | Hotel Excavation | Month 12 | Month 25 | 299 | -- |
| | Hotel Construction | Month 30 | Month 45 | 329 | Year 5 |
| | Town Square | Month 15 | Month 43 | 610 | Year 5 |
| Area 1 Town Square and Residential/Shopping District | Parcel 2 Foundations | Month 15 | Month 23 | 161 | -- |
| | Parcel 2 Core and Shell | Month 23 | Month 31 | 180 | -- |
| | Parcel 2 Tenant Improvements | Month 31 | Month 43 | 261 | -- |
| | Parcel 2 Landscaping | Month 43 | Month 45 | 59 | Year 5 |
| | Parcel 3 Foundations | Month 18 | Month 26 | 161 | -- |
| | Parcel 3 Core and Shell | Month 26 | Month 34 | 180 | -- |
| | Parcel 3 Tenant Improvements | Month 34 | Month 46 | 260 | -- |
| | Parcel 3 Landscaping | Month 46 | Month 48 | 58 | Year 5 |
| Area 2 | Demolition | Month 7 | Month 9 | 48 | -- |
| | Grading and Utilities | Month 11 | Month 16 | 130 | -- |
| Area 2 Campus District | South Garage | Month 16 | Month 34 | 390 | Year 4 |
| | Office Building 3 | Month 17 | Month 40 | 501 | Year 5 |
| | Office Building 1 | Month 17 | Month 37 | 428 | Year 4 |
| | Office Building 2 | Month 18 | Month 38 | 426 | Year 5 |
| | Office Building 5 | Month 16 | Month 40 | 521 | Year 5 |
| | Office Building 6 | Month 19 | Month 43 | 520 | Year 5 |
| Area 2 Town Square and Residential/Shopping District | Parcel 7 Foundations | Month 26 | Month 31 | 116 | -- |
| | Parcel 7 Core and Shell | Month 31 | Month 37 | 129 | -- |
| | Parcel 7 Tenant Improvements | Month 37 | Month 45 | 188 | -- |
| | Parcel 7 Landscaping | Month 45 | Month 48 | 58 | Year 5 |
| | Parcel 6 Foundations | Month 29 | Month 34 | 116 | -- |
| | Parcel 6 Core and Shell | Month 34 | Month 40 | 129 | -- |
| | Parcel 6 Tenant Improvements | Month 40 | Month 48 | 187 | -- |
| | Parcel 6 Landscaping | Month 48 | Month 51 | 59 | Year 6 |
| Area 3 | Grading and Utilities | Month 16 | Month 18 | 22 | -- |
| | Foundations | Month 36 | Month 42 | 123 | -- |
| | Core & Shell | Month 42 | Month 48 | 139 | -- |
| | Tenant Improvements | Month 48 | Month 58 | 199 | -- |
| | Landscaping | Month 58 | Month 60 | 59 | Year 6 |
| Hamilton Avenue Parcels North and South | Demolition | Month 37 | Month 37 | 22 | -- |
| | Grading and Utilities | Month 37 | Month 38 | 23 | -- |
| | Foundations | Month 38 | Month 40 | 22 | -- |
| | Core & Shell | Month 40 | Month 41 | 43 | -- |
| | Tenant Improvements | Month 41 | Month 43 | 33 | Year 5 |




**Key:**

Active Construction Period

Full Operation

**Age bins:**

3rd trimester

0-2 years

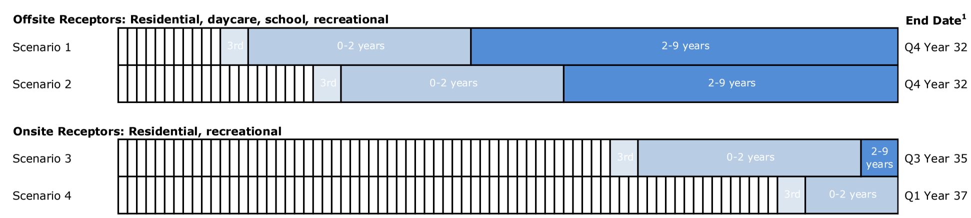
2-9 years

2-16 years

16-30 years

**Offsite Receptors: Residential, daycare, school, recreational**

**Onsite Receptors: Residential, recreational**




**Notes:**
[1] Additional details on exposure scenarios are presented in AQTR Tables 55 through 58.

# APPENDIX A
# CONSISTENCY WITH APPLICABLE AIR PLANS

# CEQA ANALYSIS
# CONFLICT WITH OR OBSTRUCT IMPLEMENTATION OF THE APPLICABLE AIR QUALITY PLAN

## WILLOW VILLAGE

## MENLO PARK, CALIFORNIA

San Mateo County is currently designated a nonattainment area for the federal ozone standard, a maintenance area for the federal CO standard, and nonattainment for state ozone, $PM_{10}$, and $PM_{2.5}$ standards. The most recently adopted regional air quality plan is the Bay Area Air Quality Management District (BAAQMD) 2017 Clean Air Plan, which includes all feasible measures to reduce emissions of $NO_X$ and ROG, which are ozone precursors, reduce transport of ozone and its precursors, and reduce emissions of fine particulate matter and toxic air contaminants. The Plan focuses on protecting public health and the climate. The Plan is established pursuant to air quality panning requirements defined in the California Health and Safety Code.

In determining consistency with the Clean Air Plan, this analysis considers whether the Project would (1) support the primary goals of the Clean Air Plan, (2) include applicable control measures from the Clean Air Plan, and (3) avoid disrupting or hindering implementation of control measures identified in the Clean Air Plan.

The 2017 Clean Air Plan defines a control strategy based on reducing emissions from all key sources, reducing "super-GHGs",[1] decreasing demand for fossil fuels, and decarbonizing the energy system. The control strategy contains 85 control measures that are specific actions to reduce air pollutants and GHGs in the San Francisco Bay Area Air Basin. These control strategies are grouped into the following categories:

- Stationary source measures;
- Transportation control measures;
- Energy control measures;
- Building control measures;
- Agricultural control measures;
- Natural and working lands control measures;
- Waste management control measures;
- Water control measures; and
- Super-GHG control measures

Many of the 85 control measures are beyond the scope and control of the Project. Some address stationary sources and will be implemented by BAAQMD using its permit authority and therefore are not suited to implementation through local planning efforts or project approval actions. The Clean Air Plan measures potentially applicable to the Project are listed below along with how the Project would be consistent with the measures. The measures are largely directed at BAAQMD action. The summary below describes how Project features would support the BAAQMD's implementation of the measures.

[1] "Super-GHGs" are defined in the Clean Air Plan as methane, black carbon, and fluorinated gases.

**Table 1. Consistency of Project with CAP Community Strategies**

| Measure | Measure Description[2] | Project Consistency |
|---|---|---|
| TR1 - Clean Air Teleworking Initiative | Develop teleworking best practices for employers and develop additional strategies to promote telecommuting. Promote teleworking on Spare the Air Days. | **Supporting.** Many of the Project's employees have the ability to telecommute and the Project promotes commuting by non-single-occupancy vehicles through its TDM (see below). |
| TR2 - Trip Reduction Programs | Implement the regional Commuter Benefits Program (Rule 14-1) that requires employers with 50 or more Bay Area employees to provide commuter benefits. Encourage trip reduction policies and programs in local plans, e.g., general and specific plans while providing grants to support trip reduction efforts. Encourage local governments to require mitigation of vehicle travel as part of new development approval, to adopt transit benefits ordinances in order to reduce transit costs to employees, and to develop innovative ways to encourage rideshare, transit, cycling, and walking for work trips. Fund various employer-based trip reduction programs. | **Supporting.** The Project would implement Transportation Demand Management (TDM) programs for the Campus District, Town Square District, and Residential/Shopping District. The Project's TDM programs may include, but is not limited to, the following measures:<br>• Improve biking/walking network<br>• Provide bicycle amenities<br>• Improve public transit service<br>• Car share program<br>• Tram service<br>• Commuter shuttles<br>• Parking management<br>• Emergency ride-home program<br>• Carpool and vanpool programs<br>• Commute assistance center<br>• On-site housing<br>The Project would include a commuter shuttle service for Campus District workers and a Campus District trip cap. |
| TR5 - Transit Efficiency and Use | Improve transit efficiency and make transit more convenient for riders through continued operation of 511 Transit, full implementation of Clipper® fare payment system and the Transit Hub Signage Program. | **Supporting**. While the explicit requirements of this measure are outside the control of the Project, the Project would be making improvements to intersections, bike lanes and pedestrian connections that will upgrade infrastructure that will benefit roadways, pedestrian and bicycle circulation systems, which will benefit transit efficiency. |
| TR8 - Ridesharing | Promote carpooling and vanpooling by providing funding to continue regional and local ridesharing programs, and support the expansion of carsharing programs. Provide incentive funding for pilot | **Supporting.** The proposed Project would implement trip reduction programs as part of the TDM programs that may include, but is not limited to, carpool and vanpool programs, tram service, and commuter shuttles. |

[2] Bay Area Air Quality Management District, 2017. Spare the Air Cool the Climate: Final 2017 Clean Air Plan. Available at: https://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf

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| | projects to evaluate the feasibility and cost-effectiveness of innovative ridesharing and other last-mile solution trip reduction strategies. Encourage employers to promote ridesharing and carsharing to their employees. | |
| TR9 - Bicycle and Pedestrian Access and Facilities | Encourage planning for bicycle and pedestrian facilities in local plans, e.g., general and specific plans, fund bike lanes, routes, paths and bicycle parking facilities. | **Supporting.** The Project promotes walking, biking, and other sustainable transportation through approximately two miles of dedicated pedestrian walks, one mile of bicycle paths and lanes, and a two-acre elevated park that provides safe and convenient access to Willow Village while relieving traffic circulation on the road below. The elevated park would connect the Project Site to the adjacent Belle Haven neighborhood via an overpass at Willow Road with bicycle and pedestrian access from Hamilton Avenue Parcel North. The Project would create a bicycle- and pedestrian-friendly environment that enhances connectivity between the Project Site and surrounding areas. The Project would also include the addition of the Willow Tunnel, which would provide pedestrian and bicycle access to the Bay Trail via a separate path, reducing the use of surface streets. The Project provides a connection from existing pedestrian and bicycle paths to the Bay Trail.<br>Safety lighting for vehicles and pedestrians would be provided. Passenger loading and building servicing would be designed to minimize conflicts between pedestrians and vehicles. |
| TR10 - Land Use Strategies | Support implementation of Plan Bay Area, maintain and disseminate information on current climate action plans and other local best practices, and collaborate with regional partners to identify innovative funding mechanisms to help local governments address air quality and climate change in their general plans. | **Supporting.** The Project consists of a dense, walkable, mixed-used development that balances jobs and housing while considering safety, traffic, retail amenities, and other community needs. The Project would be designed to meet LEED Gold standards or equivalent, and implements features that reduce air pollutant and greenhouse gas emissions, such as extensive TDM program, electrification of buildings, besides culinary, and purchase of 100% carbon-free electricity. More discussion on the Project's consistency with Plan Bay Area can be found in Appendix B. |
| TR13 - Parking Policies | Encourage parking policies and programs in local plans, e.g., reduce minimum parking requirements; limit the supply of off-street parking in transit-oriented areas; unbundle the price of parking spaces; support implementation of demand-based pricing (such as "SF Park") in high-traffic areas. | **Supporting.** The Project would limit parking below permitted City code maximum and would include shared parking. The Project also proposes a reduced parking ratio for senior housing. The price of parking spaces would be unbundled for market-rate housing. |
| TR14 - Cars and Light Trucks | Commit regional clean air funds toward qualifying vehicle purchases and infrastructure development. Partner with private, local, state and federal | **Supporting.** The Project would offer an advanced EV charging program to Campus District employees. Electric vehicle (EV) charging in the Campus District is free and valets move cars into chargers to maximize charging time. |

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| | programs to promote the purchase and lease of battery-electric and plug-in hybrid electric vehicles. | The proposed Project would also install EV charging stations in the Residential/Shopping District and Town Square District. |
| TR22 - Construction, Freight and Farming Equipment | Provide incentives for the early deployment of electric, Tier 3 and 4 off-road engines used in construction, freight and farming equipment. Support field demonstrations of advanced technology for off-road engines and hybrid drive trains. | **Supporting**. The majority of the construction equipment used during the construction of the Project would have Tier 4 engines. |
| EN1 - Decarbonize Electricity Production | Engage with PG&E, municipal electric utilities and CCEs to maximize the amount of renewable energy contributing to the production of electricity within the Bay Area as well as electricity imported into the region. Work with local governments to implement local renewable energy programs. Engage with stakeholders including dairy farms, forest managers, water treatment facilities, food processors, public works agencies and waste management to increase use of biomass in electricity production. | **Supporting.** The Project would install solar photovoltaic that would be designed to produce approximately 3,900,000 kWh per year of renewable electricity. The Project would purchase 100% carbon free electricity for the Campus District and any non-carbon free power used in the Residential/Shopping and Town Square Districts would be offset by the solar produced onsite. |
| BL1 - Green Buildings | Collaborate with partners such as KyotoUSA to identify energy-related improvements and opportunities for onsite renewable energy systems in school districts; investigate funding strategies to implement upgrades. Identify barriers to effective local implementation of the CALGreen (Title 24) statewide building energy code; develop solutions to improve implementation/enforcement. Work with ABAG's BayREN program to make additional funding available for energy-related projects in the buildings sector. Engage with additional partners to target reducing emissions from specific types of buildings. | **Supporting**. This action is directed at the Air District. However, the Project incorporates the goals associated with this measure. The Project would comply with building energy code and would be designed to meet LEED Gold standards or equivalent. |
| BL2 - Decarbonize Buildings | Explore potential Air District rulemaking options regarding the sale of fossil fuel-based space and water heating systems for both residential and commercial use. Explore incentives for property owners to replace their furnace, water heater or natural-gas powered appliances with zero-carbon alternatives. Update Air District guidance documents to recommend that commercial and multi-family | **Supporting**. This action is directed at the Air District. However, the Project incorporates the goals associated with this measure. The Project would be entirely electrically powered with the exception of commercial culinary uses, which supports the decarbonization of buildings. |

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| | developments install ground source heat pumps and solar hot water heaters. | |
| BL4 - Urban Heat Island Mitigation | Develop and urge adoption of a model ordinance for "cool parking" that promotes the use of cool surface treatments for new parking facilities, as well existing surface lots undergoing resurfacing. Develop and promote adoption of model building code requirements for new construction or re-roofing/roofing upgrades for commercial and residential multi-family housing. Collaborate with expert partners to perform outreach to cities and counties to make them aware of cool roofing and cool paving techniques, and of new tools available. | **Supporting**. The Project would include cool roofs and may include cool parking. The Project would demolish existing parking lots and would provide parks and vegetation lined roadways. Surface parking would largely be replaced by parking structures with solar ready rooftops. |
| NW2 - Urban Tree Planting | Develop or identify an existing model municipal tree planting ordinance and encourage local governments to adopt such an ordinance. Include tree planting recommendations the Air District's technical guidance, best practices for local plans and CEQA review. | **Supporting.** The Project would install approximately 700 new trees in the streets, parks and planned open spaces. Trees would be on average a 36" box or greater at the time of installation. |
| WA3 - Green Waste Diversion | Develop model policies to facilitate local adoption of ordinances and programs to reduce the amount of green waste going to landfills. | **Supporting**. The Project would implement a waste reduction strategy in the Campus District that has shown to divert over 80 percent of waste in existing campuses. |
| WA4 - Recycle and Waste Reduction | Develop or identify and promote model ordinances on community-wide zero waste goals and recycling of construction and demolition materials in commercial and public construction projects. | |
| WR2 - Support Water Conservation | Develop a list of best practices that reduce water consumption and increase on-site water recycling in new and existing buildings; incorporate into local planning guidance. | **Supporting**. The Project would be designed to meet LEED Gold standards or equivalent and would implement features that reduce water consumption. The Project would also utilize recycled water.<br><br>The source of recycled water for Willow Village is West Bay Sanitary District's Bayfront Recycled Water Plant that is anticipated to generate recycled water to accommodate existing and future development within Menlo Park's Bayfront District. In the event that West Bay Sanitary District is unable to advance the Bayfront Recycled Water Plant, as an alternative the project proposes on-site recycled water facilities consisting of four plants; one serving the office district, one serving the town square district and two |

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| | | serving the residential/shopping district. Combined the four on-site plants would meet the peak non-potable water demands for the project. |

The Project would meet community needs through planned local retail spaces, restaurants, a grocery store and pharmacy, as well as publicly accessible parks and planned open spaces. Construction phasing prioritizes amenities that serve the community, such as the grocery store and the park, which will serve to reduce VMT, particularly since the existing community is underserved with respect to grocery stores and pharmacies.

In addition, as discussed in the Transportation Impact Study, the TDM programs would meet City of Menlo Park Municipal Code requirements. The Project would also add new retail and a grocery store and pharmacy to an area that lacks these resources. The TDM programs would reduce traffic in the area, but also reduce emissions of criteria air pollutants and toxic air contaminants locally.

The Project plan includes these numerous design and operational measures to promote sustainability and environmental stewardship, which would act to reduce Project-related area and mobile source emissions. By implementing these measures while also considering community needs, the Project supports the goals of the Clean Air Plan and is consistent with applicable control measures from the plan. As discussed above, the Project includes many applicable control measures in its plan, as summarized in Table 1 above.

# APPENDIX B
# CONSISTENCY WITH GREENHOUSE GAS PLANS

# CEQA ANALYSIS
# CONFLICT WITH APPLICABLE PLANS, POLICIES OR REGULATIONS ADOPTED FOR THE PURPOSE OF REDUCING THE EMISSIONS OF GREENHOUSE GASES

## WILLOW VILLAGE

## MENLO PARK, CALIFORNIA

There are local, regional, and state policies, plans and regulations aimed at reducing emissions of greenhouse gases. The Project's consistency with the City of Menlo Park Climate Action Plan (CAP), along with SB 743, Plan Bay Area 2040, Plan Bay Area 2050, Advanced Clean Cars Initiative and the State's Zero-Emission Vehicles Mandate, and CARB's 2017 Scoping Plan Update is reviewed. Final Plan Bay Area 2050 was approved on October 21, 2021, but consistency with both Plan Bay Area 2040 and Plan Bay Area 2050 are presented to be conservative.

The City of Menlo Park CAP has been adopted for the purposes of reducing GHG emissions locally. Although not legislatively adopted, Executive Order S-03-05 establishes a long-term statewide goal to reduce GHG emissions to 80 percent below 1990 levels by 2050. SB 743 was passed to reduce greenhouse gas emissions and promote multi-modal transportation networks, providing clean, efficient access to destinations and improving public heath through active transportation. Plan Bay Area has been adopted to establish targets and strategies intended to meet the region's needs for housing at all income levels, while reducing GHGs associated with private passenger and light duty truck traffic. The Advanced Clean Cars Initiative and the State's Zero-Emission Vehicles Mandate were established to set a target of reaching 1.5 million ZEVs (meaning battery electric vehicles and fuel cell electric vehicles) and plug-in hybrid electric vehicles on California's roadways by 2025. CARB's 2017 Scoping Plan outlines the main strategies for California to achieve the legislated GHG emissions target for 2030 and "substantially advance toward our 2050 climate goals." It identifies the reductions needed by each GHG emissions sector (e.g., industry, transportation, electricity generation).

**Consistency with City of Menlo Park Climate Action Plan**

As discussed above, the City of Menlo Park adopted a CAP in 2009 to reduce municipal government and community GHG emissions. In July 2020, the City released a report[1] that updated the CAP with emissions for the years 2005 and 2017 and forecasted emissions to 2030. The 2030 Climate Action Plan provided a list of CAP projects intended to achieve a goal of "zero emissions by 2030". The report was amended in April 2021 to incorporate the scope of work for 2021 implementation. As such, the Project is evaluated for consistency with the 2030 Climate Action Plan Amended 2021, as shown in Table 1.

As shown in Table 3.5-6, the Project would not conflict with any of the applicable measures in the City's CAP. Further, because the Project would not result in GHG emissions that exceed the applicable thresholds, the Project would not impede achievement of the City's CAP GHG emissions reduction target. For the reasons described below, the Project does not conflict with the implementation of the CAP.

[1] City of Menlo Park. 2020. 2030 Climate Action Plan; A 2030 Plan to Eliminate Carbon Emissions & Protect Our Community from Climate Change. June. Available at: https://www.menlopark.org/ArchiveCenter/ViewFile/Item/11486

**Table 1. Consistency of Project with CAP Community Strategies**

| Category | Strategy | Project Consistency |
|---|---|---|
| Energy | Explore policy/program options to convert 95% of existing buildings to all-electric by 2030 | **Not applicable.** The Project is new construction and would not convert any existing buildings. The proposed Project would be entirely electrically powered with the exception of commercial culinary uses. The residential buildings would be entirely electrically powered. |
| | Eliminate the use of fossil fuels from municipal operations | **Not applicable.** The proposed Project is not a municipal project. |
| Transportation | Support setting citywide goal for increasing EVs and decreasing gasoline sales | **Consistent.** The proposed Project would offer an advanced EV charging program to Campus employees. EV charging in the Campus District is free and valets move cars into chargers to maximize charging time. The proposed Project would also install EV charging stations in the Residential/Shopping District. |
| | Expand access to EV charging for multifamily and commercial properties | **Consistent.** The proposed Project would install EV charging capabilities consistent with the City of Menlo Park Code, including residential and commercial areas on the main Project Site, expanding access to EV chargers. |
| | Reduce vehicle miles traveled (VMT) by 25% or an amount recommended by the Complete Streets Commission | **Consistent.** The proposed Project would implement TDM programs for the Campus District, Town Square District, and Residential/Shopping District. The Project's TDM programs may include, but are not limited to, the following measures:<br>• Improve biking/walking network<br>• Provide bicycle amenities<br>• Improve public transit service<br>• Car share program<br>• Tram service<br>• Commuter shuttles<br>• Parking management<br>• Emergency ride-home program<br>• Carpool and vanpool programs<br>• Commute assistance center<br>• On-site housing<br>The TDM programs would meet City of Menlo Park Municipal Code TDM requirements. The Project would also add new retail and a grocery store to an area that lacks these resources. |
| Water | Develop a climate adaptation plan to protect | **Not applicable.** This action is directed toward the City. However, the proposed Project is incorporating resiliency with respect to sea level rise and flooding into its civil plan. As part of the |

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| | the community from sea level rise and flooding | design effort, building finished floor elevations will be proposed to meet City of Menlo Park code and to accommodate a future rise in sea levels:<br>• Raise the building sites through grading activities to a minimum grade elevation of 13 ft NAVD, a minimum of 2 feet above the Base Flood Elevation of 11 ft NAVD.<br>• Proposed buildings will have a minimum finished floor elevation of at least 14 ft NAVD88 and are set high enough such that it is likely site adaptations would not be necessary for even the highest estimates of sea level rise for the useful life of the project.<br>• The entire project storm drain system is designed to drain to the City storm drain main in willow, which in turn drains to the Ravenswood Pump Station (operated by CalTrans) located northeast of the Project site along Bayfront Expressway. The storm drain system is therefore not hydraulically connected to the Bay and will not be impacted by sea level rise. |

**Consistency with SB 743**

SB 743 eliminated vehicular congestion, traditionally expressed as Level of Service (LOS), as the operative metric for identifying transportation impacts, and replaced it with Vehicle Miles Traveled (VMT). The Project would not exceed the City's thresholds of significance for VMT, which are consistent with OPR's 2018 Technical Advisory on Evaluating Transportation Impacts in CEQA, which OPR published to address the changes from SB 743.[2] Therefore, the Project does not conflict with the implementation of SB 743.

**Consistency with Plan Bay Area 2040 and Plan Bay Area 2050**

Pursuant to California Senate Bill 375, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) adopted *Plan Bay Area 2050* to establish the region's long-term strategic plan focused on the interrelated elements of housing, the economy, transportation, and the environment. *Plan Bay Area 2050*'s core strategy is encouraging growth in existing communities along the existing transportation network, focusing new development in Priority Development Areas (PDAs) and Transit Priority Areas (TPAs) within urbanized centers where there is more public transit and other mobility options available to reduce driving by cars and light trucks. In addition to significant transit and roadway performance investments to encourage focused growth, *Plan Bay Area 2050* directs funding to neighborhood active transportation and complete streets projects, climate initiatives, lifeline transportation and access initiatives, pedestrian and bicycle safety programs, and PDA planning. The *Plan Bay Area 2050* report was recently approved in October 2021, before which *Plan Bay Area 2040* was the most recent final version. The Project is conservatively evaluated for consistency with *Plan Bay Area 2040* and *Plan Bay Area 2050*, as shown in Tables 2 and 3 below. For the reasons described below, the Project does not conflict with the implementation of *Plan Bay Area 2040* or *Plan Bay Area 2050*.

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2 Governor's Office of Planning and Research, State of California. 2018. Technical Advisory on Evaluating Transportation Impacts in CEQA. December. Available at: http://opr.ca.gov/docs/20190122-743_Technical_Advisory.pdf

**Table 2. Consistency of Project with Plan Bay Area 2040**

| Category | Strategy | Project Consistency |
|---|---|---|
| Climate Protection | Reduce per-capita $CO_2$ emissions | **Consistent**. The proposed Project would be entirely electrically powered with the exception of commercial culinary uses. The residential buildings would be entirely electrically powered. The proposed Project would offer an advanced EV charging program to Facebook employees. EV charging in the Campus District is free and valets move cars into chargers to maximize charging time. The proposed Project would also install EV charging stations in the Residential/Shopping District. The proposed Project would implement a TDM program for the entire project. The Project's TDM program may include, but is not limited to, the following measures:<br>• Improve biking/walking network<br>• Provide bicycle amenities<br>• Improve public transit service<br>• Car share program<br>• Tram service<br>• Commuter shuttles<br>• Parking management<br>• Emergency ride-home program<br>• Carpool and vanpool programs<br>• Commute assistance center<br>• On-site housing |
| Adequate Housing | House the region's population | **Consistent**. The proposed Project would include up to 1,730 residential dwelling units. |
| Healthy and Safe Communities | Reduce adverse health impacts | **Consistent**. The proposed Project would not result in the exposure of future residents or nearby off-site sensitive receptors to adverse health effects exceeding BAAQMD thresholds for excess cancer risk, chronic HI, or $PM_{2.5}$ concentration. Furthermore, the Project would use Tier 4 construction equipment for the majority of Project construction activities, as specified in the mitigation measure, which reduces the health impact on the community. The Project's TDM and EV programs also reduce the health impact from mobile sources. |
| Open Space and Agricultural Preservation | Direct development within urban footprint | **Consistent**. The proposed Project would include a publicly accessible park, a dog park, an elevated park, and a town square to provide green space to the residents, employees, visitors, and surrounding neighborhood. The proposed Project is redevelopment of an underutilized site in the urban footprint. |

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| Equitable Access | Decrease share of lower-income households' budgets spent on housing and transportation | **Consistent**. The proposed Project would include 308 units of affordable housing. Furthermore, the Project would bring amenities (e.g., local serving retail like a grocery store and pharmacy) to an existing neighborhood that does not have amenities, which would reduce transportation needs. |
| | Increase share of affordable housing | **Consistent**. The proposed Project would include 308 units of affordable housing. |
| | Do not increase share of households at risk of displacement | **Consistent**. The proposed Project would include the demolition of existing office, industrial, and warehouse buildings and construction of up to 1,730 new residential dwelling units. The Project would not result in displacement of existing housing. |
| Economic Vitality | Increase share of jobs accessible in congested conditions | **Consistent**. The proposed Project would collocate jobs and housing in a congested area. |
| | Increase jobs in middle-wage industries | **Consistent**. The proposed Project would add up to 200,000 square feet of retail in an area currently without amenities, and a hotel, increasing middle-wage jobs. |
| | Reduce per-capita delay on freight network | **Not applicable.** This action is not directly applicable to the proposed Project. |
| Transportation System Effectiveness | Increase non-auto mode share | **Consistent**. The proposed Project would develop housing units, retail and office space near existing residential, office, commercial, and light manufacturing uses, reducing the demand for travel by single occupancy vehicles. The proposed Project would also implement a TDM program that may include, but is not limited to, the following measures:<br>• Improve biking/walking network<br>• Provide bicycle amenities<br>• Improve public transit service<br>• Car share program<br>• Tram service<br>• Commuter shuttles<br>• Parking management<br>• Emergency ride-home program<br>• Carpool and vanpool programs<br>• Commute assistance center<br>• On-site housing |
| | Reduce vehicle operating and maintenance costs due to pavement conditions | **Consistent.** The roads would be maintained consistent with municipal requirements. |

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| | Reduce per-rider transit delay due to aged infrastructure | **Not applicable.** This action is not directly applicable to the proposed Project. The Project will be making improvements to intersections, bike lanes and pedestrian connections that will upgrade infrastructure that will benefit transit. |

**Table 3. Consistency of Project with Plan Bay Area 2050**

| Category | | Strategy | Project Consistency |
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| **Housing Strategies** | Protect and Preserve Affordable Housing | Further strengthen renter protections beyond state law | **Not applicable**. This action is not directly applicable to the proposed Project as this requires Municipal action. |
| | | Preserve existing affordable housing | **Not applicable**. This action is not directly applicable to the proposed Project. The proposed Project would include the demolition of existing office, industrial, and warehouse buildings and construction of up to 1,730 new residential dwelling units. The Project would not result in displacement of existing affordable housing and would add additional affordable housing to the area. |
| | Spur Housing Production for Residents of All Income Levels | Allow a greater mix of housing densities and types in Growth Geographies | **Not applicable.** This action is not directly applicable to the proposed Project as it is not located in a Growth Geography; however, the proposed Project would develop housing units, retail, and office space near existing residential, office, commercial, and light manufacturing uses. |
| | | Build adequate affordable housing to ensure homes for all | **Consistent**. The proposed Project would include 308 units of affordable housing. |
| | | Integrate affordable housing into all major housing projects | **Consistent**. The proposed Project would include 308 units of affordable housing. |
| | | Transform aging malls and office parks into neighborhoods | **Consistent**. The proposed Project would demolish aging office, industrial, and warehouse buildings and would include construction of up to 1,730 new residential dwelling units as part of a mix use neighborhood also including retail, hotel, and office uses. |

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| | Create Inclusive Communities | Provide targeted mortgage, rental and small business assistance to Equity Priority Communities | **Not applicable**. This action is not directly applicable to the proposed Project as this requires Municipal action. |
| | | Accelerate reuse of public and community-owned land for mixed-income housing | **Not applicable**. This action is not directly applicable to the proposed Project as it does not utilize any public or community-owned land. |
| **Economic Strategies** | Improve Economic Mobility | Implement a statewide universal basic income | **Not applicable**. This action is not directly applicable to the proposed Project as it requires statewide action. |
| | | Expand job training and incubator programs | **Not applicable**. This action is not directly applicable to the proposed Project as this requires Municipal action. |
| | | Invest in high-speed internet in underserved low-income communities | **Not applicable**. This action is not directly applicable to the proposed Project as this requires Municipal action. |
| | Shift the Location of Jobs | Allow greater commercial densities in Growth Geographies | **Not applicable**. This action is not directly applicable to the proposed Project; however, the proposed Project would add up to 200,000 square feet of retail in an area currently without amenities, and a hotel. |
| | | Provide incentives to employers to shift jobs to housing-rich areas well served by transit | **Not applicable**. This action is not directly applicable to the proposed Project; however, the proposed Project would co-locate jobs and housing. |
| | | Retain and invest in key industrial lands | **Not applicable**. This action is not directly applicable to the proposed Project which is not located on key industrial lands. |
| **Transportation Strategies** | Maintain and Optimize the Existing System | Restore, operate and maintain the existing system | **Not applicable**. This action is not directly applicable to the proposed Project. However, the Project would be making improvements to intersections, bike lanes and pedestrian connections that will upgrade infrastructure that will benefit roadways, pedestrian and bicycle circulation systems. |
| | | Support community-led transportation enhancements in Equity Priority Communities. | **Not applicable.** This action is not directly applicable to the proposed Project. However, the Project would be making improvements to intersections, bike lanes and pedestrian connections that will enhance transportation in the community. |

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| | | Enable a seamless mobility experience | **Not applicable**. This action is not directly applicable to the proposed Project as it requires coordination among the regions existing transit agencies. |
| | | Reform regional transit fare policy | **Not applicable**. This action is not directly applicable to the proposed Project as it requires coordination among the regions existing transit agencies. |
| | | Implement per-mile tolling on congested freeways with transit alternatives | **Not applicable**. This action is not directly applicable to the proposed Project as it requires regional/Caltrans action. |
| | | Improve interchanges and address highway bottlenecks | **Not applicable**. This action is not directly applicable to the proposed Project. The Project would be implementing TDM programs and making improvements to intersections, bike lanes and pedestrian connections that will improve transportation and decrease single-occupancy commuter vehicles. |
| | | Advance other regional programs and local priorities | **Not applicable**. This action is not directly applicable to the proposed Project. The Project will be making improvements to local intersections, bike lanes and pedestrian connections, which help fulfill local transportation priorities. |
| | Create Healthy and Safe Streets | Build a Complete Streets network | **Consistent**. The proposed Project would enhance streets to promote walking, biking, and other micro-mobility by improving biking and walking networks and providing bicycle amenities. |
| | | Advance regional Vision Zero policy through street design and reduced speeds | **Consistent.** The Project would comply with City of Menlo Park requirements in support of Vision Zero. |
| | Build a Next-Generation Transit Network | Enhance local transit frequency, capacity and reliability | **Not applicable.** This action is not directly applicable to the proposed Project; however, the proposed Project would include a private shuttle and tram system for the office uses. |
| | | Expand and modernize the regional rail network | **Not applicable.** This action is not directly applicable to the proposed Project as this requires regional and state level action. |

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| | | Build an integrated regional express lanes and express bus network | **Not applicable.** This action is not directly applicable to the proposed Project as this requires regional and Caltrans action. |
| **Environmental Strategies** | Reduce Risks from Hazards | Adapt to sea level rise | **Not applicable.** This action is directed toward the City. However, the proposed Project is incorporating resiliency with respect to sea level rise and flooding into its civil plan. As part of the design effort, building finished floor elevations will be proposed to meet City of Menlo Park code and to accommodate a future rise in sea levels:<br>• Raise the building sites through grading activities to a minimum grade elevation of 13 ft NAVD, a minimum of 2 feet above the Base Flood Elevation of 11 ft NAVD.<br>• Proposed buildings will have a minimum finished floor elevation of at least 14 ft NAVD88 and are set high enough such that it is likely site adaptations would not be necessary for even the highest estimates of sea level rise for the useful life of the buildings.<br>•<br>• The entire project storm drain system is designed to drain to the City storm drain main in willow, which in turn drains to the Ravenswood Pump Station (operated by CalTrans) located northeast of the Project site along Bayfront Expressway. The storm drain system is not hydraulically connected to the Bay and will not be impacted by sea level rise. |
| | | Provide means-based financial support to retrofit existing residential buildings | **Not applicable.** This action is not directly applicable to the proposed Project as it does not include retrofit of any existing buildings. |
| | | Fund energy upgrades to enable carbon neutrality in all existing commercial and public buildings | **Not applicable.** The Project is new construction and would not convert any existing buildings; however, the proposed Project would be entirely electrically powered with the exception of commercial culinary uses, with a commitment to purchase 100% carbon free power, where |

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| | | | possible. The Project also would replace old less efficient buildings with new efficient buildings. |
| | Expand Access to Parks and Open Space | Maintain urban growth boundaries | **Consistent**. The proposed Project would be constructed within an incorporated city on a site currently developed with urban uses. |
| | | Protect and manage high-value conservation lands | **Not applicable.** This action is not directly applicable to the proposed Project as the Project would re-develop aging buildings and is not located in high-value conservation lands. |
| | | Modernize and expand parks, trails and recreation facilities | **Consistent**. The proposed Project would include a publicly accessible park, a dog park, an elevated park, and a town square to provide green space to the residents, employees, visitors, and community members. Streetscapes would also be lined with vegetation. The Project would also provide a connection for the Bay Trail, which is across Bayfront Expressway. |
| | Reduce Climate Emissions | Expand commute trip reduction programs at major employers | **Consistent**. The proposed Project would implement trip reduction programs as part of the TDM programs that may include, but is not limited to, carpool and vanpool programs, tram service, and commuter shuttles. |
| | | Expand clean vehicle initiatives | **Consistent.** The proposed Project would install EV charging capabilities consistent with the City of Menlo Park Code, expanding access to EV chargers. |
| | | Expand transportation demand management initiatives | **Consistent**. The proposed Project would implement TDM programs that may include, but is not limited to, the following measures:<br>• Improve biking/walking network<br>• Provide bicycle amenities<br>• Improve public transit service<br>• Car share program<br>• Tram service<br>• Commuter shuttles<br>• Parking management<br>• Emergency ride-home program<br>• Carpool and vanpool programs<br>• Commute assistance center<br>• On-site housing |

**Consistency with Advanced Clean Cars Initiative and the State's Zero-Emission Vehicles Mandate**

The Project is consistent with State goals for zero-emission vehicles (ZEVs) as expressed in the Advanced Clean Cars Initiative and the ZEV goal established by Executive Order B-16-12, which sets a target of reaching 1.5 million ZEVs (meaning battery electric vehicles and fuel cell electric vehicles) and plug-in hybrid electric vehicles on California's roadways by 2025. The Project is also consistent with State goals established by Executive Order N-79-20, which sets a target that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035.

The Project supports these ZEV goals by installing EV charging capabilities consistent with the City of Menlo Park Code. The Project would also have a comprehensive EV charging program in its Campus District, which would incentivize the further penetration of EVs into the fleet. EV chargers would also be installed with the Project in Mixed Use land uses, including residential areas, contributing to emissions reductions due to increased eVMT charged by the Project chargers. Therefore, the Project does not conflict with the implementation of this initiative.

**Consistency with 2017 Scoping Plan Update**

As directed by SB 32, CARB's 2017 Scoping Plan Update describes how the State plans to achieve the 2030 GHG emission reduction goal for California of 40 percent below 1990 levels by 2030. The 2017 Scoping Plan Update's strategy for meeting the State's 2030 GHG target incorporates the full range of legislative actions and state-developed plans that have relevance to the year 2030, including the LCFS, SB 350, the 2016 Mobile Source Strategy, the Sustainable Freight Action Plan, SB 1383, and the State's Cap-and-Trade Program (AB 398). The 2017 Scoping Plan Update does not regulate local land use projects. The 2017 Scoping Plan Update regulates the emissions associated with such projects (i.e., electricity, fuel, etc.), but not the projects themselves.

The Project would be consistent with key State plans and regulatory requirements referenced in the 2017 Scoping Plan Update designed to reduce statewide emissions. According to the 2017 Scoping Plan Update, reductions needed to achieve the 2030 target are expected to be achieved by increasing the RPS to 50 percent of the State's electricity by 2030, greatly increasing the fuel economy of vehicles and the number of zero-emission or hybrid vehicles, reducing the rate of growth in VMT, supporting high speed rail and other alternative transportation options, and increasing the use of high efficiency appliances, water heaters, and HVAC systems. The Project would support and would not impede implementation of these potential reduction strategies identified by CARB, and it would benefit from statewide and utility-provider efforts towards increasing the portion of electricity provided from renewable resources.[3] The Project would also benefit from statewide efforts towards increasing the fuel economy standards of vehicles and reducing the carbon content of fuels. The Project would utilize energy efficiency appliances and equipment, as required by Title 24, and it would provide EV charging stations to support the future use of electric and hybrid-electric vehicles by employees and visitors traveling to and from the site. The Project would install EV charging capabilities consistent with the City of Menlo Park Code. The electricity for EV charging at the Project would be supplied with 100% renewable and/or carbon free energy. For these reasons, the Project would be consistent with the objectives of the 2017 Scoping Plan Update.

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[3] As discussed previously, with the passage of SB 100, California's RPS has been increased over what is prescribed by the 2017 Scoping Plan Update, requiring retail sellers and local publicly-owned electric utilities to procure eligible renewable electricity for 44 percent of retail sales by the end of 2024, 52 percent by the end of 2027, and 60 percent by the end of 2030; and requires that CARB should plan for 100 percent eligible renewable energy resources and zero-carbon resources by the end of 2045.

The Project will be much more efficient on average than existing development in the City and far more efficient than what the Scoping Plan assumes for new development throughout the state.

In addition, the Project is consistent with the 2017 Scoping Plan Update's guidance on mitigation measures: "To the degree a project relies on GHG mitigation measures, CARB recommends that lead agencies prioritize on-site design features that reduce emissions, especially from VMT, and direct investments in GHG reductions within the project's region that contribute potential air quality, health, and economic co-benefits locally. For example, on-site design features to be considered at the planning stage include land use and community design options that reduce VMT, promote transit-oriented development, promote street design policies that prioritize transit, biking, and walking, and increase low carbon mobility choices, including improved access to viable and affordable public transportation, and active transportation opportunities." (CARB, 2017). The Project's design reduces VMT because it provides a mix of land uses and includes pedestrian features to promote walking. The Project would include multiuse pathways to promote bicycle and pedestrian connectivity both within and through the main Project Site. The Project would also provide retail land uses in a retail desert, placing a grocery and pharmacy in close proximity to the adjacent Belle Haven neighborhood. In addition, the Project's TDM Plan include features to reduce VMT.

For the reasons described above, the Project does not conflict with the implementation of the 2017 Scoping Plan Update.

# APPENDIX C
# DATA RECEIVED

**Instructions:** Please fill in all cells highlighted in yellow. Please confirm or update cells highlighted in orange

**Daily Trips Rates and VMT**

| Land Use | Fleet Type / Land Use | Daily Project Trip Rates (Weekday) | | | | Daily Project VMT (Weekday) (including reductions for passby and diverted trips) | | | | EV Percentage of Fleet[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | End of Phase 1a | End of Phase 1b | End of Phase 2 | TOTAL (trips/1,000 sf) | End of Phase 1a | End of Phase 1b | End of Phase 2 | TOTAL | |
| Faceook Office - Existing 2019 | Cars (per 1,000 s.f.) | | | | 9.19 | | | | 110,860 | -- |
| | Trucks (per 1,000 s.f.) | | | | 0.22 | | | | 2,640 | N/A |
| | Shuttles (per 1,000 s.f.) | | | | 0.66 | | | | 21,088 | 0% |
| | On-Demand (per 1,000 s.f.) | | | | 0.66 | | | | 7,919 | 38% |
| Facebook Office | Cars (per 1,000 s.f.) | 9.16 | 10.05 | 10.05 | | 53,996 | 178,766 | 178,766 | | -- |
| | Trucks (per 1,000 s.f.) | 0.23 | 0.23 | 0.23 | | 1,344 | 4,056 | 4,056 | | N/A |
| | Shuttles (per 1,000 s.f.) | 1.32 | 0.44 | 0.44 | | 21,088 | 21,088 | 21,088 | | 0% |
| | On-Demand (per 1,000 s.f.) | 0.68 | 0.68 | 0.68 | | 4,031 | 12,168 | 12,168 | | 38% |
| Mixed Use | Residential (per d.u.) | 4.35 | 4.35 | 4.35 | | 30,841 | 43,077 | 71,524 | | EMFAC2021 Default |
| | Retail[3] (per 1,000 s.f.) | 25.07 | 25.07 | 25.07 | | 25,195 | 33,587 | 33,594 | | EMFAC2021 Default |
| | Park (per acre) | 42.80 | 42.80 | 42.80 | | 860 | 860 | 1,147 | | EMFAC2021 Default |
| | Hotel (per room) | -- | 6.69 | 6.69 | | -- | 14,814 | 14,814 | | EMFAC2021 Default |

**Notes:**

[1]. Dashes indicate EV percentage will be calculated elsewhere based on charger usage data provided by Facebook.
Trucks are marked N/A as none of the vehicle categories within the fleet are electric (as shown in the upper table).
Assume EV percentage of On-Demand remains the same between existing conditions and full buildout. Existing EV Percentage previously provided by Facebook.
The default EMFAC2021 electrification for San Mateo county will be assumed for vehicles operating in the Mixed Use district.

[2]. Estimate of trip rate reductions due to implementation of Transportation Demand Management measures.

[3]. All non-Facebook office space is classified as Retail.

Instructions

**Please provide background traffic volumes for any roadway with over 10,000 vehicles per day in the vicinity of the project.**

| Roadway | Segment Limit | | Vehicles Per Day |
|---|---|---|---|
| Chrysler Drive | Bayfront | Constitution | 20,049 |
| Chrysler Drive | Constitution | Jefferson | 14,148 |
| Chilco St | Mayfront | Consitution | 15,522 |
| O'Brien Dr | Willow | Kavanaugh | 14,729 |
| Ivy Drive | Chilco | Willow | 12,813 |
| Newbridge St | Chilco | Willow | 13,662 |
| Newbridge St | Willow | Ralmar | 15,143 |
| Newbridge St | Ralmar | University | 12,250 |
| | | | |
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**Notes:**

1. Segment limits are the cross streets on each link. Please add additional rows to include all necessary segment limits.

**Instructions:**
Please provide segment limits for each link location listed below, in addition to traffic volumes at full buildout and the fleet make-up of the traffic. Please add additional link locations and rows as needed.

**Facebook Office**

* HEX - net new volumes based on model assignment. Negative values are zeroed for a conservative approach

| Link Location | Segment Limits[1] | | Net New Traffic Volumes - Full Buildout (Vehicles/day) | Percentage of Total Traffic (total Facebook traffic under Project Conditions) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Cars | On-Demand | Shuttles | Trucks |
| Willow Road | Bayfront | Hamilton | 101 | 88% | 6% | 4% | 2.0% |
| Willow Road | Hamilton | Park | 0 | | | | |
| Willow Road | Park | O'Brien | 0 | | | | |
| Willow Road | O'Brien | Newbridge | 658 | | | | |
| Bayfront Expressway | Marsh | Chilco | 0 | | | | |
| Bayfront Expressway | Chilco | Willow | 0 | | | | |
| Bayfront Expressway | Willow | University | 596 | | | | |
| Bayfront Expressway | University | County lim | 745 | | | | |
| University Avenue | Bayfront | Adams | 385 | | | | |
| University Avenue | Adams | O'Brien | 465 | | | | |
| University Avenue | O'Brien | Kavanaugh | 3,693 | | | | |
| University Avenue | Kavanaugh | Bay | 3,679 | | | | |
| O'Brien Drive | Willow | Kavanaugh | 1,679 | | | | |
| O'Brien Drive | Kavanaugh | Adams | 4,358 | | | | |
| O'Brien Drive | Adams | University | 4,390 | | | | |
| Adams Dr | University | Adams Ct | 75 | | | | |
| Adams Dr | Adams Ct | O'Brien | 0 | | | | |
| Adams Ct | | | 70 | | | | |

**Notes:**
1. Segment limits are the cross streets on each link. Please add additional rows to include all necessary segment limits.
If additional link locations (i.e. modeled roadways) are needed, please add them in.

**Please provide the total traffic volumes entering the site, broken down by entrance. This should include cars, on-demand and trucks. The shuttles will be considered separately, based on the schedules as provided by Facebook.**

| Entrance | Net New Traffic Volumes - Full Buildout (Vehicles/day) |
|---|---|
| **Willow/North** | **28** |
| **Willow/Hamilton** | **-541** |
| **Willow/Park** | **-1,043** |
| **O'Brien/Park** | **7,914** |
| **Adams Court** | **179** |

**Instructions:**

Please provide segment limits for each link location listed below, in addition to traffic volumes at full buildout and the fleet make-up of the traffic. Please add additional link locations and rows as needed.

**Mixed Use**

| Link Location | Segment Limits[1] | | Total Traffic Volumes - Full Buildout (Vehicles/day) |
|---|---|---|---|
| Willow Road | Bayfront | Hamilton | 2,976 |
| Willow Road | Hamilton | Park | 0 |
| Willow Road | Park | O'Brien | 6,362 |
| Willow Road | O'Brien | Newbridge | 6,875 |
| Bayfront Expressway | Marsh | Chilco | 1,284 |
| Bayfront Expressway | Chilco | Willow | 1,566 |
| Bayfront Expressway | Willow | University | 1,557 |
| Bayfront Expressway | University | County limit | 1,536 |
| University Avenue | Bayfront | Adams | 309 |
| University Avenue | Adams | O'Brien | 516 |
| University Avenue | O'Brien | Kavanaugh | 1,707 |
| University Avenue | Kavanaugh | Bay | 1,737 |
| O'Brien Drive | Willow | Kavanaugh | 991 |
| O'Brien Drive | Kavanaugh | Adams | 2,398 |
| O'Brien Drive | Adams | University | 2,325 |
| Adams Dr | University | Adams Ct | 8 |
| Adams Dr | Adams Ct | O'Brien | 80 |
| Adams Ct | | | 87 |

**Notes:**

1. Segment limits are the cross streets on each link. Please add additional rows to include all necessary segment limits. If additional link locations (i.e. modeled roadways) are needed, please add them in.

**Please provide the total traffic volumes entering the site, broken down by entrance.**

| Entrance | Net New Traffic Volumes - Full Buildout (Vehicles/day) |
|---|---|
| **Willow/North** | **0** |
| **Willow/Hamilton** | **1,720** |
| **Willow/Park** | **8,691** |
| **O'Brien/Park** | **4,592** |
| **Adams Court** | **23** |

SIGNATURE DEVELOPMENT GROUP

# MEMORANDUM

To: Kyle Perata, City of Menlo Park

From: Faye Brandin, Signature Development Group

Subject: Emergency Backup Generator Memorandum

Date: October 20, 2020 (REVISED December 21, 2021, revisions in red)

---

Dear Kyle:

This is a memorandum following up the email you sent on July 24th, requesting an update to previously submitted documents on June 5th.

Staff comment:

On June 5th you provided two generator supplemental forms that are slightly different. Can you take a look and let me know why two different forms were submitted? Is one of the forms for the grocery store generator and one for the Office Campus generators?

In addition to the forms, the submittal also included a narrative response that included the detailed specifications for two different generators. I also attached that document for reference.

Would you please review the attached documents and provide me with clarification on the number of generators, general size/specs for the generators, and a site plan showing the anticipated locations of the generators.

In addition to the generator supplemental form, the City also requires submittal of its hazardous materials information form (HMIF), and a chemical inventory (inventory would identify the approximate amount of diesel fuel for each generator) for review of applications involving hazardous materials.

Response:

The information has been updated to include a total of twelve emergency backup generators across Willow Village, four in the Campus District, one in the Town Square District, six for the Residential/Shopping District, and one at the Willow Hamilton North Parcel.

The following items are provided are part of this response:

- Site Plan with anticipated locations of the emergency backup generators (updated)
- Campus District emergency backup generator supplements with the following:
    - Two emergency backup generators to service Meeting, Collaboration, and Conference Space, located inside the north garage, sizes: 103"(W)x201"(L)x119"(H) each;
    - Two emergency backup generators servicing Office Buildings 1, 2, 3, 4, 5, and 6, sizes: 110"(W)x270"(L)x164"(H) each;

- Town Square District: one emergency backup generator to service the Hotel, located inside the basement level of the hotel, size: 77"(W)x167"(L)x78"(H).
- For the Residential/Shopping District, refer to the Preliminary Mixed-Use Emergency Backup Generator Summary and Generator Supplements:
    - Each of the six residential/mixed-use buildings will have their own emergency backup generator
    - Sizes included in the summary from PAE Engineers
- Cut sheet for one generator at the Willow Hamilton North Parcel.

If hazardous materials are associated with emergency backup generator use, we propose submitting the hazardous materials form (HMIF) at the time we submit permits to commence construction on all buildings, but prior to any hazardous materials incidental to all uses, being stored and used on site.

Please do not hesitate to contact me with any questions. I can be reached at (510) 862-5629.

Sincerely,

Faye Brandin

CITY OF MENLO PARK

**COMMUNITY DEVELOPMENT DEPARTMENT**
**PLANNING DIVISION**
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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

**GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)

Generator(s) will be used for life safety egress lighting, accessible egress elevator loads and other misc. standby loads.

| | |
|---|---|
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Estimated Diesel tank capacity is 4,000 Gallons | **NOISE RATING**<br>85 dBA |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Estimated generator size (2) @ 750kW | **ENCLOSURE COLOR**<br>Generators located interior of parking garage |
| **ROUTE FOR FUELING HOSE ACCESS**<br>Remote fuel station located on exterior of the building | **PARKING LOCATION OF FUELING TRUCK**<br>Exterior, drive up to remote fill station |
| **FREQUENCY OF REFUELING**<br>Two times per year | **HOURS OF SERVICE ON A FULL TANK**<br>24 hours at 100% generator capacity |

**PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)

Monthly, Sunday AM

**ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)

Double-wall fuel tank with leak detection and remote fuel fill station with automatic shut off and alarms

**OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)

- Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack
- Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school

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**GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)

Generator(s) will be used for life safety egress lighting, accessible egress elevator loads and other misc. standby loads.

| | |
|---|---|
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Estimated Diesel tank size is 3,200 gallons. | **NOISE RATING**<br>Internal acoustical dampening to 75db at 23' |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Estimated generator size (2) @ 1750kW; 2900hp | **ENCLOSURE COLOR**<br>Generators located interior of parking garage |
| **ROUTE FOR FUELING HOSE ACCESS**<br>Remote fuel fill station located on exterior of buildling | **PARKING LOCATION OF FUELING TRUCK**<br>Exterior, drive up to remote fuel fill station |
| **FREQUENCY OF REFUELING**<br>two times per year | **HOURS OF SERVICE ON A FULL TANK**<br>8 hours at 100% generator capacity |

**PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)

Monthly, Sunday AM

**ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)

Double-wall fuel tank with leak detection and remote fuel fill station with automatic shut off and alarms

**OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)

- Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack
- Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school

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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

| | |
|---|---|
| **GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)<br>Generator(s) will be used for life safety egress lighting, accessible egress elevator loads and other misc. standby loads. | |
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Estimated Diesel tank size is 1,350 gallons. | **NOISE RATING**<br>Internal acoustical dampening to 75db at 23' |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Estimated generator size (1) @ 600kW, 900hp | **ENCLOSURE COLOR**<br>Generators located interior of parking garage basement level |
| **ROUTE FOR FUELING HOSE ACCESS**<br>Remote fuel fill station located on exterior of buildling | **PARKING LOCATION OF FUELING TRUCK**<br>Exterior, drive up to remote fuel fill station |
| **FREQUENCY OF REFUELING**<br>two times per year | **HOURS OF SERVICE ON A FULL TANK**<br>24 hours at 100% generator capacity |
| **PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)<br>Monthly, Sunday AM | |
| **ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)<br>Double-wall fuel tank with leak detection and remote fuel fill station with automatic shut off and alarms | |
| **OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)<br>• Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack<br>• Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school | |

# Memo

| | |
|---|---|
| **Date:** | September 23, 2020 |
| **Project:** | Willow Village Mixed-Use Development |
| **Project Number:** | 18-1489 |
| **To:** | Faye Brandin (SDG) |
| **From:** | Scott Bevan, PE |
| **Subject:** | Mixed-Use Generator Summary (Preliminary) |
| **Distribution:** | PAE Team |

The purpose of this memo is to provide preliminary on-site emergency power system description and sizing for the mixed-use buildings of the Willow Village Mixed-Use District in Menlo Park, CA.

**EMERGENCY POWER SYSTEM SUMMARY**

Based on preliminary information, PAE assumes that each mixed-use building will require certain loads to be backed up by generator power due to building codes, operational requirements and owner preference. A dedicated standby generator power system will be provided at each mixed-use building.

Specific loads and tenant requirements are unknown at this time, but it is assumed each generator system will include capacity for (1) fire pump, (1-2) elevator(s), and a provision for non-emergency backup power to Optional Standby tenant loads as determined by tenant. The table below summarizes the load types assumed to require generator backup.

**Table 1: Generator Load Types**

| Classification | System Description | Notes |
|---|---|---|
| Life Safety / Emergency (EM) | Emergency Lighting | |
| | Fire Alarm Panels | |
| | Fire Pump | Assumed to be required for all buildings. |
| Legally Required Standby (LRS) | Elevator(s) | All buildings assumed to be five stories or greater. |
| Optional Standby (OS) | Optional Standby Provision | |
| | Grocery Tenant (RS2 only) | |

Fire pumps are required to have a reliable source of power per CEC 695.3 and NFPA 20. The determination of whether the PG&E service is a reliable source of power is an issue for the AHJ. If the service is deemed to be unreliable, then an alternate source is required, and typically this is a standby diesel generator. Given all the PG&E issues lately, PAE currently assumes that if fire pump is needed at a building, then a generator will be required.

Each standby generator is anticipated to be diesel-engine driven with integral base fuel tank, located within a dedicated indoor equipment room or within an exterior custom acoustic enclosure, constructed in compliance with NFPA 110 requirements. The desired run-time of the generator is unknown at this time but can be approximated to be 8 hours or less.

The generator equipment will be provided with custom acoustic enclosure and/or treatment systems to maintain nighttime and daytime acoustic thresholds at the property line as determined by City of Menlo Park zoning and noise ordinances.

The generator system will operate during utility power interruption in order to maintain critical building operation, or on a monthly basis for testing purposes. The generator system will be selected to meet Tier 2 emission standards and have engine exhaust to the exterior meeting all local city ordinance and code requirements.

Refer to the attached standby generator equipment cutsheets for information on fuel tank volume, acoustic enclosure dimensions, sound data, and weights. These cutsheets are meant to be representative of this equipment. Actual manufacturer equipment shown, and specific equipment attributes are used for preliminary coordination purposes only.

**EMERGENCY POWER SYSTEM LOAD SUMMARY**

The preliminary generator load summary and recommended generator sizes are shown in the table below. Refer to the appendix for more information. These loads will be refined as the design progresses.

**Table 2: Generator Load Summary**

| BUILDING ID | GENERATOR LOAD (KW) | RECOMMENDED GENERATOR SIZE (KW) |
|---|---|---|
| RS2 | 741 | 1,000 |
| RS3 | 571 | 750 |
| RS4 | 407 | 500 |
| RS5 | 361 | 500 |
| RS6 | 199 | 250 |
| RS7 | 125 | 150 |

End of memo.

| Facebook Willow Village Generator Load Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Area (SF)** | **Load (W/SF)** | **Quantity** | **Unit Load (kW)** | **Total Load** | **Generator Branch** | **Notes** |
| **Mixed Use RS2** | | | | | | | |
| Emergency Lighting | 631,657 | 0.25 | | | 158 | EM | |
| Fire Alarm Panels | | | 1 | 15 | 15 | EM | |
| Fire Pump | | | 1 | 150 | 150 | EM | 150 HP |
| Elevators | | | 2 | 34 | 68 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 150 | 150 | OPT | |
| Grocery Provision | | | 1 | 200 | 200 | OPT | |
| | | | | **Sub-Total** | **741** | | |
| **Mixed Use RS3** | | | | | | | |
| Emergency Lighting | 753,901 | 0.25 | | | 188 | EM | |
| Fire Alarm Panels | | | 1 | 15 | 15 | EM | |
| Fire Pump | | | 1 | 150 | 150 | EM | 150 HP |
| Elevators | | | 2 | 34 | 68 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 150 | 150 | OPT | |
| | | | | **Sub-Total** | **571** | | |
| **Mixed Use RS4** | | | | | | | |
| Emergency Lighting | 499,573 | 0.25 | | | 125 | EM | |
| Fire Alarm Panels | | | 1 | 10 | 10 | EM | |
| Fire Pump | | | 1 | 104 | 104 | EM | 100 HP |
| Elevators | | | 2 | 34 | 68 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 100 | 100 | OPT | |
| | | | | **Sub-Total** | **407** | | |
| **Mixed Use RS5** | | | | | | | |
| Emergency Lighting | 316,257 | 0.25 | | | 79 | EM | |
| Fire Alarm Panels | | | 1 | 10 | 10 | EM | |
| Fire Pump | | | 1 | 104 | 104 | EM | 100 HP |
| Elevators | | | 2 | 34 | 68 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 100 | 100 | OPT | |
| | | | | **Sub-Total** | **361** | | |
| **Mixed Use RS6** | | | | | | | |
| Emergency Lighting | 225,800 | 0.25 | | | 56 | EM | |
| Fire Alarm Panels | | | 1 | 5 | 5 | EM | |
| Fire Pump | | | 1 | 54 | 54 | EM | 50 HP |
| Elevators | | | 1 | 34 | 34 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 50 | 50 | OPT | |
| | | | | **Sub-Total** | **199** | | |
| **Mixed Use RS7** | | | | | | | |
| Emergency Lighting | 86,600 | 0.25 | | | 22 | EM | |
| Fire Alarm Panels | | | 1 | 5 | 5 | EM | |
| Fire Pump | | | 1 | 34 | 34 | EM | 30 HP |
| Elevators | | | 1 | 34 | 34 | LRS | 30 HP |
| Optional Standby Provision | | | 1 | 30 | 30 | OPT | |
| | | | | **Sub-Total** | **125** | | |

BUILDING ID: RS2

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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

| | |
|---|---|
| **GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)<br>Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage. | |
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 660 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>75.3db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 1000 kW (approx)<br>Engine output: 1490 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>9 hours at generator fully rated load |
| **PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)<br>Monthly, Sunday, AM | |
| **ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)<br>Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.<br>Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc. | |
| **OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)<br>• Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack<br>• Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school | |

BUILDING ID: RS3


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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

**GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)

Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage.

| | |
|---|---|
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 660 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>75.3db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 750 kW (approx)<br>Engine output: 1220 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>13 hours at generator fully rated load |

**PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)

Monthly, Sunday, AM

**ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)

Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.
Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc.

**OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)

- Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack
- Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school

BUILDING ID: RS4

CITY OF MENLO PARK

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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

| | |
|---|---|
| **GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)<br>Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage. | |
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 270 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>73db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 500 kW (approx)<br>Engine output: 755 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>8 hours at generator fully rated load |
| **PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)<br>Monthly, Sunday, AM | |
| **ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)<br>Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.<br>Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc. | |
| **OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)<br>• Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack<br>• Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school | |

BUILDING ID: RS5


## COMMUNITY DEVELOPMENT DEPARTMENT
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# APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

**GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)

Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage.

| | |
|---|---|
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 270 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>73db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 500 kW (approx)<br>Engine output: 755 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>8 hours at generator fully rated load |

**PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)

Monthly, Sunday, AM

**ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)

Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.
Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc.

**OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)

- Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack
- Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school

BUILDING ID: RS6

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## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

| | |
|---|---|
| **GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)<br>Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage. | |
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 270 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>72db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 250 kW (approx)<br>Engine output: 464 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>14 hours at generator fully rated load |
| **PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)<br>Monthly, Sunday, AM | |
| **ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)<br>Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.<br>Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc. | |
| **OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)<br>• Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack<br>• Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school | |

BUILDING ID: RS7


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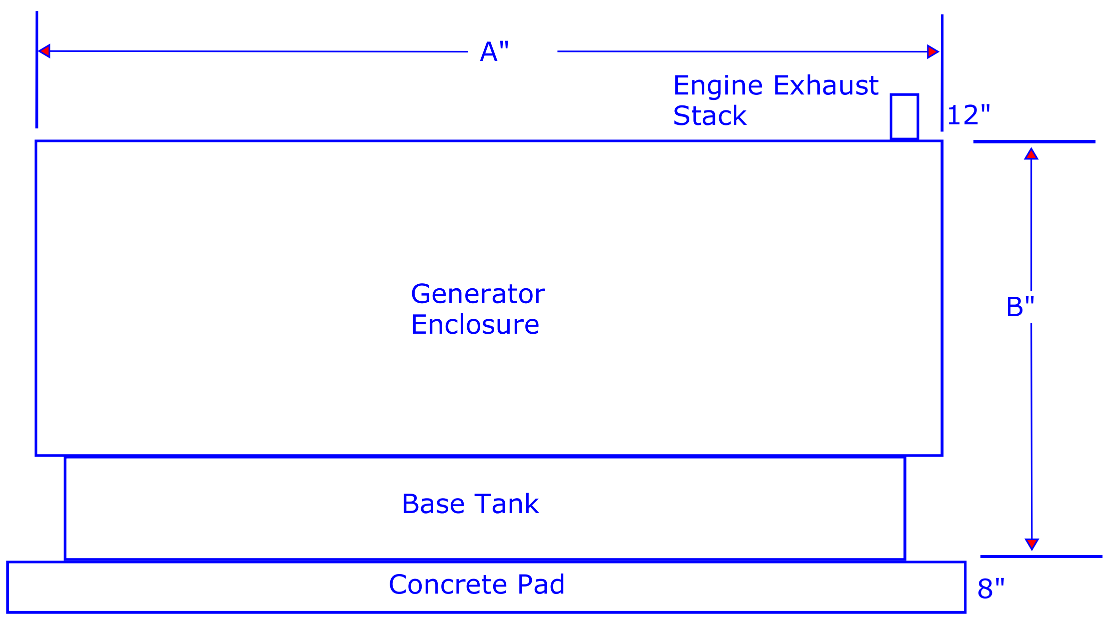
## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

| | |
|---|---|
| **GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)<br>Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage. | |
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 270 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>72db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 150 kW (approx)<br>Engine output: 324 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>24 hours at generator fully rated load |
| **PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)<br>Monthly, Sunday, AM | |
| **ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)<br>Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.<br>Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc. | |
| **OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)<br>• Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack<br>• Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school | |

| GENERATOR SIZE (kW) | DIMENSION 'A' (") | DIMENSION 'B' (") |
|---|---|---|
| 1000 | 315 | 137 |
| 750 | 315 | 137 |
| 500 | 222 | 106 |
| 250 | 222 | 106 |
| 150 | 180 | 93 |




Section
(NTS)

1000KW GENERATOR

**Specification sheet**

# Diesel generator set QST30 series engine

680 kW - 1000 kW 60 Hz

## Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime power applications.

## Features

**Cummins heavy-duty engine -** Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

**Alternator -** Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Permanent Magnet Generator (PMG) -** Offers enhanced motor starting and fault clearing short circuit capability.

**Circuit breakers -** Option for manually-and/or electrically-operated circuit breakers.

**Control system -** The PowerCommand® electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Masterless Paralleling -** An optional electrically operated circuit breaker can be added for a simple masterless paralleling solution.

**Cooling system -** Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

**NFPA -** The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service -** Backed by a comprehensive warranty and worldwide distributor network.

| | Standby rating | Prime rating | Continuous rating | Data sheets |
|---|---|---|---|---|
| Model | 60 Hz<br>kW (kVA) | 60 Hz<br>kW (kVA) | 60 Hz<br>kW (kVA) | 60 Hz |
| **DQFAA** | 750 (938) | 680 (850) | | D-3329 |
| **DQFAB** | 800 (1000) | 725 (907) | | D-3330 |
| **DQFAC** | 900 (1125) | 818 (1023) | | D-3331 |
| **DQFAD** | 1000 (1250) | 900 (1125) | | D-3332 |

## Generator set specifications

| | |
|---|---|
| Governor regulation class | ISO 8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | ± 0.5% |
| Random voltage variation | ± 0.5% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.25% |
| Radio frequency emissions compliance | IEC 61000-4-2: Level 4 Electrostatic discharge<br>IEC 61000-4-3: Level 3 Radiated susceptibility |

## Engine specifications

| | |
|---|---|
| Bore | 140 mm (5.51 in.) |
| Stroke | 165.0 mm (6.5 in.) |
| Displacement | 30.5 L (1860 $in^3$) |
| Cylinder block | Cast iron, V 12 cylinder |
| Battery capacity | 1800 amps minimum at ambient temperature of -18 °C to 0 °C (0 °F to 32 °F) |
| Battery charging alternator | 35 amps |
| Starting voltage | 24 volt, negative ground |
| Fuel system | Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff |
| Fuel filter | Triple element, 10 micron filtration, spin-on fuel filters with water separator |
| Air cleaner type | Dry replaceable element |
| Lube oil filter type(s) | Four spin-on, combination full flow filter and bypass filters |
| Standard cooling system | High ambient radiator |

## Alternator specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip-proof, revolving field |
| Stator | 2/3 pitch |
| Rotor | Single bearing flexible discs |
| Insulation system | Class H on low and medium voltage, Class F on high voltage |
| Standard temperature rise | 150 °C Standby at 40 °C ambient |
| Exciter type | PMG (Permanent Magnet Generator) |
| Phase rotation | A (U), B (V), C (W) |
| Alternator cooling | Direct drive centrifugal blower fan |
| AC waveform Total Harmonic Distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone Influence Factor (TIF) | < 50 per NEMA MG1-22.43 |
| Telephone Harmonic Factor (THF) | < 3 |

## Available voltages

**60 Hz Line – Neutral/Line - Line**

| | | | |
|---|---|---|---|
| • 120/208 | • 220/380 | • 240/416 | • 347/600 |
| • 139/240 | • 230/400 | • 277/480 | |

Note: Consult factory for other voltages.

## Generator set options

**Engine**

- 208/240/480 V coolant heater for ambient above 4.5 °C (40 °F)
- 208/240/480 V coolant heater for ambient below 4.5 °C (40 °F)

**Control panel**

- PowerCommand 3.3 with Masterless Load Demand (MLD)
- Run relay package
- Ground fault indication
- Paralleling configuration
- Remote fault signal package
- Exhaust gas temperature sensor
- 120/240 V 100 W control anti-condensation heater

**Alternator**

- 80 °C rise
- 105 °C rise
- 150 °C rise
- 120/240 V 300 W anti-condensation heater
- Temperature sensor - RTDs, 2-phase
- Temperature sensor – alternator bearing RTD
- Differential current transformers

**Exhaust system**

- Critical grade exhaust silencer
- Exhaust packages
- Industrial grade exhaust silencer
- Residential grade exhaust silencer

**Cooling system**

- High ambient 50 °C radiator

**Generator set**

- AC entrance box
- Battery
- Battery rack with hold-down - floor standing
- Circuit breaker - set mounted
- Disconnect switch - set mounted
- PowerCommand network
- Remote annunciator panel
- Spring isolators
- 2 year warranty
- 5 year warranty
- 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

## PowerCommand 3.3 Control System

An integrated microprocessor based generator set control system providing voltage regulation, engine protection, alternator protection, operator interface and isochronous governing. Refer to document S-1570 for more detailed information on the control.

**AmpSentry** – Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.

**Power management –** Control function provides battery monitoring and testing features and smart starting control system.

**Advanced control methodology –** Three phase sensing, full wave rectified voltage regulation, with a PWM output for stable operation with all load types.

**Communications interface –** Control comes standard with PCCNet and Modbus® interface.

**Regulation compliant –** Prototype tested: UL, CSA and CE compliant.

**Service** - InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

**Easily upgradeable –** PowerCommand controls are designed with common control interfaces.

**Reliable design –** The control system is designed for reliable operation in harsh environment.

**Multi-language support**

## Operator panel features

**Operator/display functions**

- Displays paralleling breaker status
- Provides direct control of the paralleling breaker
- 320 x 240 pixels graphic LED backlight LCD
- Auto, manual, start, stop, fault reset and lamp test/panel lamp switches
- Alpha-numeric display with pushbuttons
- LED lamps indicating generator set running, remote start, not in auto, common shutdown, common warning, manual run mode, auto mode and stop

**Paralleling control functions**

- First Start Sensor System selects first generator set to close to bus
- Phase Lock Loop Synchronizer with voltage matching
- Sync check relay
- Isochronous kW and kVar load sharing
- Load govern control for utility paralleling
- Extended Paralleling (Base Load/Peak Shave) Mode
- Digital power transfer control, for use with a breaker pair to provide open transition, closed transition, ramping closed transition, peaking and base load functions,
- Alternator data
- Line-to-Neutral and Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kW, kVar, power factor kVA (three phase and total)
- Engine data
- DC voltage
- Engine speed
- Lube oil pressure and temperature
- Coolant temperature
- Comprehensive FAE data (where applicable)
- Other data
- Genset model data
- Start attempts, starts, running hours, kW hours
- Load profile (operating hours at % load in 5% increments)
- Fault history
- Data logging and fault simulation (requires InPower)

## Standard control functions

**Digital governing**

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

**Digital voltage regulation**

- Integrated digital electronic voltage regulator
- 3-phase, 4-wire Line-to-Line sensing
- Configurable torque matching

**AmpSentry AC protection**

- AmpSentry protective relay
- Over current and short circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field overload shutdown

**Engine protection**

- Battery voltage monitoring, protection and testing
- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown
- Full authority electronic engine protection

**Control functions**

- Time delay start and cool down
- Real time clock for fault and event time stamping
- Exerciser clock and time of day start/stop
- Data logging
- Cycle cranking
- Load shed
- Configurable inputs and outputs (4)
- Remote emergency stop

**Options**

- Auxiliary output relays (2)

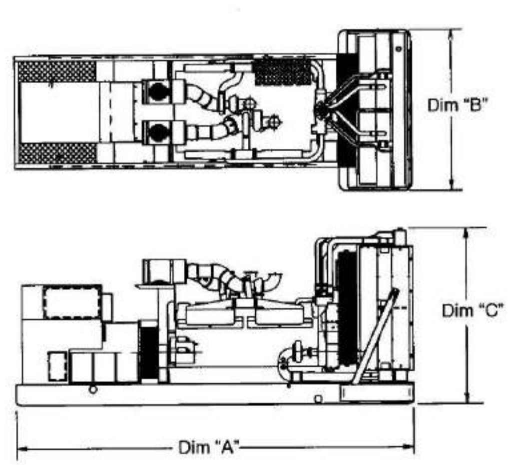
## Ratings definitions

**Emergency Standby Power (ESP)**:
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP)**:
Applicable for supplying power to a constant electrical load for limited hours. Limited-Time running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP)**:
Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP):**
Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




- This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

| Model | Dim 'A' mm (in.) | Dim 'B' mm (in.) | Dim 'C' mm (in.) | Set Weight dry* (lb) | Set Weight wet* (lb) |
|---|---|---|---|---|---|
| DQFAA | 4287 (168.8) | 1990 (78.3) | 2355 (92.7) | 6671 (14707) | 6969 (15363) |
| DQFAB | 4287 (168.8) | 1990 (78.3) | 2355 (92.7) | 6894 (15199) | 7192 (15855) |
| DQFAC | 4287 (168.8) | 1990 (78.3) | 2355 (92.7) | 7373 (16254) | 7670 (16910) |
| DQFAD | 4287 (168.8) | 1990 (78.3) | 2355 (92.7) | 7631 (16824) | 7929 (17480) |

* Weights represent a set with standard features. See outline drawings for weights of other configurations.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% Continuous operation and also UL 869A Listed Service Equipment. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | **U.S. EPA** | Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation. |
| CSA | All low voltage models are CSA certified to product class 4215-01. | **International Building Code** | The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012. |

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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S-1508 (05/20)

# Generator set data sheet

**Model:** DQFAD
**Frequency:** 60 Hz
**Fuel type:** Diesel
**kW rating:** 1000 Standby
900 Prime
**Emissions level:** EPA NSPS Stationary Emergency Tier 2

| | |
|---|---|
| **Exhaust emission data sheet:** | **EDS-1063** |
| **Exhaust emission compliance sheet:** | **EPA-1097** |
| **Sound performance data sheet:** | **MSP-1038** |
| **Cooling performance data sheet:** | **MCP-156** |
| **Prototype test summary data sheet:** | **PTS-266** |
| **Standard set-mounted radiator cooling outline:** | **A049K674** |
| **Optional remote radiator cooling outline:** | **A053G787** |

## Fuel consumption

| | Standby | | | | Prime | | | | Continuous |
|---|---|---|---|---|---|---|---|---|---|
| | kW (kVA) | | | | kW (kVA) | | | | kW (kVA) |
| Ratings | 1000 (1250) | | | | 900 (1125) | | | | |
| Load | 1/4 | 1/2 | 3/4 | Full | 1/4 | 1/2 | 3/4 | Full | Full |
| US gph | 18.7 | 36.4 | 54.2 | 71.9 | 16.9 | 32.4 | 48.0 | 63.5 | |
| L/hr | 70.6 | 137.8 | 205.1 | 272.3 | 64.0 | 122.8 | 181.5 | 240.3 | |

## Engine

| Engine | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Engine manufacturer | Cummins Inc. | | |
| Engine model | QST30-G5 NR2 | | |
| Configuration | Cast iron, V 12 cylinder | | |
| Aspiration | Turbocharged and low temperature after-cooled | | |
| Gross engine power output, kWm (bhp) | 1112 (1490) | 1007 (1350) | |
| BMEP at set rated load, kPa (psi) | 2417 (351) | 2160 (313) | |
| Bore, mm (in.) | 140 (5.51) | | |
| Stroke, mm (in.) | 165 (6.5) | | |
| Rated speed, rpm | 1800 | | |
| Piston speed, m/s (ft/min) | 9.91 (1950) | | |
| Compression ratio | 14.7:1 | | |
| Lube oil capacity, L (qt) | 154 (162.8) | | |
| Overspeed limit, rpm | 2100 ±50 | | |
| Regenerative power, kW | 82 | | |

## Fuel flow

| | | |
|---|---|---|
| Maximum fuel flow, L/hr (US gph) | 570 (150) | |
| Maximum fuel inlet restriction, kPa (in Hg) | 27 (8.0) | |
| Maximum fuel inlet temperature, °C (°F) | 66 (150) | |

## Air

| Air | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Combustion air, m³/min (scfm) | 88 (3150) | 81 (2880) | |
| Maximum air cleaner restriction, kPa (in $H_2O$) | 6.2 (25) | | |
| Alternator cooling air, m³/min (cfm) | 204 (7300) | | |

## Exhaust

| | | | |
|---|---|---|---|
| Exhaust flow at set rated load, m³/min (cfm) | 211 (7540) | 195 (6950) | |
| Exhaust temperature, °C (°F) | 477 (890) | 467 (873) | |
| Maximum back pressure, kPa (in $H_2O$) | 6.8 (27) | | |

## Standard set-mounted radiator cooling

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 56 (132.8) | | |
| Fan load, $kW_m$ (HP) | 33.1 (44.4) | | |
| Coolant capacity (with radiator), L (US gal) | 167 (44) | | |
| Cooling system air flow, m³/min (scfm) | 1097.5 (38753) | | |
| Total heat rejection, MJ/min (Btu/min) | 48.9 (46455) | 43.9 (41660) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |
| Maximum fuel return line restriction kPa (in Hg) | 67.5 (20) | | |

## Optional heat exchanger cooling

| | |
|---|---|
| Set coolant capacity, L (US gal) | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | |
| Total heat radiated to room, MJ/min (Btu/min) | |
| Maximum raw water pressure, jacket water circuit, kPa (psi) | |
| Maximum raw water pressure, aftercooler circuit, kPa (psi) | |
| Maximum raw water pressure, fuel circuit, kPa (psi) | |
| Maximum raw water flow, jacket water circuit, L/min (US gal/min) | |
| Maximum raw water flow, aftercooler circuit, L/min (US gal/min) | |
| Maximum raw water flow, fuel circuit, L/min (US gal/min) | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min) | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min) | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min) | |
| Raw water delta P at min flow, jacket water circuit, kPa (psi) | |
| Raw water delta P at min flow, aftercooler circuit, kPa (psi) | |
| Raw water delta P at min flow, fuel circuit, kPa (psi) | |
| Maximum jacket water outlet temp, °C (°F) | |
| Maximum aftercooler inlet temp, °C (°F) | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | |
| Maximum fuel return line restriction, kPa (in Hg) | |

## Optional remote radiator cooling[1]

| Optional remote radiator cooling[1] | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Max flow rate at max friction head, jacket water circuit, L/min (US gal/min) | 992 (262) | | |
| Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min) | 303 (80) | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | 22.67 (21500) | 21.01 (19925) | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | 18.35 (17400) | 15.69 (14885) | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | 6.1 (5753) | 5.6 (5301) | |
| Maximum friction head, jacket water circuit, kPa (psi) | 69 (10) | | |
| Maximum friction head, aftercooler circuit, kPa (psi) | 48 (7) | | |
| Maximum static head, jacket water circuit, m (ft) | 14 (46) | | |
| Maximum static head, aftercooler circuit, m (ft) | 14 (46) | | |
| Maximum jacket water outlet temp, °C (°F) | 104 (220) | 100 (212) | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | 41 (105) | | |
| Maximum aftercooler inlet temp, °C (°F) | 62 (143) | 56 (133) | |
| Maximum fuel flow, L/hr (US gph) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | 67.5 (20) | | |

## Weights[2]

| | |
|---|---|
| Unit dry weight kgs (lbs) | 7594 (16742) |
| Unit wet weight kgs (lbs) | 7857 (17322) |

**Notes**:

[1] For non-standard remote installations contact your local Cummins representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating factors

| | |
|---|---|
| **Standby** | Engine power available up to 701 m (2300 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18°F). |
| **Prime** | Engine power available up to 727 m (2385 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 3.5% per 305 m (1000 ft) and 7% per 10 °C (18 °F). |
| **Continuous** | |

## Ratings definitions

| Emergency Standby Power (ESP): | Limited-Time Running Power (LTP): | Prime Power (PRP): | Base Load (Continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. No sustained overload capability is available at this rating. |

## Alternator data

| Voltage | Connection[1] | Temp rise degrees C | Duty[2] | Single phase factor[3] | Max surge kVA[4] | Surge kW | Alternator data sheet | Feature code |
|---|---|---|---|---|---|---|---|---|
| 120/208-139/240 | 12-lead | 125/105 | S/P | | 4234 | 1019 | ADS-312 | B252 |
| 240/416-277/480 | 12-lead | 125/105 | S/P | | 4234 | 1019 | ADS-312 | B252 |
| 277/480 | Wye, 3-phase | 125/105 | S/P | | 3866 | 1018 | ADS-311 | B276 |
| 220/380-277/480 | Wye, 3-phase | 125/105 | S/P | | 4602 | 1018 | ADS-330 | B282 |
| 220/380-277/480 | Wye, 3-phase | 105/80 | S/P | | 4602 | 1018 | ADS-330 | B283 |
| 210/380-277/480 | Wye, 3-phase | 80 | S | | 5521 | 1024 | ADS-331 | B284 |
| 240/416-277/480 | Wye | 125/105 | S/P | | 4234 | 1019 | ADS-312 | B288 |
| 347/600 | 3-phase | 125/105 | S/P | | 3866 | 1021 | ADS-311 | B300 |
| 347/600 | 3-phase | 105/80 | S/P | | 4234 | 1024 | ADS-312 | B301 |
| 347/600 | 3-phase | 80 | S | | 4602 | 1004 | ADS-330 | B604 |

**Notes**:

[1] Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor[3]. All single phase ratings are at unity power factor.

[2] Standby (S), Prime (P) and Continuous ratings (C).

[3] Factor for the *Single phase output from Three phase alternator* formula listed below.

[4] Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

## Formulas for calculating full load currents:

**Three phase output**

$$\frac{kW \times 1000}{Voltage \times 1.73 \times 0.8}$$

**Single phase output**

$$\frac{kW \times SinglePhaseFactor \times 1000}{Voltage}$$

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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D-3332 (09/17)

750KW GENERATOR

**Specification sheet**

# Diesel generator set QSK23 series engine

600 kW - 800 kW 60 Hz

Standby

## Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime Power applications.

## Features

**Cummins heavy-duty engine -** Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

**Alternator -** Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Permanent Magnet Generator (PMG) -** Offers enhanced motor starting and fault clearing short circuit capability.

**Circuit breakers -** Option for manually-and/or electrically-operated circuit breakers.

**Control system -** The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency, and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Peer-to-peer paralleling -** For applications where two or more generators with PowerCommand 3.3 control can be combined with an electrically operated circuit breaker and a combination of transfer switch(s).

**Cooling system -** Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

**Enclosures -** Optional weather protective and sound attenuated enclosures are available.

**NFPA -** The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service -** Backed by a comprehensive warranty and worldwide distributor network.

| | Standby rating | Prime rating | Continuous rating | Data sheets |
|---|---|---|---|---|
| Model | 60 Hz kW (kVA) | 60 Hz kW (kVA) | 60 Hz kW (kVA) | 60 Hz |
| **DQCA** | 600 (750) | 545 (681) | | D-3352 |
| **DQCB** | 750 (938) | 680 (850) | | D-3353 |
| **DQCC** | 800 (1000) | 725 (906) | | D-3354 |

## Generator set specifications

| | |
|---|---|
| Governor regulation class | ISO8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | ± 0.5% |
| Random voltage variation | ± 0.5% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.25% |
| Radio frequency emissions compliance | IEC 61000-4-2: Level 4 electrostatic discharge<br>IEC 61000-4-3: Level 3 radiated susceptibility |

## Engine specifications

| | |
|---|---|
| Bore | 169.9 mm (6.69 in) |
| Stroke | 169.9 mm (6.69 in) |
| Displacement | 23.15 liters (1413 in$^3$) |
| Configuration | Cast iron, in line 6 cylinder |
| Battery capacity | 1400 amps minimum at ambient temperature of 0 °C to 10 °C (32 °F to 50 °F) |
| Battery charging alternator | 35 amps |
| Starting voltage | 24 volt, negative ground |
| Fuel system | Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff |
| Fuel filter | Spin-on fuel filters with water separator |
| Air cleaner type | Dry replaceable element with restriction indicator |
| Lube oil filter type(s) | Fleet guard dual venturi spin-on, combination full flow and bypass filters |
| Standard cooling system | High ambient radiator |

## Alternator specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip proof, revolving field |
| Stator | 2/3 pitch |
| Rotor | Single bearing flexible disc |
| Insulation system | Class H |
| Standard temperature rise | 125 ºC Standby at 40 °C ambient |
| Exciter type | Permanent Magnet Generator (PMG) |
| Phase rotation | A (U), B (V), C (W) |
| Alternator cooling | Direct drive centrifugal blower fan |
| AC waveform Total Harmonic Distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone Influence Factor (TIF) | < 50 per NEMA MG1-22.43 |
| Telephone Harmonic Factor (THF) | < 3% |

## Available voltages

**60 Hz Line-Neutral/Line-Line**

- 110/190
- 115/200
- 120/208
- 127/220
- 139/240
- 220/380
- 230/380
- 240/416
- 255/440
- 277/480
- 347/600

Note: Consult factory for other voltages.

## Generator set options and accessories

**Engine**
- 208/240/480 V coolant heater for ambient above 4.5 ºC (40 ºF)
- Fuel/water separator
- Heavy duty air cleaner

**Alternator**
- 80 °C rise
- 105 °C rise
- 125 °C rise
- 120/240 V anti-condensation heater
- Temperature sensor - alternator bearing RTD

**Control panel**
- PC3.3
- PC3.3 with MLD
- 120/240 V 100 W control anti-condensation heater
- Ground fault indication
- Remote fault signal package
- Run relay package
- Run time display

**Cooling system**
- 50 °C ambient

## Generator set options and accessories (continued)

**Exhaust system**

- Industrial grade exhaust silencer (12 to 18 dBA)
- Residential grade exhaust silencer (18 to 25 dBA)
- Critical grade exhaust silencer (25 to 35 dBA)
- Super critical exhaust silencer (35 to 45 dBA)

**Generator set**

- AC entrance box
- Battery
- Battery rack with hold-down
- Circuit breaker - set mounted
- Remote annunciator panel
- Spring isolators

- 2 year warranty
- 5 year warranty
- 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

## PowerCommand 2.3 – control system

**PowerCommand 2.3 control** - An integrated generator set control system providing voltage regulation, engine protection, generator protection, operator interface, and isochronous governing (optional).

**Control** - Provides battery monitoring and testing features and smart-starting control system.

**InPower™** - PC based service tool available for detailed diagnostics.

**PCCNet RS485** - Network interface (standard) to devices such as remote annunciator for NFPA 110 applications.

**Control boards** - Potted for environmental protection.

**Ambient operation** - Suitable for operation in ambient temperatures from -40 °C to +70 °C and altitudes to 13,000 feet (5000 meters).

**Prototype tested** - UL, CSA, and CE compliant.

**AC protection**

- AmpSentry protective relay
- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload
- Overload warning
- Reverse kW shutdown
- Reverse Var shutdown
- Short circuit protection

**Engine protection**

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (over crank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

**Operator/display panel**

- Manual off switch
- 128 x 128 alpha-numeric display with push button access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 ºC to +70 ºC

**Alternator data**

- Line-to-Neutral AC volts
- Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kVA, kW, power factor

**Engine data**

- DC voltage
- Lube oil pressure
- Coolant temperature

**Other data**

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)
- Total kilowatt hours
- Load profile

**Digital governing (optional)**

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

**Digital voltage regulation**

- Integrated digital electronic voltage regulator
- 3-phase Line-to-Line sensing
- Configurable torque matching
- Fault current regulation under single or three phase fault conditions

**Control functions**

- Time delay start and cool down
- Glow plug control (some models)
- Cycle cranking
- PCCNet interface
- (4) Configurable inputs
- (4) Configurable outputs
- Remote emergency stop
- Battle short mode
- Load shed
- Real time clock with exerciser
- Derate

**Options**

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand for Windows® remote monitoring software (direct connect)
- AC output analogue meters
- PowerCommand 2.3 and 3.3 control with AmpSentry protection

For further detail on PC 2.3, see document S-1569.
For further detail on PC 3.3, see document S-1570.

## Ratings definitions

**Emergency Standby Power (ESP)**:

Applicable for supplying power to varying electrical loads for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP)**:

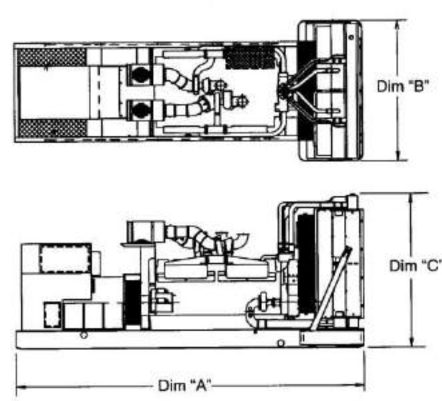
Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP)**:

Applicable for supplying power to varying electrical loads for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP)**:

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

## Dimensions and weights with standard cooling system

| Model | Dim 'A' (mm) (in.) | Dim 'B' (mm) (in.) | Dim 'C' (mm) (in.) | Set weight* dry (kg) (lbs) | Set weight* wet (kg) (lbs) |
|---|---|---|---|---|---|
| **DQCA** | 4395.4 (173) | 1855.5 (73) | 2065.7 (81) | 6075 (13395) | 6337 (13973) |
| **DQCB** | 4395.4 (173) | 1855.5 (73) | 2065.7 (81) | 6075 (13395) | 6337 (13973) |
| **DQCC** | 4395.4 (173) | 1855.5 (73) | 2065.7 (81) | 6075 (13395) | 6337 (13973) |

## Dimensions and weights with optional cooling system with seismic feature codes L228-2 and/or L225-2

| Model | Dim 'A' (mm) (in.) | Dim 'B' (mm) (in.) | Dim 'C' (mm) (in.) | Set weight* dry (kg) (lbs) | Set weight* wet (kg) (lbs) |
|---|---|---|---|---|---|
| **DQCA** | 4395.4 (173) | 1715 (68) | 2060.1 (81.1) | 6377 (14061) | 6518 (14372) |
| **DQCB** | 4395.4 (173) | 1715 (68) | 2060.1 (81.1) | 6377 (14061) | 6518 (14372) |
| **DQCC** | 4395.4 (173) | 1715 (68) | 2060.1 (81.1) | 6377 (14061) | 6518 (14372) |

* Weights represent a set with standard features. See outline drawings for weights of other configurations.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The generator set is available listed to UL 2200 for all 60 Hz low voltage models, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | **U.S. EPA** | Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation. |
| CSA | All low voltage models are CSA certified to product class 4215-01. | **International Building Code** | The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009, and IBC2012. |

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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## Generator Set Data Sheet

**Model:** DQCB
**Frequency:** 60 Hz
**Fuel Type:** Diesel
**kW Rating:** 750 Standby
680 Prime
**Emissions Level:** EPA NSPS Stationary Emergency Tier 2

| | |
|---|---|
| **Exhaust Emission Data Sheet:** | **EDS-1087** |
| **Exhaust Emission Compliance Sheet:** | **EPA-1121** |
| **Sound Data Sheet:** | **MSP-1159** |
| **Sound Data Sheet – with Seismic Feature Codes L228-2 (IBC) and/or L225-2 (OSHPD):** | **MSP-1013** |
| **Cooling System Data in various Ambient Conditions:** | **MCP-248** |
| **Cooling System Data in various Ambient Conditions – with Seismic Feature Codes L228-2 (IBC) and/or L225-2 (OSHPD):** | **MCP-174** |
| **Prototype Test Summary Data Sheet:** | **PTS-160** |

## Fuel Consumption

| | Standby | | | | Prime | | | | Continuous |
|---|---|---|---|---|---|---|---|---|---|
| | kW (kVA) | | | | kW (kVA) | | | | kW (kVA) |
| **Ratings** | 750 (938) | | | | 680 (850) | | | | |
| **Load** | **1/4** | **1/2** | **3/4** | **Full** | **1/4** | **1/2** | **3/4** | **Full** | **Full** |
| **US gph** | 16.0 | 28.0 | 40.0 | 51.0 | 15.0 | 25.0 | 36.5 | 48.0 | |
| **L/hr** | 60.6 | 106.0 | 151.4 | 193.1 | 56.8 | 94.6 | 138.2 | 181.7 | |

## Engine

| Engine | Standby Rating | Prime Rating | Continuous Rating |
|---|---|---|---|
| Engine manufacturer | Cummins Inc. | | |
| Engine model | QSK23-G7 NR2 | | |
| Configuration | Cast Iron, in line, 6 cylinder | | |
| Aspiration | Turbocharged and low temperature after-cooled | | |
| Gross engine power output, kWm (bhp) | 910 (1220) | 808 (1085) | |
| BMEP at set rated load, kPa (psi) | 2435 (353) | 2214 (321) | |
| Bore, mm (in.) | 170 (6.69) | | |
| Stroke, mm (in.) | 170 (6.69) | | |
| Rated speed, rpm | 1800 | | |
| Piston speed, m/s (ft/min) | 10.21 (2010) | | |
| Compression ratio | 16:1 | | |
| Lube oil capacity, L (qt) | 102 (108) | | |
| Overspeed limit, rpm | 2100 | | |
| Regenerative power, kW | 93 | | |

## Fuel Flow

| | | |
|---|---|---|
| Maximum fuel flow, L/hr (US gph) | 685 (181) | |
| Maximum fuel inlet restriction, kPa (in Hg) | 13.44 (4) | |
| Maximum fuel inlet temperature, °C (°F) | 71 (160) | |

## Air

| Air | Standby Rating | Prime Rating | Continuous Rating |
|---|---|---|---|
| Combustion air, $m^3$/min (scfm) | 64 (2242) | 62 (2189) | |
| Maximum air cleaner restriction, kPa (in $H_2O$) | 6.2 (25) | | |
| Alternator cooling air, $m^3$/min (cfm) | 117 (4156) | | |

## Exhaust

| | | | |
|---|---|---|---|
| Exhaust flow at set rated load, $m^3$/min (cfm) | 152 (5358) | 146 (5147) | |
| Exhaust temperature, °C (°F) | 476 (888) | 458 (856) | |
| Maximum back pressure, kPa (in $H_2O$) | 10.1 (40.8) | | |

## Standard Set-Mounted Radiator Cooling (Non-Seismic)

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 24 (32) | | |
| Coolant capacity (with radiator), L (US gal) | 109.5 (29) | | |
| Cooling system air flow, $m^3$/min (scfm) | 1069.8 (37779.6) | | |
| Total heat rejection, MJ/min (Btu/min) | 32.3 (30655) | 29.6 (28065) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |
| Maximum fuel return line restriction kPa (in Hg) | 30.47 (9) | | |

## Optional Set-Mounted Radiator Cooling (with Seismic Feature Codes L228-2 (IBC) and/or L225-2 (OSHPD))

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 27 (36) | | |
| Coolant capacity (with radiator), L (US gal) | 89 (23.5) | | |
| Cooling system air flow, $m^3$/min (scfm) | 1252 (44183) | | |
| Total heat rejection, MJ/min (Btu/min) | 32.3 (30655) | 29.6 (28065) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |
| Maximum fuel return line restriction, kPa (in Hg) | 30.47 (9) | | |

## Optional Heat Exchanger Cooling

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum raw water pressure, jacket water circuit, kPa (psi) | | | |
| Maximum raw water pressure, aftercooler circuit, kPa (psi) | | | |
| Maximum raw water pressure, fuel circuit, kPa (psi) | | | |
| Maximum raw water flow, jacket water circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, aftercooler circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, fuel circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min) | | | |
| Raw water delta P at min flow, jacket water circuit, kPa (psi) | | | |

| | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Raw water delta P at min flow, aftercooler circuit, kPa (psi) | | | |
| Raw water delta P at min flow, fuel circuit, kPa (psi) | | | |
| Maximum jacket water outlet temp, ℃ (℉) | | | |
| Maximum aftercooler inlet temp, ℃ (℉) | | | |
| Maximum aftercooler inlet temp at 25 ℃ (77 ℉) ambient, ℃ ( ℉) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Optional Remote Radiator Cooling[1]

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Max flow rate at max friction head, jacket water circuit, L/min (US gal/min) | | | |
| Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum friction head, jacket water circuit, kPa (psi) | | | |
| Maximum friction head, aftercooler circuit, kPa (psi) | | | |
| Maximum static head, jacket water circuit, m (ft) | | | |
| Maximum static head, aftercooler circuit, m (ft) | | | |
| Maximum jacket water outlet temp, ℃ (℉) | | | |
| Maximum aftercooler inlet temp at 25 ℃ (77 ℉) ambient, ℃ (℉) | | | |
| Maximum aftercooler inlet temp, ℃ (℉) | | | |
| Maximum fuel flow, L/hr (US gph) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Weights[2]

| | |
|---|---|
| Unit dry weight kgs (lbs) | 6075 (13395) |
| Unit wet weight kgs (lbs) | 6337 (13973) |

**Notes:**

[1] For non-standard remote installations contact your local Cummins representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating Factors

| | |
|---|---|
| **Standby** | Engine power available up to 1371 m (4497 ft) at ambient temperatures up to 40 ℃ (104 ℉). Above these elevations, derate at 4.4% per 305 m (1000 ft). Above 40 ℃ (104 ℉), derate 10% per 10 ℃ (18 ℉). |
| **Prime** | Engine power available up to 1084 m (3555 ft) at ambient temperatures up to 40 ℃ (104 ℉). Above these elevations, derate at 4.5% per 305 m (1000 ft). Above 40 ℃ (104 ℉), derate 20.9% per 10 ℃ (18 ℉). |
| **Continuous** | |

## Ratings Definitions

| Emergency Standby Power (ESP): | Limited-Time Running Power (LTP): | Prime Power (PRP): | Base Load (Continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. No sustained overload capability is available at this rating. |

## Alternator Data

| Voltage | Connection[1] | Temp Rise Degrees C | Duty[2] | Single Phase Factor[3] | Max surge kVA[4] | Winding No. | Alternator Data Sheet | Feature Code |
|---|---|---|---|---|---|---|---|---|
| 380-480 | Wye | 125/105 | S/P | | 3313 | 312 | ADS-310 | B282-2 |
| 220/380 | Wye | 105/80 | S/P | | 4234 | 311 | ADS-312 | B599-2 |
| 480 | Wye | 105/80 | S/P | | 3313 | 312 | ADS-310 | B600-2 |
| 480 | Wye | 80 | S | | 3866 | 312 | ADS-311 | B601-2 |
| 600 | Wye | 105/80 | S/P | | 3313 | 7 | ADS-310 | B603-2 |
| 600 | Wye | 80 | S/P | | 3866 | 7 | ADS-311 | B604-2 |
| 380 | Wye | 80 | S | | 4234 | 312 | ADS-312 | B660-2 |
| 480 | Wye | 125 | P | | 2944 | 312 | ADS-309 | B718-2 |
| 600 | Wye | 125 | P | | 2944 | 7 | ADS-309 | B720-2 |
| 190-480 | Wye | 125/105 | S/P | | 2944 | 311 | ADS-309 | B720-2 |
| 380-480 | Wye | 125/105 | S/P | | 3313 | 311 | ADS-310 | B731-2 |
| 208/416 | Wye | 105/80 | S/P | | 3866 | 311 | ADS-311 | B733-2 |
| 208/416 | Wye | 80 | S | | 4234 | 311 | ADS-312 | B734-2 |
| 400 | Wye | 105 | S | | 3866 | 312 | ADS-311 | B735-2 |
| 480 | Wye | 125 | S | | 2944 | 312 | ADS-309 | B738-2 |
| 600 | Wye | 125 | S | | 2944 | 7 | ADS-309 | B739-2 |
| 416 | Wye | 125/105 | S/P | | 3313 | 312 | ADS-310 | B741-2 |

**Notes**:

[1] Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor[3]. All single phase ratings are at unity power factor.

[2] Standby (S), Prime (P) and Continuous ratings (C).

[3] Factor for the *Single phase output from Three phase alternator* formula listed below.

[4] Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

## Formulas for Calculating Full Load Currents:

**Three phase output**

$$\frac{kW \times 1000}{Voltage \times 1.73 \times 0.8}$$

**Single phase output**

$$\frac{kW \times SinglePhaseFactor \times 1000}{Voltage}$$

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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D-3353 PDA056P768 (06/19)

500KW GENERATOR

**Specification sheet**

# Diesel generator set QSX15 series engine

450 kW – 500 kW Standby

## Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

## Features

**Cummins heavy-duty engine** - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Permanent Magnet Generator (PMG)** - Offers enhanced motor starting and fault clearing short-circuit capability.

**Control system** - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Cooling system** - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

**Enclosures** - Optional weather protective and sound attenuated enclosures are available.

**Fuel tanks** - Dual wall sub-base fuel tanks are also available.

**NFPA** - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

| | Standby rating | Prime rating | Continuous rating | Data sheets |
|---|---|---|---|---|
| Model | 60 Hz<br>kW (kVA) | 60 Hz<br>kW (kVA) | 60 Hz<br>kW (kVA) | 60 Hz |
| DFEJ | 450 (563) | 410 (513) | | D-3400 |
| DFEK | 500 (625) | 455 (569) | | D-3401 |

## Generator set specifications

| | |
|---|---|
| Governor regulation class | ISO 8528 part 1 Class G3 |
| Voltage regulation, no load to full load | ± 0.5% |
| Random voltage variation | ± 0.5% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.25% |
| EMS compatibility | IEC 61000-4-2: Level 4 Electrostatic discharge<br>IEC 61000-4-3: Level 3 Radiated susceptibility |

## Engine specifications

| | |
|---|---|
| Design | Turbocharged with air-to-air charge air-cooling |
| Bore | 136.9 mm (5.39 in.) |
| Stroke | 168.9 mm (6.65 in.) |
| Displacement | 14.9 L (912.0 $in^3$) |
| Cylinder block | Cast iron with replaceable wet liners, in-line 6 cylinder |
| Battery capacity | 1400 Amps minimum at ambient temperature 0 °C (32 °F) |
| Battery charging alternator | 35 Amps |
| Starting voltage | 24 volt, negative ground |
| Fuel system | Full authority electronic (FAE) Cummins HPI-TP |
| Fuel filter | |
| Air cleaner type | |
| Lube oil filter type(s) | Single spin-on combination full flow and bypass filters |
| Standard cooling system | 40 ºC (104 ºF) ambient radiator |

## Alternator specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip-proof revolving field |
| Stator | 2/3 pitch |
| Rotor | Single bearing, flexible discs |
| Insulation system | Class H |
| Standard temperature rise | 125 °C standby at 40 °C ambient |
| Exciter type | PMG (Permanent Magnet Generator) |
| Phase rotation | A (U), B (V), C (W) |
| Alternator cooling | Direct drive centrifugal blower fan |
| AC waveform total harmonic distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone influence factor (TIF) | < 50% per NEMA MG1-22.43 |
| Telephone harmonic factor (THF) | < 3% |

## Available voltages

**60 Hz Line – Neutral/Line - Line**

- 110/190
- 110/220
- 115/200
- 115/230
- 120/208
- 127/220
- 139/240
- 220/380
- 230/400
- 240/416
- 255/440
- 277/480
- 347/600

Note: Consult factory for other voltages.

## Generator set options

### Engine

- 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 °C (40°F)
- 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 °C (40°F)
- 120 V 300 W lube oil heater
- Heavy duty air cleaner with safety element

### Alternator

- 80 °C rise
- 105 °C rise
- 150 °C rise
- 120/240 V 200 W anti-condensation heater

### Exhaust system

- Critical grade exhaust silencer
- Exhaust packages
- Industrial grade exhaust silencer
- Residential grade exhaust silencer

### Fuel system

- 1022 L (270 gal) sub-base tank
- 1136 L (300 gal) sub-base tank
- 1514 L (400 gal) sub-base tank
- 1893 L (500 gal) sub-base tank
- 2271 L (600 gal) sub-base tank
- 2498 L (660 gal) sub-base tank
- 3218 L (850 gal) sub-base tank
- 6435 L (1700 gal) sub-base tank
- 9558 L (2525 gal) sub-base tank

### Cooling system

- High ambient 50 °C radiator

### Control panel

- PC 3.3
- PC 3.3 with MLD
- 120/240 V 100 W control anti-condensation heater
- Ground fault indication
- Remote fault signal package
- Run relay package

### Generator set

- AC entrance box
- Battery
- Battery charger
- Export box packaging
- UL 2200 Listed
- Main line circuit breaker
- Paralleling accessories
- Remote annunciator panel
- Spring isolators
- Enclosure: aluminium, steel, weather protective or sound attenuated
- 2 year standby power warranty
- 2 year prime power warranty
- 5 year basic power warranty
- 10 year major components warranty

*Note: Some options may not be available on all models - consult factory for availability.

## Control system 2.3

**The PowerCommand 2.3 control system** - An integrated generator set control system providing voltage regulation, engine protection, generator protection, operator interface and isochronous governing (optional).

**Control** – Provides battery monitoring and testing features and smart-starting control system.

**InPower™** – PC-based service tool available for detailed diagnostics.

**PCCNet RS485** – Network interface (standard) to devices such as remote annunciator for NFPA 110 applications.

**Control boards** – Potted for environmental protection.

**Ambient operation** – Suitable for operation in ambient temperatures from -40 °C to +70 °C and altitudes to 13,000 feet (5000 meters). Prototype tested - UL, CSA and CE compliant.

### AC protection

- AmpSentry protective relay
- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload
- Overload warning
- Reverse kW shutdown
- Reverse Var shutdown
- Short circuit protection

### Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

### Operator/display panel

- Manual off switch
- 128 x 128 Alpha-numeric display with push button access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating genset running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 ºC to +70 ºC

### Alternator data

- Line-to-Neutral AC volts
- Line-to-Line AC volts
- 3-phase AC current
- Frequency
- kVA, kW, power factor

### Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature

**Control functions**

- Time delay start and cool down
- Glow plug control (some models)
- Cycle cranking
- PCCNet interface
- (4) Configurable inputs
- (4) Configurable outputs
- Remote emergency stop
- Battle short mode
- Load shed
- Real time clock with exerciser
- Derate

**Digital governing (optional)**

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

**Digital voltage regulation**

- Integrated digital electronic voltage regulator
- 3-phase Line-to-Line sensing
- Configurable torque matching
- Fault current regulation under single or three phase fault conditions

**Other data**

- Genset model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)
- Total kilowatt hours
- Load profile

**Options**

- Auxiliary output relays (2)
- 120/240 V, 100 W anti-condensation heater
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand for Windows® remote monitoring software (direct connect)
- AC output analogue meters
- PowerCommand 2.3 and 3.3 control with AmpSentry protection

For further detail on PC 2.3 see document S-1569.

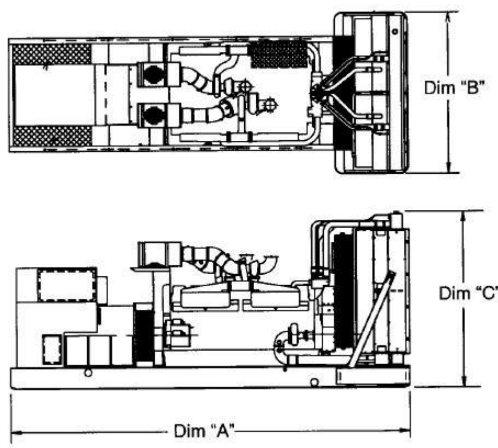
For further detail on PC 3.3 see document S-1570.

**Emergency Standby Power (ESP):**
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time running Power (LTP)**:
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP)**:
Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP)**:
Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




This outline drawing if for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

| Model | Dim 'A' mm (in.) | Dim 'B' mm (in.) | Dim 'C' mm (in.) | Set weight dry* kg (lbs) | Set weight wet* kg (lbs) |
|---|---|---|---|---|---|
| DFEJ | 3864 (152.1) | 1524 (60.0) | 1812 (71.3) | 4098 (9035) | 4234 (9335) |
| DFEK | 3864 (152.1) | 1524 (60.0) | 1812 (71.3) | 4325 (9535) | 4461 (9835) |

*Weights represent a set with standard features. See outline drawings for weights of other configurations.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | **U.S EPA** | Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation. |
| CSA | All low voltage models are CSA certified to product class 4215-01. | **International Building Code** | The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012. |

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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## Generator set data sheet

**Model:** DFEK
**Frequency:** 60
**Fuel type:** Diesel
**KW rating:** 500 standby
455 prime
**Emissions level:** EPA NSPS Stationary Emergency Tier 2

| | |
|---|---|
| **Exhaust emission data sheet:** | **EDS-173** |
| **Exhaust emission compliance sheet:** | **EPA-1005** |
| **Sound performance data sheet:** | **MSP-177** |
| **Cooling performance data sheet:** | **MCP-105** |
| **Prototype test summary data sheet:** | **PTS-145** |
| **Standard set-mounted radiator cooling outline:** | **0500-3326** |
| **Optional set-mounted radiator cooling outline:** | |
| **Optional heat exchanger cooling outline:** | |
| **Optional remote radiator cooling outline:** | |

## Fuel consumption

| | **Standby** | | | | **Prime** | | | | **Continuous** |
|---|---|---|---|---|---|---|---|---|---|
| | **kW (kVA)** | | | | **kW (kVA)** | | | | **kW (kVA)** |
| **Ratings** | 500 (625) | | | | 455 (569) | | | | |
| **Load** | **1/4** | **1/2** | **3/4** | **Full** | **1/4** | **1/2** | **3/4** | **Full** | **Full** |
| **US gph** | 11.6 | 18.8 | 25.7 | 34.4 | 10.9 | 17.6 | 23.7 | 30.4 | |
| **L/hr** | 44 | 71 | 97 | 130 | 41 | 67 | 90 | 115 | |

## Engine

| | **Standby rating** | **Prime rating** | **Continuous rating** |
|---|---|---|---|
| Engine manufacturer | Cummins Inc. | | |
| Engine model | QSX15-G9 | | |
| Configuration | Cast iron with replaceable wet cylinder liners, in-line 6 cylinder | | |
| Aspiration | Turbocharged with air-to-air charge air cooling | | |
| Gross engine power output, kWm (bhp) | 563.0 (755.0) | 507.3 (680.0) | |
| BMEP at set rated load, kPa (psi) | 2433.9 (353.0) | 2213.2 (321.0) | |
| Bore, mm (in) | 136.9 (5.39) | | |
| Stroke, mm (in) | 168.9 (6.65) | | |
| Rated speed, rpm | 1800 | | |
| Piston speed, m/s (ft/min) | 10.1 (1995.0) | | |
| Compression ratio | 17.0:1 | | |
| Lube oil capacity, L (qt) | 83.3 (88.0) | | |
| Overspeed limit, rpm | 2150 ± 50 | | |
| Regenerative power, kW | 52.00 | | |

## Fuel flow

| | | |
|---|---|---|
| Fuel flow at rated load, L/hr (US gph) | 423.9 (112.0) | |
| Maximum inlet restriction, mm Hg (in Hg) | 127.0 (5.0) | |
| Maximum return restriction, mm Hg (in Hg) | 165.1 (6.5) | |

## Air

| Air | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Combustion air, m3/min (scfm) | 41.6 (1470.0) | 38.8 (1370.0) | |
| Maximum air cleaner restriction, kPa (in H2O) | 6.2 (25.0) | | |
| Alternator cooling air, m3/min (scfm) | 62.0 (2190.0) | | |

## Exhaust

| | | | |
|---|---|---|---|
| Exhaust flow at set rated load, $m^3$/min (cfm) | 102.6 (3625.0) | 88.7 (3135.0) | |
| Exhaust temperature, ° C (° F) | 482.8 (901.0) | 466.7 (872.0) | |
| Maximum back pressure, kPa (in $H_2O$) | 10.2 (41.0) | | |

## Standard set-mounted radiator cooling

| | | | |
|---|---|---|---|
| Ambient design, ° C (° F) | 40 (104) | | |
| Fan load, $kW_m$ (HP) | 19 (25.5) | | |
| Coolant capacity (with radiator), L (US Gal) | 57.9 (15.3) | | |
| Cooling system air flow, $m^3$/min (scfm) | 707.5 (25000.0) | | |
| Total heat rejection, MJ/min (Btu/min) | 19.6 (18485.0) | 17.7 (16680.0) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |

## Optional set-mounted radiator cooling

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 19 (25.5) | | |
| Coolant capacity (with radiator), L (US gal) | 57.9 (15.3) | | |
| Cooling system air flow, $m^3$/min (scfm) | 707.5 (25000.0) | | |
| Total heat rejection, MJ/min (Btu/min) | 19.6 (18485.0) | 17.7 (16680.0) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |

## Optional heat exchanger cooling

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US Gal.) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum raw water pressure, jacket water circuit, kPa (psi) | | | |
| Maximum raw water pressure, aftercooler circuit, kPa (psi) | | | |
| Maximum raw water pressure, fuel circuit, kPa (psi) | | | |
| Maximum raw water flow, jacket water circuit, L/min (US Gal/min) | | | |
| Maximum raw water flow, aftercooler circuit, L/min (US Gal/min) | | | |
| Maximum raw water flow, fuel circuit, L/min (US Gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US Gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US Gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US Gal/min) | | | |
| Raw water delta P at min flow, jacket water circuit, kPa (psi) | | | |
| Raw water delta P at min flow, aftercooler circuit, kPa (psi) | | | |
| Raw water delta P at min flow, fuel circuit, kPa (psi) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C ( °F) | | | |

## Optional remote radiator cooling[1]

| | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Max flow rate at max friction head, jacket water circuit, L/min (US gal/min) | | | |
| Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum friction head, jacket water circuit, kPa (psi) | | | |
| Maximum friction head, aftercooler circuit, kPa (psi) | | | |
| Maximum static head, jacket water circuit, m (ft) | | | |
| Maximum static head, aftercooler circuit, m (ft) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum fuel flow, L/hr (US gph) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Weights[2]

| | |
|---|---|
| Unit dry weight kgs (lbs) | 4325 (9535) |
| Unit wet weight kgs (lbs) | 4461 (9835) |

**Notes**:
[1] For non-standard remote installations contact your local Cummins Power Generation representative.
[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating factors

| | |
|---|---|
| **Standby** | Genset may be operated up to 640 m (2100 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 1150 m (3770 ft), derate by 3.8% per 305 m (1000 ft), and 6.1% per 10 °C (3.4% per 10 °F). Above 1150 m (3770 ft) up to 1680 m (5510 ft), derate 6.3% total for 1150 m (3770 ft) plus 1.6% per 305 m (1000 ft) over 1150 m (3770 ft) and 3.8% per 10 °C (2.2% per 10 °F). Above 1680 m (5510 ft), up to 3000 m (9840 ft), derate 9.0% total for 1680 m (5510 ft) plus 3.7% per 305 m (1000 ft) and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 24.8% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) above 3000 m (9840 ft) and 10% per 10 °C (5.6% per 10 °F). |
| **Prime** | Genset may be operated up to 640 m (2100 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 1150 m (3770 ft), derate by 3.8% per 305 m (1000 ft), and 6.1% per 10 °C (3.4% per 10 °F). Above 1150 m (3770 ft) up to 1680 m (5510 ft), derate 6.3% total for 1150 m (3770 ft) plus 1.6% per 305 m (1000 ft) over 1150 m (3770 ft) and 3.8% per 10 °C (2.2% per 10 °F). Above 1680 m (5510 ft), up to 3000 m (9840 ft), derate 9.0% total for 1680 m (5510 ft) plus 3.7% per 305 m (1000 ft) and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 24.8% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) above 3000 m (9840 ft) and 10% per 10 °C (5.6% per 10 °F). |
| **Continuous** | |

## Ratings definitions

| Emergency standby power (ESP): | Limited-time running power (LTP): | Prime power (PRP): | Base load (continuous) power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

## Alternator data

| Three Phase Table[1] | | 105 °C | 105 °C | 105 °C | 125 °C | 125 °C | 125 °C | 125 °C | 125 °C | 150 °C | 150 °C | 150 °C | 150 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature Code | | B262 | B301 | B252 | B258 | B252 | B414 | B246 | B300 | B426 | B413 | B424 | B419 |
| Alternator Data Sheet Number | | 308 | 307 | 307 | 308 | 307 | 308 | 306 | 306 | 307 | 307 | 305 | 306 |
| Voltage Ranges | | 110/190 thru 139/240 220/380 Thru 277/480 | 347/600 | 120/208 Thru 139/240 240/416 Thru 277/480 | 110/190 Thru 139/240 220/380 Thru 277/480 | 120/208 Thru 139/240 240/416 Thru 277/480 | 120/208 Thru 139/240 240/416 Thru 277/480 | 277/480 | 347/600 | 110/190 Thru 139/240 220/380 Thru 277/480 | 120/208 Thru 139/240 240/416 Thru 277/480 | 277/480 | 347/600 |
| Surge kW | | 514 | 517 | 514 | 514 | 514 | 516 | 515 | 515 | 512 | 514 | 512 | 515 |
| Motor Starting kVA (at 90% sustained voltage) | Shunt | | | | | | | | | | | | |
| | PMG | 2429 | 2208 | 2208 | 2429 | 2208 | 2429 | 1896 | 1896 | 2208 | 2208 | 1749 | 1896 |

| Full Load Current Amps at Standby Rating | 110/190 | 120/208 | 110/220 | 115/230 | 139/240 | 220/380 | 230/400 | 240/416 | 255/440 | 277/480 | 347/600 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1901 | 1737 | 1642 | 1571 | 1505 | 951 | 903 | 868 | 821 | 753 | 602 | |

**Note:**

[1] Single phase power can be taken from a three phase generator set at up to 40% of the generator set nameplate kW rating at unity power factor.

## Formulas for calculating full load currents:

**Three phase output**

$$\frac{kW \times 1000}{Voltage \times 1.73 \times 0.8}$$

**Single phase output**

$$\frac{kW \times SinglePhaseFactor \times 1000}{Voltage}$$

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Power Generation

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250KW GENERATOR

**Specification Sheet**

# Diesel Generator Set QSL9-G7 Series Engine

250 kW - 300 kW Standby


## Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime Power applications.

## Features

**Cummins heavy-duty engine** - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Control system** - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Cooling system** - Standard cooling package provides reliable running at the rated power level.

**Enclosures** - Optional weather protective and sound attenuated enclosures are available.

**Fuel tanks** - Dual wall sub-base fuel tanks are also available.

**NFPA** - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

| | Standby rating | | Prime rating | | Continuous rating | | Data sheets | |
|---|---|---|---|---|---|---|---|---|
| Model | 60 Hz kW (kVA) | 50 Hz kW (kVA) | 60 Hz kW (kVA) | 50 Hz kW (kVA) | 60 Hz kW (kVA) | 50 Hz kW (kVA) | 60 Hz | 50 Hz |
| DQDAA | 250 (313) | | 225 (281) | | | | D-3442 | |
| DQDAB | 275 (344) | | 250 (313) | | | | D-3443 | |
| DQDAC | 300 (375) | | 270 (338) | | | | D-3444 | |

## Generator Set Specifications

| | |
|---|---|
| Governor regulation class | ISO 8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | ± 0.5% |
| Random voltage variation | ± 0.5% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.5% |
| Radio frequency emissions compliance | IEC 801.2 through IEC 801.5; MIL-STD-461C, Part 9 |

## Engine Specifications

| | |
|---|---|
| Bore | 114.0 mm (4.49 in) |
| Stroke | 145 mm (5.69 in) |
| Displacement | 8.9 L (543 $in^3$) |
| Configuration | Cast iron, in-line 6 cylinder |
| Battery capacity | 750 amps minimum at ambient temperature of -18 °C (-0.4 °F) and above |
| Battery charging alternator | 70 amps |
| Starting voltage | 24 volt, negative ground |
| Fuel system | Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff |
| Fuel filter | Dual element with water separator |
| Air cleaner type | Normal duty |
| Lube oil filter type(s) | Single spin-on, combination full flow and bypass filters |
| Standard cooling system | High ambient radiator |

## Alternator Specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip proof revolving field |
| Stator | 2/3 pitch |
| Rotor | Single bearing, flexible discs |
| Insulation system | Class H |
| Standard temperature rise | 125 °C Standby, 105 ºC Prime |
| Exciter type | Permanent Magnet Generator (PMG) |
| Phase rotation | A (U), B (V), C (W) |
| Alternator cooling | Direct drive centrifugal blower |
| AC waveform Total Harmonic Distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone Influence Factor (TIF) | < 50 per NEMA MG1-22.43 |
| Telephone Harmonic Factor (THF) | < 3 |

## Available Voltages

| **60 Hz** 3-phase | | | **50 Hz** 3-phase | |
|---|---|---|---|---|
| Reconnectable | | Non-Reconnectable | Reconnectable | Non-Reconnectable |
| • 110/90<br>• 139/240<br>• 240/416 | • 120/208<br>• 120/240<br>• 254/440 | • 277/480<br>• 347/600 | | |

Note: Consult factory for other voltages.

## Generator Set Options and Accessories

**Engine**

- 120/240 V 1500 W coolant heater
- 120/240 V 150 W lube oil heater
- Heavy duty air cleaner
- Engine oil temperature

**Control panel**

- 120/240 V 100 W control anti-condensation heater
- Exhaust pyrometer
- Ground fault indication
- Remote fault signal package
- Run relay package
- Paralleling configuration

**Alternator**

- 105 °C rise
- 125 °C rise
- 120/240 V 100 W anti-condensation heater
- PMG excitation
- Single phase

**Exhaust system**

- Genset mounted muffler
- Heavy duty exhaust elbow
- Slip on exhaust connection
- NPT exhaust connection

**Fuel system**

- 1022 L (270 gal) sub-base tank
- 1136 L (300 gal) sub-base tank
- 1514 L (400 gal) sub-base tank
- 1893 L (500 gal) sub-base tank
- 2271 L (600 gal) sub-base tank
- 2498 L (660 gal) sub-base tank
- 2725 L (720 gal) sub-base tank
- 5565 L (1470 gal) sub-base tank

**Generator set**

- AC entrance box
- Battery
- Battery charger
- Export box packaging
- UL 2200 Listed
- Main line circuit breaker
- PowerCommand network
- Communications Module (NCM)
- Remote annunciator panel
- Spring isolators
- Enclosure: aluminum, steel, weather protective or sound attenuated
- 2 year Standby power warranty
- 2 year Prime power warranty
- 5 year Basic power warranty
- 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

# Control System PCC 2100

**PowerCommand** control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ protective relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Standard PCCNet™ and optional Echelon® LonWorks® network interface.
- Control suitable for operation in ambient temperatures from -40 ℃ to +70 ℃ (-40 ℉ to +158 ℉) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

**Operator/display panel**

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating genset running, not in auto, common warning, common shutdown
- Configurable LED lamps (5)
- Configurable for local language

**Engine protection**

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning (some models)
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant -start disconnect
- Cranking lockout
- Sensor failure indication

**Engine data**

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature (some models)
- Engine speed

**AmpSentry AC protection**

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down
- Excitation fault

**Alternator data**

- Line-to-Line and Line-to-Neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA

**Other data**

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history
- Load profile (hours less than 30% and hours more than 90% load)
- System data display (optional with network and other PowerCommand gensets or transfer switches)

**Governing**

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode
- Glow plug control (some models)

**Voltage regulation**

- Digital PWM electronic voltage regulation
- Three phase Line-to-Neutral sensing
- Suitable for PMG or shunt excitation
- Single and three phase fault regulation
- Configurable torque matching

**Control functions**

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- Configurable customer inputs (4)
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

**Options**

- LED bargraph AC data display
- Thermostatically controlled space heater
- Key-type mode switch
- Ground fault module
- Auxiliary relays (3)
- Echelon LONWORKS interface
- Modlon Gateway to convert to Modbus (loose)
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Digital input and output module(s) (loose)
- Remote annunciator (loose)

For further detail see document S-1409.

## Ratings Definitions

**Emergency Standby Power (ESP)**:

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP)**:

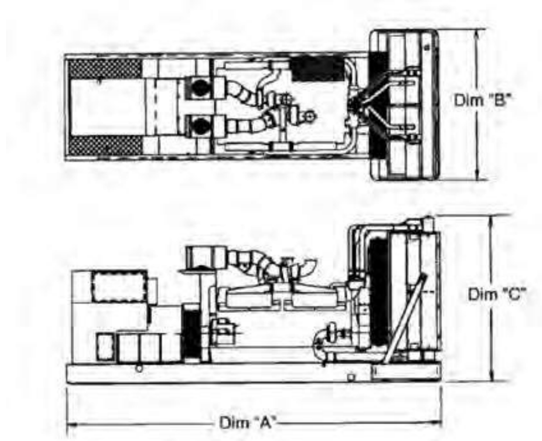
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP)**:

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP)**:

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

## Dimensions and weights with standard cooling system

| Model | Dim "A" mm (in.) | Dim "B" mm (in.) | Dim "C" mm (in.) | Estimated set weight* dry kg (lbs) | Estimated set weight* wet kg (lbs) |
|---|---|---|---|---|---|
| **DQDAA** | 3023 (119.0) | 1270 (50.0) | 1617 (64.0) | 2184 (4814) | 2234 (4926) |
| **DQDAB** | 3023 (119.0) | 1270 (50.0) | 1617 (64.0) | 2184 (4814) | 2234 (4926) |
| **DQDAC** | 3023 (119.0) | 1270 (50.0) | 1617 (64.0) | 2319 (5113) | 2370 (5225) |

## Dimensions and weights with optional cooling system with seismic feature codes L228-2 and/or L225-2

| Model | Dim "A" mm (in.) | Dim "B" mm (in.) | Dim "C" mm (in.) | Estimated set weight* dry kg (lbs) | Estimated set weight* wet kg (lbs) |
|---|---|---|---|---|---|
| **DQDAA** | 3023 (119.0) | 1270 (50.0) | 1676 (66.0) | 2184 (4814) | 2234 (4926) |
| **DQDAB** | 3023 (119.0) | 1270 (50.0) | 1676 (66.0) | 2184 (4814) | 2234 (4926) |
| **DQDAC** | 3023 (119.0) | 1270 (50.0) | 1676 (66.0) | 2319 (5113) | 2370 (5225) |

*Note: Weights represent a set with standard features. See outline drawings for weights of other configurations.

## Codes and Standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | U.S. EPA | Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards,40 CFR 60 subpart IIII Tier 3 exhaust emission levels. U.S. applications must be applied per this EPA regulation. |
| | All low voltage models are CSA certified to product class 4215-01. | International Building Code | The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012. |

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

**Our energy working for you.™**

## Generator set data sheet

| | |
|---|---|
| **Model:** | **DQDAA** |
| **Frequency:** | **60 Hz** |
| **Fuel type:** | **Diesel** |
| **kW rating:** | **250 Standby**<br>**225 Prime** |
| **Emissions level:** | **EPA NSPS Stationary Emergency Tier 3** |

| | |
|---|---|
| **Exhaust emission data sheet:** | **EDS-1073** |
| **Exhaust emission compliance sheet:** | **EPA-1101** |
| **Sound performance data sheet:** | **MSP-1026** |
| **Cooling performance data sheet:** | **MCP-163** |
| **Prototype test summary data sheet:** | **PTS-164** |
| **Standard set-mounted radiator cooling outline:** | **A048R355** |
| **Optional set-mounted radiator cooling outline with seismic feature codes L228-2 (IBC) or L225-2 (OSHPD):** | **A041F591** |

## Fuel consumption

| | Standby | | | | Prime | | | | Continuous |
|---|---|---|---|---|---|---|---|---|---|
| | **kW (kVA)** | | | | **kW (kVA)** | | | | **kW (kVA)** |
| **Ratings** | 250 (313) | | | | 225 (281) | | | | |
| **Load** | **1/4** | **1/2** | **3/4** | **Full** | **1/4** | **1/2** | **3/4** | **Full** | **Full** |
| **US gph** | 6.0 | 10.5 | 15.1 | 19.6 | 5.5 | 9.5 | 13.6 | 17.7 | |
| **L/hr** | 22.5 | 39.7 | 56.9 | 74.2 | 20.7 | 36.1 | 51.5 | 67.0 | |

## Engine

| Engine | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Engine manufacturer | Cummins Inc. | | |
| Engine model | QSL9-G7 | | |
| Configuration | Cast iron, in-line 6 cylinder | | |
| Aspiration | Turbocharged and after-cooled | | |
| Gross engine power output, $kW_m$ (bhp) | 346 (464) | 312 (419) | |
| BMEP at set rated load, kPa (psi) | 2606 (378) | 2351 (341) | |
| Bore, mm (in.) | 114.0 (4.49) | | |
| Stroke, mm (in.) | 145 (5.69) | | |
| Rated speed, rpm | 1800 | | |
| Piston speed, m/s (ft/min) | 8.7 (1707.0) | | |
| Compression ratio | 16.1:1 | | |
| Lube oil capacity, L (qt) | 30.0 (31.7) | | |
| Overspeed limit, rpm | 2070 ± 50 | | |
| Regenerative power, kW | 35.00 | | |

## Fuel flow

| | | |
|---|---|---|
| Maximum fuel flow, L/hr (US gph) | 138.1 (36.5) | |
| Maximum fuel inlet restriction, mm Hg (in Hg) | 152.4 (6.0) | |
| Maximum return restriction, mm Hg (in Hg) | 254.0 (10.0) | |

## Air

| Air | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Combustion air, $m^3$/min (scfm) | 22.3 (787) | 20.8 (733) | |
| Maximum air cleaner restriction, kPa (in $H_2O$) | 6.2 (25.0) | | |
| Alternator cooling air, $m^3$/min (cfm) | 59.4 (2100.0) | | |

## Exhaust

| | | | |
|---|---|---|---|
| Exhaust flow at set rated load, $m^3$/min (cfm) | 54.6 (1927) | 50.8 (1796) | |
| Exhaust temperature, °C (°F) | 525 (977) | 495 (923) | |
| Maximum back pressure, kPa (in $H_2O$) | 10.2 (41.0) | | |

## Standard set-mounted radiator cooling (non-seismic)

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 26.09 (35) | | |
| Coolant capacity (with radiator), L (US gal) | 34.29 (9.06) | | |
| Cooling system air flow, $m^3$/min (scfm) | 427.58 (15100) | | |
| Total heat rejection, MJ/min (Btu/min) | 8.93 (8467.0) | 8.55 (8104.0) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |

## Optional set-mounted radiator cooling (with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 27.8 (37.2) | | |
| Coolant capacity (with radiator), L (US gal) | 30.3 (8.0) | | |
| Cooling system air flow, $m^3$/min (scfm) | 568.1 (20075.0) | | |
| Total heat rejection, MJ/min (Btu/min) | 8.93 (8467.0) | 8.55 (8104.0) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |

## Optional heat exchanger cooling

| | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum raw water pressure, jacket water circuit, kPa (psi) | | | |
| Maximum raw water pressure, aftercooler circuit, kPa (psi) | | | |
| Maximum raw water pressure, fuel circuit, kPa (psi) | | | |
| Maximum raw water flow, jacket water circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, aftercooler circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, fuel circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min) | | | |
| Raw water delta P at min flow, jacket water circuit, kPa (psi) | | | |
| Raw water delta P at min flow, aftercooler circuit, kPa (psi) | | | |
| Raw water delta P at min flow, fuel circuit, kPa (psi) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | | | |

## Optional remote radiator cooling[1]

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Max flow rate at max friction head, jacket water circuit, L/min (US gal/min) | | | |
| Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum friction head, jacket water circuit, kPa (psi) | | | |
| Maximum friction head, aftercooler circuit, kPa (psi) | | | |
| Maximum static head, jacket water circuit, m (ft) | | | |
| Maximum static head, aftercooler circuit, m (ft) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum fuel flow, L/hr (US gph) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Weights[2]

| | |
|---|---|
| Unit dry weight kgs (lbs) | 2184 (4814) |
| Unit wet weight kgs (lbs) | 2234 (4926) |

**Notes**:

[1] For non-standard remote installations contact your local Cummins representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating factors

| | |
|---|---|
| **Standby** | Engine power available up to 1494 m (4900 ft) at ambient temperature up to 40 °C (104 °F). Above these elevations, derate at 7% per 400m (1312 ft). Above 40 °C (104 °F) derate 5.5% per 10 °C (18 °F). Derates must be combined when both altitude of 1494 m (4900 ft) and temperature of 40 °C (104 °F) are exceeded. |
| **Prime** | Engine power available up to 1452 m (4764 ft) at ambient temperature up to 40 °C (104 °F). Above these elevations, derate at 7% per 400m (1312 ft). Above 40 °C (104 °F) derate 5.5% per 10 °C (18 °F). Derates must be combined when both altitude of 1452 m (4764 ft) and temperature of 40 °C (104 °F) are exceeded. |
| **Continuous** | |

## Ratings definitions

| Emergency Standby Power (ESP): | Limited-Time Running Power (LTP): | Prime Power (PRP): | Base Load (Continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

## Alternator data

| Three phase table[1] | | 80 °C | 80 °C | 80 °C | 80 °C | 105 °C | 105 °C | 105 °C | 125 °C | 125 °C | 125 °C | 125 °C | 125 °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature code | | B260 | B257 | B251 | B302 | B259 | B256 | B301 | B258 | B252 | B246 | B247 | B300 |
| Alternator data sheet number | | 342 | 341 | 341 | 341 | 341 | 341 | 340 | 341 | 340 | 340 | 340 | 340 |
| Voltage ranges | | 110/190 thru 139/240 220/380 thru 277/480 | 120/208 thru 139/240 240/416 thru 277/480 | 277/480 | 347/600 | 110/190 thru 139/240 220/380 thru 277/480 | 120/208 thru 139/240 240/416 thru 277/480 | 347/600 | 110/190 thru 139/240 220/380 thru 277/480 | 120/208 thru 139/240 240/416 thru 277/480 | 277/480 | 277/480 | 347/600 |
| Surge kW | | 322 | 322 | 322 | 322 | 322 | 322 | 322 | 322 | 322 | 322 | 322 | 322 |
| Motor starting kVA (at 90% sustained voltage) | Shunt | | | | | | | | | | | | |
| | PMG | 1372 | 1210 | 1210 | 1210 | 1210 | 1210 | 1028 | 1210 | 1028 | 1028 | 1028 | 1028 |

| Full load current - amps at Standby rating | 120/208 | 127/220 | 139/240 | 220/380 | 240/416 | 254/440 | 277/480 | 347/600 |
|---|---|---|---|---|---|---|---|---|
| | 867 | 820 | 752 | 475 | 434 | 410 | 376 | 301 |

**Note**:

[1] Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor. Also see Note 3 below

## Formulas for calculating full load currents:

**Three phase output**

$$\frac{kW \times 1000}{Voltage \times 1.73 \times 0.8}$$

**Single phase output**

$$\frac{kW \times SinglePhaseFactor \times 1000}{Voltage}$$

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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D-3442 (10/17)

Specification Sheet

# Enclosures and Tanks

250-1000 kW Gensets

## Enclosure Standard Features

- 14-gauge steel construction (panels)
- Stainless steel hardware
- Zinc phosphate pretreatment, e-coat primer and super durable powder topcoat paint minimize corrosion and color fade
- Package listed to UL 2200
- Designed to satisfy national electrical code installation requirements
- Fuel and electrical stub-up area within enclosure perimeter
- Fixed louvers
- Cambered roof prevents water accumulation
- Recessed, lockable doors in two sides
- Retainers hold doors open for easy access
- Enclosed exhaust silencer ensures safety and protects against rust
- Rain cap
- Exterior oil and coolant drains with interior valves for ease of service
- Rodent barriers on inlet
- Non-hydroscopic sound attenuating material
- Side mounted controls and circuit breakers
- Easy access lifting points for spreader bars
- Dual vibration isolation system (250-500 kW)
- Spring vibration isolation system (600-1000 kW)
- Enclosure mounts to lifting base or fuel tank (250-500 kW)
- Enclosure mounts to lifting base (600-1000 kW)
- Factory pre-assembled package
- Designed for outdoor use only
- Externally mounted emergency stop button for operator safety (optional on 250-500 kW)
- Horizontal air discharge to prevent leaf and snow accumulation (600-1000 kW)

## Options

- Three levels of sound attenuation
- Motorized louvers to protect from ice and snow accumulation (available on air inlet for all models and on air outlet on level II, 250-500 kW enclosures only)
- Horizontal air discharge, sound level 2 only (250-500 kW)
- Aluminium construction with roll-coated polymer paint
- Wind rated to 150 mph
- Neutral sandstone paint color
- Factory mounted battery charger
- External 120 VAC service outlet
- Rain hoods for air inlet (250-500 kW)
- Lifting base in lieu of a sub-base tank (250-500 kW)
  - Pre-wired AC distribution package
  - 100 amp (250-500 kW) or 150 amp (600-1000 kW) main circuit breaker; connected to 120 VAC Line-Neutral and 208 or 240 VAC Line-Line, spare breaker positions and capacity for future upgrades (600-1000 kW)
  - GFCI protected internal 120 VAC service receptacle
  - GFCI protected weather proof external 120 volt service receptacle
  - All factory installed AC powered features pre-wired into load center
- Interior lights – 120 volt (600-1000 kW)
- Rain hoods for air inlet (250-500 kW)
- Seismic isolators available (600-1000 kW)

## Fuel Tanks

**Standard sub-base tank features**

- UL 142 Listed
- ULC-S601-07 Listed
- NFPA37 compliant
- Dual walled, steel construction
- Emergency tank and rupture basin vents
- Tank mounted mechanical fuel gauge
- Fuel supply and return tubes
- Top mounted leak detection float switch
- Low and high level fuel switches
- Mounting brackets for optional pump and control (250-500 kW)
- Integral lifting points

**Sub-base tank options**

- Pre-wired fuel pump and control
- Fuel overfill alarm – internal or external
- Overflow and tank fill plugs
- Five gallon spill fill box – internal or external
- Fill pipe extender
- Local code approvals available

## 200-500 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

| Genset model (60 Hz) | Gallons /hour at full load | 270 gallon tank | 300 gallon tank | 400 gallon tank | 500 gallon tank | 600 gallon tank | 660 gallon tank | 720 gallon tank | 850 gallon tank | 1420 gallon tank | 1470 gallon tank | 1700 gallon tank | 2050 gallon tank | 2525 gallon tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 DQDAA | 20 | 14 | 15 | 20 | 25 | 30 | 33 | 36 | | 72 | 74 | | 104 | |
| 275 DQDAB | 21 | 13 | 14 | 19 | 24 | 29 | 31 | 34 | | 66 | 70 | | 96 | |
| 300 DQDAC | 23 | 12 | 13 | 17 | 22 | 26 | 29 | 31 | | 61 | 64 | | 88 | |
| 300 DQHAB | 23 | 12 | 13 | 17 | 22 | 26 | 29 | | 37 | | | 74 | | |
| 450 DFEJ | 30 | 9 | 10 | 13 | 17 | 20 | 22 | | 28 | | | 57 | | 84 |
| 500 DFEK | 34 | 8 | 9 | 11 | 15 | 18 | 19 | | 25 | | | 50 | | 74 |

Operating hours are measured at 60 Hz, standby rating.

## 600-1000 kW Dual Wall Sub-base Fuel Tanks – usable operating hours

| Genset model | Gallons /hour at full load | 200 gallon tank | 660 gallon tank | 1000 gallon tank | 1500 gallon tank | 2000 gallon tank | 2400 gallon tank |
|---|---|---|---|---|---|---|---|
| 600 DQCA | 42 | 5 | 16 | 24 | 36 | 48 | 57 |
| 600 DQPAA | 45 | 4 | 15 | 22 | 33 | 44 | 53 |
| 650 DQPAB | 50 | 4 | 13 | 20 | 30 | 40 | 48 |
| 750 DQCB | 51 | 4 | 13 | 20 | 29 | 39 | 47 |
| 750 DQFAA | 53 | 4 | 12 | 19 | 28 | 38 | 45 |
| 800 DQCC | 53 | 4 | 12 | 19 | 28 | 38 | 45 |
| 800 DQFAB | 56 | 4 | 12 | 18 | 27 | 36 | 43 |
| 900 DQFAC | 64 | 3 | 10 | 16 | 23 | 31 | 38 |
| 1000 DQFAD | 72 | 3 | 9 | 14 | 21 | 28 | 33 |

*3000 gallon tank offered as an accessory kit – refer to NAAC-5853 spec sheet.

- Operating hours are measured at 60 Hz, standby rating.
- Up to 90% fill alarm to comply with NFPA30, operating capacity is reduced by 10%.

## Enclosure Package Sound Pressure Levels @ 7 meters dB(A)

| Genset model | Weather protective enclosure (F200, F203) | QuietSite level 1 sound attenuated enclosure (F201, F204) | QuietSite level 2 sound attenuated enclosure (F202, F205) |
|---|---|---|---|
| 250 DQDAA | 90 | 88 | 72 |
| 275 DQDAB | 90 | 88 | 73 |
| 300 DQDAC | 90 | 88 | 73 |
| 300 DQHAB | 89 | 88 | 76 |
| 450 DFEJ | 88 | 85 | 74 |
| 500 DFEK | 89 | 87 | 73 |
| 600 DQCA | 90.6/86* | 79.3/78* | 74.1/73* |
| 600 DQPAA | 89.10 | 80.70 | 74.70 |
| 650 DQPAB | 89.70 | 81.40 | 75 |
| 750 DQCB | 91.1/87* | 79.9/79* | 75.3/74* |
| 750 DQFAA | 87.8 | 77.8 | 73.8 |
| 800 DQCC | 91.3/87* | 80.2/79* | 75.7/74* |
| 800 DQFAB | 88.1 | 78.3 | 74 |
| 900 DQFAC | 88.8 | 79.1 | 74.6 |
| 1000 DQFAD | 89.6 | 80.1 | 75.3 |

- All data is 60 Hz, full load standby rating, steel enclosures only.
- Data is a measured average of 8 positions.
- Sound levels for aluminium enclosures are approximately 2 dB(A) higher than listed sound levels for steel enclosures.

* Sound data with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

## Package Dimensions of Enclosure, Exhaust System, and UL Tank

For 250kW & 500kW

**250-500 kW**

| Tank size (gal) | Weather protective package length (in) | QuietSite level I package length (in) | QuietSite level 2 package length (in) | Width (in) | Height (in) | Weather protective package weight (lbs) | QuietSite level 1 package weight (lbs) | QuietSite level 2 package weight (lbs) |
|---|---|---|---|---|---|---|---|---|
| 270 | 188 | 188 | 222 | 82 | 106 | 4991 | 5471 | 6711 |
| 300 | 188 | 188 | 222 | 82 | 104 | 5648 | 6073 | 6991 |
| 400 | 188 | 188 | 222 | 82 | 106 | 5833 | 6258 | 7176 |
| 500 | 188 | 188 | 222 | 82 | 108 | 5956 | 6381 | 7299 |
| 600 | 188 | 188 | 222 | 82 | 111 | 6116 | 6541 | 7459 |
| 660 | 188 | 188 | 222 | 82 | 113 | 6235 | 6660 | 7578 |
| 720 | 188 | 188 | 222 | 82 | 114 | 6174 | 6599 | 7517 |
| 850 | 188 | 188 | 222 | 82 | 118 | 6529 | 6954 | 7872 |
| 1420 | 200 | 200 | 222 | 82 | 128 | 6863 | 7343 | 8583 |
| 1470 | 192 | 192 | 222 | 82 | 128 | 7253 | 7733 | 8973 |
| 1700 | 234 | 234 | 234 | 82 | 128 | 7982 | 8407 | 9325 |
| 2050 | 284 | 284 | 284 | 82 | 128 | 8383 | 8863 | 10103 |
| 2525 | 346 | 346 | 346 | 82 | 128 | 9391 | 9871 | 11111 |
| Lifting base | 188 | 188 | 222 | 82 | 100 | 4335 | 4760 | 5678 |

**600-1000 kW**

For 750kW & 1000kW

| Tank size (gal) | Weather protective package length (in) | QuietSite level I package length (in) | QuietSite level 2 package length (in) | Width (in) | Height (in) | Weather protective package weight (lbs) | QuietSite level 1 package weight (lbs) | QuietSite level 2 package weight (lbs) |
|---|---|---|---|---|---|---|---|---|
| 200 | 260 | 303 | 315 | 98 | 137 | 10194 | 13074 | 14954 |
| 660 | 260 | 303 | 315 | 98 | 137 | 9586 | 12466 | 14346 |
| 1000 | 260 | 303 | 315 | 98 | 141 | 10117 | 12997 | 14877 |
| 1500 | 260 | 303 | 315 | 98 | 146 | 10677 | 13557 | 15437 |
| 2000 | 292 | 327 | 327 | 98 | 143 | 11959 | 14839 | 16719 |
| 2400 | 338 | 338 | 338 | 98 | 143 | 12961 | 15841 | 17721 |

- This weight does not include the generator set. Consult your local Cummins distributor or the appropriate generator specification sheet.
- Width is 86" lifting eye to lifting eye (250-500 kW), 102" lifting eye to lifting eye (600-1000 kW).
- Height - Florida, Michigan, and Suffolk add 6.4" (250-500 kW) or 2" (600-1000 kW) for bottom space.
- Maximum length emergency vent removed.

| | |
|---|---|
| CSA | CSA - The generator set is CSA certified to product class 4215-01. |
| UL | UL - The generator set is available listed to UL 2200, stationary engine generator assemblies. The PowerCommand® control is listed to UL 508 - Category NITW7 for U.S. and Canadian usage. |

**For more information contact your local Cummins distributor or visit power.cummins.com**

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S-1443 (11/18)

150KW GENERATOR

**Specification sheet**

# Diesel generator set

QSB7 series engine

125-200 kW @ 60 Hz

EPA Tier 3 emissions

## Description

Cummins® generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby applications.

## Features

**Heavy duty engine** - Rugged 4-cycle industrial diesel delivers reliable power and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Control system** - The PowerCommand® 1.1 electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Cooling system** - Standard cooling package provides reliable running at up to 50 °C (122 °F) ambient temperature.

**Enclosures** - The aesthetically appealing enclosure incorporates special designs that deliver one of the quietest generators of its kind. Aluminium material plus durable powder coat paint provides the best anti-corrosion performance. The generator set enclosure has been evaluated to withstand 180 MPH wind loads in accordance with ASCE7 -10. The design has hinged doors to provide easy access for service and maintenance.

**Fuel tanks** - Dual wall sub-base fuel tanks are offered as optional features, providing economical and flexible solutions to meet extensive code requirements on diesel fuel tanks.

**NFPA** - The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

| | Standby 60 Hz | | Prime 60 Hz | | |
|---|---|---|---|---|---|
| **Model** | **kW** | **kVA** | **kW** | **kVA** | **Data sheets** |
| C125D6D | 125 | 156 | 113 | 141 | NAD-6371-EN |
| C150D6D | 150 | 188 | 135 | 169 | NAD-6372-EN |
| C175D6D | 175 | 219 | 158 | 197 | NAD-6373-EN |
| C200D6D | 200 | 250 | 180 | 225 | NAD-6374-EN |

## Generator set specifications

| | |
|---|---|
| Governor regulation class | ISO8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | ± 1.0% |
| Random voltage variation | ± 1.0% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.50% |
| Radio frequency emissions compliance | FCC code title 47 part 15 class A and B |

## Engine specifications

| | |
|---|---|
| Design | Turbocharged and charge air cooled |
| Bore | 107 mm (4.21 in.) |
| Stroke | 124 mm (4.88 in.) |
| Displacement | 6.7 L (408 $in^3$) |
| Cylinder block | Cast iron, in-line 6 cylinder |
| Battery capacity | 2 x 850 amps per battery at ambient temperature of 0 °C (32 °F) |
| Battery charging alternator | 100 amps |
| Starting voltage | 2 x 12 volt in parallel, negative ground |
| Lube oil filter type(s) | Spin-on with relief valve |
| Standard cooling system | High ambient radiator |
| Rated speed | 1800 rpm |

## Alternator specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip proof, revolving field |
| Stator | 2/3 pitch |
| Rotor | Direct coupled, flexible disc |
| Insulation system | Class H per NEMA MG1-1.65 |
| Standard temperature rise | 120 ºC (248 °F) Standby |
| Exciter type | Torque match (shunt) with PMG as option |
| Alternator cooling | Direct drive centrifugal blower |
| AC waveform Total Harmonic Distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone Influence Factor (TIF) | < 50 per NEMA MG1-22.43 |
| Telephone Harmonic Factor (THF) | < 3% |

## Available voltages

| 1-phase | 3-phase | | | | |
|---|---|---|---|---|---|
| • 120/240 | • 120/208 | • 120/240 | • 277/480 | • 347/600 | • 127/220 |

## Generator set options

**Fuel system**
- Basic fuel tanks
- Regional fuel tanks

**Engine**
- Engine air cleaner – normal or heavy duty
- Shut down – low oil pressure
- Extension – oil drain
- Engine oil heater

**Alternator**
- 120 °C temperature rise alternator
- 105 °C temperature rise alternator
- PMG excitation
- Alternator heater, 120 V
- Reconnectable full 1 phase output alternator upto 175 kWe

**Control**
- AC output analog meters
- Stop switch – emergency
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)

**Electrical**
- One, two or three circuit breaker configurations
- 80% rated circuit breakers
- 80% or 100% rated LSI circuit breakers
- Battery charger

**Enclosure**
- Aluminium enclosure Sound Level 1 or Level 2, green color
- Aluminium weather protective enclosure with muffler installed, green color

**Cooling system**
- Shutdown – low coolant level
- Warning – low coolant level
- Extension – coolant drain
- Coolant heater options:
  - <4 °C (40 °F) – cold weather
  - <-18 °C (0 °F) – extreme cold

**Exhaust system**
- Exhaust connector NPT
- Exhaust muffler mounted

**Generator set application**
- Base barrier – elevated genset
- Radiator outlet duct adapter

**Warranty**
- Base warranty – 2 year/1000 hours, Standby
- Base warranty – 1 year/unlimited hours, Prime
- 3 & 5 year Standby warranty options

## Generator set accessories

- Coolant heater
- Battery heater kit
- Engine oil heater
- Remote control displays
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)
- Annunciator – RS485
- Audible alarm
- Remote monitoring device – PowerCommand 500/550
- Battery charger – stand-alone, 12 V
- Circuit breakers
- Enclosure Sound Level 1 to Sound Level 2 upgrade kit
- Base barrier – elevated generator set
- Mufflers – industrial, residential or critical
- Alternator PMG excitation
- Alternator heater
- Improved PC1.1 display readability
- Top conduit entry access

## Control system PowerCommand 1.1

**PowerCommand control** is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

**Operator/display panel**

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -40 °C to +70 °C
- Bargraph display (optional)

**AC protection**

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

**Engine protection**

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown

**Alternator data**

- Line-to-Line and Line-to-neutral AC volts
- 3-phase AC current
- Frequency
- Total kVa

**Engine data**

- DC voltage
- Lube oil pressure
- Coolant temperature
- Engine speed

**Other data**

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)

**Digital governing (optional)**

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

**Digital voltage regulation**

- Integrated digital electronic voltage regulator
- 2-phase Line-to-Line sensing
- Configurable torque matching

**Control functions**

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop
- Automatic Transfer Switch (ATS) control
- Generator set exercise, field adjustable

**Options**

- Auxiliary output relays (2)
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand 500/550 for remote monitoring and alarm notification (accessory)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8)
- AC output analog meters (bargraph)
  - Color-coded graphical display of:
    - 3-phase AC voltage
    - 3-phase current
    - Frequency
    - kVa
- Remote operator panel
- PowerCommand 2.3 control with AmpSentry protection

## Ratings definitions

**Emergency Standby Power (ESP):**

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP):**

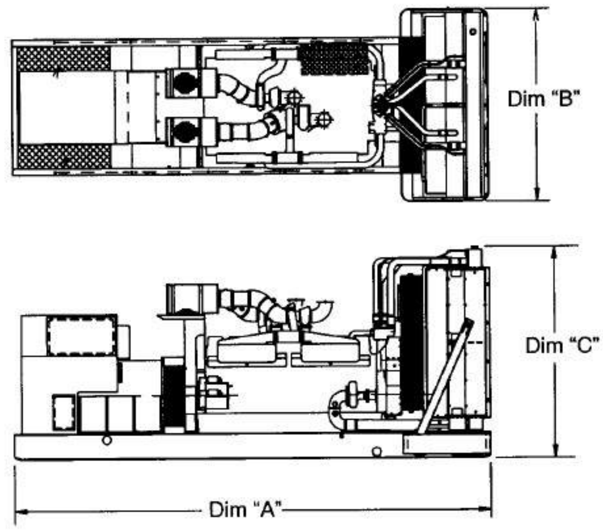
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP):**

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP):**

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

| Model | Dim "A" mm (in.) | Dim "B" mm (in.) | Dim "C" mm (in.) | Set weight*wet kg (lbs.) |
|---|---|---|---|---|
| **Open set** | | | | |
| **C125D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C150D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C175D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C200D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **Weather protective enclosure** | | | | |
| **C125D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C150D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C175D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C200D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **Sound attenuated enclosure Level 1** | | | | |
| **C125D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C150D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C175D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C200D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **Sound attenuated enclosure Level 2** | | | | |
| **C125D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C150D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C175D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C200D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |

* Weights above are average. Actual weight varies with product configuration.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | **U.S. EPA** | Engine certified to U.S. EPA SI Stationary Emission Regulation 40 CFR, Part 60. |
| CSA | All low voltage models are CSA certified to product class 4215-01. | **International Building Code** | The generator set is certified to International Building Code (IBC) 2012. |

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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NAS-6370-EN.DOCX (04/19) A061F585

## Generator Set Data Sheet

| | |
|---|---|
| Model: | C150D6D |
| Frequency: | 60 Hz |
| Fuel Type: | Diesel |
| KW Rating: | 150 Standby<br>135 Prime |
| Emissions level: | EPA Tier 3, Stationary Emergency |

| | |
|---|---|
| Exhaust Emission Data Sheet: | EDS-3044 |
| Exhaust Emission Compliance Sheet: | EPA-2033 |
| Sound Performance Data Sheet: | MSP-4008 |
| Cooling Performance Data Sheet: | MCP-2048 |
| Prototype Test Summary Data Sheet: | PTS-636 |

## Fuel Consumption

| | Standby | | | | Prime | | | |
|---|---|---|---|---|---|---|---|---|
| | kW (kVA) | | | | kW (kVA) | | | |
| Ratings | 150 (188) | | | | 135 (169) | | | |
| Load | 1/4 | 1/2 | 3/4 | Full | 1/4 | 1/2 | 3/4 | Full |
| US gph | 4.7 | 6.9 | 9.2 | 11.7 | 4.4 | 6.4 | 8.4 | 10.7 |
| L/hr | 17.78 | 26.11 | 34.82 | 44.28 | 16.65 | 24.22 | 31.79 | 40.49 |

## Engine

| | Standby rating | Prime rating |
|---|---|---|
| Engine Manufacturer | Cummins Inc. | |
| Engine Model | QSB7-G5 | |
| Configuration | Cast iron, in-line, 6 cylinders | |
| Aspiration | Turbocharged and charge air cooled | |
| Gross Engine Power Output, kWm (bhp) | 242 (324) | 208 (279) |
| BMEP at set rated load, kPa (psi) | 1763 (255.7) | 1601 (232) |
| Bore, mm (in) | 107 (4.21) | |
| Stroke, mm (in) | 124 (4.88) | |
| Rated Speed, rpm | 1800 | |
| Piston Speed, m/s (ft/min) | 7.44 (1464) | |
| Compression Ratio | 17.2:1 | |
| Lube Oil Capacity, L (qt) | 17.4 (18.38) | |
| Overspeed Limit, rpm | 2250 | |

## Fuel Flow

| | |
|---|---|
| Maximum Fuel Flow, L/hr (US gph) | 103 (27.0) |
| Maximum Fuel Inlet Restriction with Clean Filter, mm Hg (in Hg) | 127 (5.0) |

## Air

| Air | Standby rating | Prime rating |
|---|---|---|
| Combustion Air, m3/min (scfm) | 14.78 (522) | 14.22 (502) |
| Maximum Air Cleaner Restriction with Clean Filter, kPa (in H2O) | 3.7 (15) | |

## Exhaust

| | | |
|---|---|---|
| Exhaust Flow at set rated load, $m^3$/min (cfm) | 35.62 (1258) | 33.66 (1189) |
| Exhaust Temperature, °C (°F) | 466.67 (872) | 453.89 (849) |
| Maximum Back Pressure, kPa (in $H_2O$) | 10 (40.19) | 10 (40.19) |
| Actual Exhaust Back Pressure with CPG Sound level 2 Enclosure Muffler, kPa (in $H_2O$) | 9.5 (38.18) | 8.6 (34.36) |
| Actual Exhaust Back Pressure with CPG Weather Enclosure Muffler, kPa (in $H_2O$) | 7.2 (28.93) | 6.5 (26) |

## Standard Set-mounted Radiator Cooling

| | | |
|---|---|---|
| Ambient Design, ° C (° F) | 50 (122) | |
| Fan Load, $kW_m$ (HP) | 14.02 (18.8) | |
| Coolant Capacity (with radiator), L (US Gal) | 22 (5.9) | |
| Cooling System Air Flow, $m^3$/min (scfm) | 305.82 (10800) | |
| Total Heat Rejection, MJ/min (Btu/min) | 7.91 (7499) | 7.25 (6871) |
| Maximum Cooling Air Flow Static Restriction, kPa (in $H_2O$) | 0.12 (0.5) | |

## Weight[2]

| | |
|---|---|
| Unit Wet Weight kgs (lbs) | 1390 (3064) |

Notes:

[1] For non-standard remote installations contact your local Cummins Power Generation representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating Factors

| | |
|---|---|
| Standby | Engine power available up to 3425 m (11237 ft.) at ambient temperatures up to 40° C (104° F) and 2298 m (7540 ft.) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters. |
| Prime | Engine power available up to 2743 m (9000 ft.) at ambient temperatures up to 40° C (104° F) and 2151 m (7057 ft.) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters. |

## Ratings Definitions

| Emergency Standby Power (ESP): | Limited-time Running Power (LTP): | Prime Power (PRP): | Base Load (continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

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## Alternator Data

| Standard Alternators | Single phase[2] | Three Phase[1] | | | | | |
|---|---|---|---|---|---|---|---|
| Maximum Temperature Rise above 40 °C Ambient | 120 °C | 120 °C | | | | | |
| Feature Code | BB88-2 | B946-2 | B986-2 | B952-2 | B943-2 | BB86-2 | BB88-2 |
| Alternator Data Sheet Number | ADS212 | ADS-210 | ADS-210 | ADS-209 | ADS-209 | ADS-210 | ADS-212 |
| Voltage Ranges | 120/240 | 120/208 | 120/240 | 347/600 | 277/480 | 127/220 | 120/208, 127/220, 277/480 |
| Voltage Feature Code | R104 | R098-2 | R106-2 | R114-2 | R002-2 | R020-2 | R098-2, R020-2, R106-2, R002-2 |
| Surge kW | 205.9 | 210.2 | 211.4 | 211.1 | 211.4 | 210.7 | 211.6 |
| Motor Starting kVA (at 90% sustained voltage) Shunt | 770 | 563 | 563 | 516 | 516 | 563 | 770 |
| Motor Starting kVA (at 90% sustained voltage) PMG | 920 | 663 | 663 | 607 | 607 | 663 | 920 |
| Full Load Current Amps at Standby Rating | 625 | 520 | 451 | 180 | 226 | 492 | 226 to 520 |

## Alternator Data

| Standard Alternators | Single phase[2] | Three phase[1] | | | | |
|---|---|---|---|---|---|---|
| Maximum Temperature Rise above 40 °C Ambient | 105 °C | 105 °C | 105 °C | 105 °C | 105 °C | 105 °C |
| Feature Code | BB87-2 | BB93-2 | BB94-2 | BB95-2 | BB92-2 | BB85-2 |
| Alternator Data Sheet Number | ADS-212 | ADS-210 | ADS-210 | ADS-209 | ADS-209 | ADS-210 |
| Voltage Ranges | 120/208, 120/240, 127/220, 277/480, 347/600 | 120/208 | 120/240 | 277/480 | 347/600 | 127/220 |
| Voltage Feature Code | R098-2, R020-2, R002-2, R104-2, R106-2, R114-2 | R098-2 | R106-2 | R002-2 | R114-2 | R020-2 |
| Surge kW | 205.9 | 210.2 | 211.4 | 211.4 | 210.7 | 211.6 |
| Motor Starting kVA (at 90% sustained voltage) Shunt | 770 | 563 | 563 | 516 | 516 | 563 |
| Motor Starting kVA (at 90% sustained voltage) PMG | 920 | 663 | 663 | 607 | 607 | 663 |
| Full Load Current Amps at Standby Rating | 625 | 520 | 451 | 226 | 180 | 492 |

Notes:
[1] Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor
[2] Full single phase output up to full set rated 3-phase kW at 1.0 power factor

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## Formulas for Calculating Full Load Currents:

| Three phase output | Single phase output |
| --- | --- |
| $\frac{kW \times 1000}{Voltage \times 1.73 \times 0.8}$ | $\frac{kW \times SinglePhaseFactor \times 1000}{Voltage}$ |

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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# Sound Data

## C150D6D

## QSB7-G5 NR3 60Hz Diesel

### A-weighted Sound Pressure Level @ 7 meters, dB(A)

See notes 2, 5 and 7-11 listed below

| Configuration | Exhaust | Applied Load | Position (Note 2) | | | | | | | | 8 Position Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | 84 | 86 | 88 | 88 | 83 | 90 | 88 | 88 | 87 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | 86 | 85 | 83 | 87 | 84 | 89 | 83 | 86 | 86 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | 83 | 79 | 74 | 74 | 74 | 75 | 75 | 80 | 78 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | 72 | 72 | 71 | 72 | 73 | 72 | 71 | 73 | 72 |

### Average A-weighted Sound Pressure Level @ 1 meter, dB(A)

See notes 1, 5 and 7-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Pressure Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 46 | 68 | 81 | 89 | 91 | 91 | 90 | 88 | 86 | 90 | 98 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 42 | 67 | 83 | 90 | 89 | 90 | 87 | 84 | 80 | 81 | 96 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 45 | 62 | 74 | 80 | 80 | 81 | 79 | 76 | 77 | 73 | 88 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 45 | 63 | 72 | 77 | 76 | 77 | 76 | 73 | 71 | 65 | 84 |

### A-weighted Sound Pressure Level @ Operator Location, dB(A)

See notes 1, 3, 5 and 7-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Pressure Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 43 | 68 | 79 | 85 | 89 | 89 | 90 | 89 | 88 | 95 | 99 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 42 | 67 | 79 | 84 | 84 | 82 | 81 | 78 | 75 | 78 | 90 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 50 | 66 | 75 | 81 | 82 | 81 | 78 | 75 | 74 | 69 | 87 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 50 | 67 | 76 | 80 | 79 | 79 | 76 | 73 | 72 | 61 | 86 |

## A-weighted Sound Power Level, dB(A)

See notes 1, 3 and 6-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Power Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 63 | 86 | 98 | 106 | 108 | 109 | 107 | 106 | 103 | 107 | 116 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 60 | 85 | 101 | 108 | 107 | 107 | 105 | 102 | 97 | 99 | 114 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 63 | 80 | 92 | 99 | 99 | 99 | 97 | 94 | 95 | 91 | 106 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 64 | 81 | 91 | 95 | 94 | 95 | 94 | 91 | 90 | 84 | 102 |

## Exhaust Sound Power Level, dB(A)

See notes 4 and 6-14 listed below

| Configuration | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Power Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Open Exhaust (No Muffler) | 100% Standby | N/A | 64 | 93 | 106 | 115 | 117 | 114 | 113 | 113 | 105 | 94 | 122 |

Global Notes:

**1.** Sound pressure levels at 1 meter are measured per the requirements of ISO 3744, ISO 8528-10, and European Communities Directive 2000/14/EC as applicable. The microphone measurement locations are 1 meter from a reference parallelepiped just enclosing the generator set (enclosed or unenclosed).

**2.** Seven-meter measurement location 1 is 7 meters (23 feet) from the generator (alternator) end of the generator set, and the locations proceed counterclockwise around the generator set at 45° angles at a height of 1.2 meters (48 inches) above the ground surface.

**3.** Sound Power Levels are calculated according to ISO 3744, ISO 8528-10, and/or CE (European Union) requirements.

**4.** Exhaust Sound Levels are measured and calculated per ISO 6798, Annex A.

**5.** Reference Sound Pressure Level is 20 μPa

**6.** Reference Sound Power Level is 1 pW ($10^{-12}$ Watt)

**7.** Sound data for remote-cooled generator sets are based on rated load without cooling fan noise.

**8.** Sound data for the generator set with infinite exhaust do not include the exhaust noise contribution

**9.** Published sound levels are measured at CE certified test site and are subject to instrumentation measurement, installation, and manufacturing variability.

**10.** Unhoused/Open configuration generator sets refers to generator sets with no sound enclosures of any kind.

**11.** Housed/Enclosed/Closed/Canopy configuration generator sets refer to generator sets that have noise reduction sound enclosure installed over the generator set and usually integrally attached to the skid base/base frame/fuel container base of the generator set.

**12.** Published sound levels meet the requirements India's Central Pollution Control Board (Ministry of Environment & Forests), vide GSR 371 (E), which states the A-weighted sound level at 1 meter from any diesel generator set up to a power output rating of 1000kVA shall not exceed 75 dB(A).

**13.** For updated noise pollution information for India see website: http://www.envfor.nic.in/legis/legis.html

**14.** Sound levels must meet India's Ambient Air Noise Quality Standards detailed for Daytime/Nighttime operation in Noise Pollution (Regulation and Control) Rules, 2000

Specification sheet

# Dual wall sub-base diesel fuel tanks -

## 10-200 kW generator sets

## Description

Cummins® offers two series of fuel tanks (basic series and regional series) for the 10~125 kW diesel generator sets. The “basic” series of fuel tanks provide economical solutions for areas with no or minimal local/regional code requirements on diesel fuel tanks. The footprint of “basic” tanks matches the generator set’s footprint. The “regional” series of fuel tanks provide flexible and upgradable solutions for areas with extensive local/regional code requirements on diesel fuel tanks. The footprint of the “regional” series of fuel tanks extends beyond the generator set to allow room for installation of optional features at factory or accessories in the field for meeting local/regional code requirements or customer specification on diesel fuel tanks. All fuel tanks and optional features are compatible with factory installed enclosures.

These tanks are constructed of heavy gauge steel and include an internally reinforced baffle structure for supporting the generator set. The fuel tank design features fewer seams and welds for better corrosion resistance performance.

These tanks are pre-treated with a conversion coating and then finished with a textured powder paint. The paint has superior UV and chemical resistance with best-in-class adhesion, flexibility, and durability to resist chipping and substrate corrosion. Both interior compartments are treated with a rust preventative for extended corrosion protection.

These tanks are UL and ULC Listed as secondary containment generator base tanks. Inner and outer containments are leak checked per UL and ULC testing procedures to ensure their integrity.

These fuel tanks are offered in various sizes to satisfy different fuel capacities requirements.

## Compatible generator set model

| Engine | D1703M | V2203M | 4BT3.3-G5 | 4BTAA3.3-G7 | QSB5-G5 | QSB7-G5 |
|---|---|---|---|---|---|---|
| Generator set model names | C10D6 | C20D6 | C25D6 | C50D6 | C50D6C | C125D6D |
| | C15D6 | | C30D6 | C60D6 | C60D6C | C150D6D |
| | | | C35D6 | | C80D6C | C175D6D |
| | | | C40D6 | | C100D6C | C200D6D |
| | | | | | C125D6C | |
| | | | | | | |

## Basic fuel tanks

**Standard features:**

**UL 142 and ULC-S601 listed** - Minimum 110% secondary containment capacity.

**NFPA and IFC** - Capable of meeting NFPA 30 and NFPA 110 codes with available factory installed optional features.

**Emergency pressure relief vents** - Ensure adequate ventilation of the primary and secondary tank compartments under extreme temperature and emergency conditions.

**Normal atmospheric vent** - "Mushroom" style vent ensures adequate venting of the primary tank during fill, generator set running and temperature variations. Raised above fuel fill.

**Raised fuel fill** - includes lockable sealed fuel cap.

**Lifting eyes** - Allow lifting of fuel tank with generator set installed.

**Optional features:**

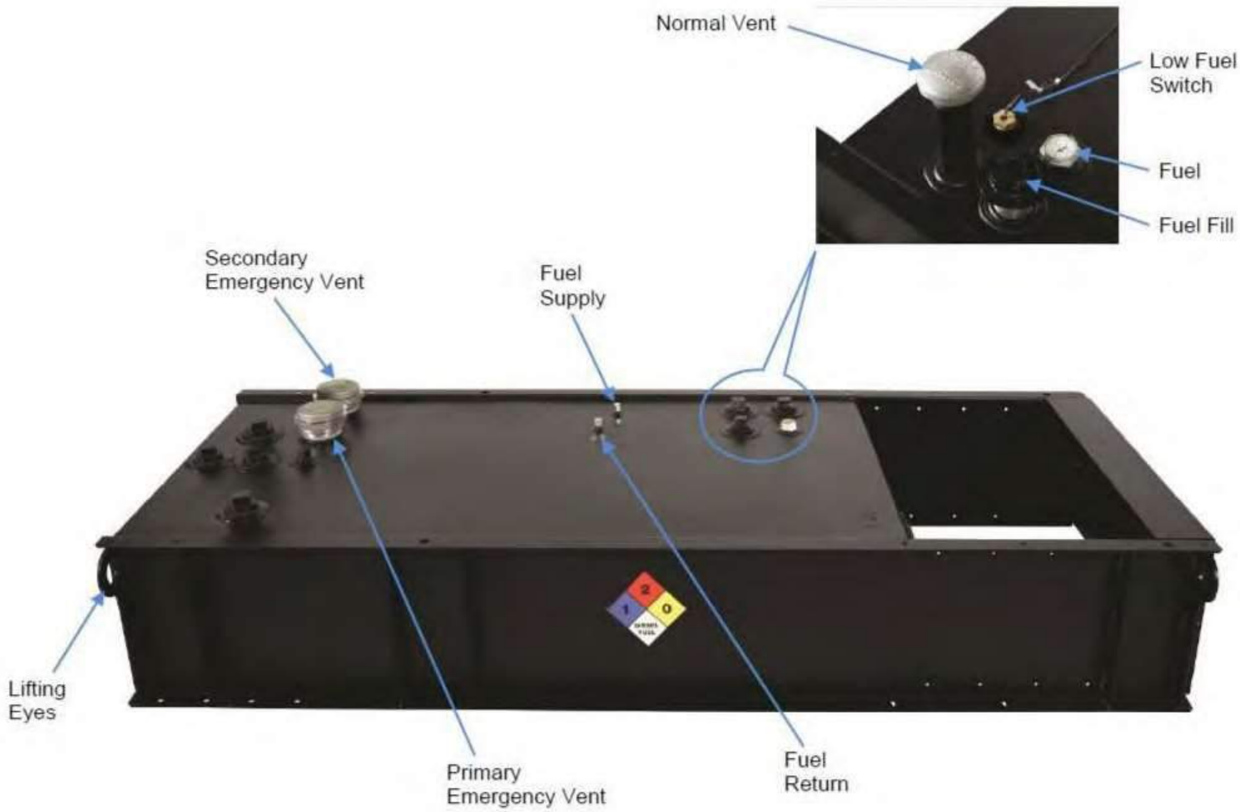
**Secondary containment basin switch (rupture switch)** - Activates a warning in the event of a primary tank leak. Side mounted.

**Low fuel level switch** - Activates a warning when 40% of the fuel is left in the tank.

**Fuel level gauge** - Provides direct reading of fuel level. Top mounted.

**Electric fuel level sender with gauge** - Allows remote electrical monitoring of fuel tank level. Flying leads for customer connection.

**Tank to foundation clearance** - 2-inch bolt-thru risers allow visual inspection under tank including rodent barrier.




*Picture is for reference only. See outline drawing for tank specific information by model.

## Basic tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time |
|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr |
| 10 | C10D6 | D1703M | 1.12 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 41 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 81 |
| 15 | C15D6 | D1703M | 1.38 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 33 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 66 |
| 20 | C20D6 | V2203M | 1.81 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 25 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 50 |
| 25 | C25D6 | 4BT3.3-G5 | 2.42 | C319-2 | 24 | 87.6 x 34 x 15 | 456 | 74 | 31 |
| | | | | C320-2 | 48 | 87.6 x 34 x 23 | 669 | 132 | 54 |
| 30 | C30D6 | 4BT3.3-G5 | 2.81 | C319-2 | 24 | 87.6 x 34 x 15 | 456 | 74 | 26 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 69 |
| 35 | C35D6 | 4BT3.3-G5 | 3.16 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 42 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 62 |
| 40 | C40D6 | 4BT3.3-G5 | 3.66 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 36 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 53 |
| 50 | C50D6 | 4BTAA3.3-G7 | 4.25 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 31 |
| | | | | C320-2 | 48 | 87.6 x 34 x 42 | 977 | 263 | 62 |
| 60 | C60D6 | 4BTAA3.3-G7 | 5.04 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 26 |
| | | | | C320-2 | 48 | 87.6 x 34 x 42 | 977 | 263 | 52 |
| 50 | C50D6C | QSB5-G5 | 5.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 49 |
| | | | | C320-2 | 48 | 117 x 40 x 25 | 809 | 260 | 49 |
| 60 | C60D6C | QSB5-G5 | 6.10 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 42 |
| | | | | C320-2 | 48 | 117 x 40 x 33 | 966 | 353 | 57 |
| 80 | C80D6C | QSB5-G5 | 7.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 35 |
| | | | | C320-2 | 48 | 117 x 40 x 33 | 966 | 353 | 48 |
| 100 | C100D6C | QSB5-G5 | 8.90 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 29 |
| | | | | C320-2 | 48 | 117 x 40 x 48 | 1471 | 526 | 59 |
| 125 | C125D6C | QSB5-G6 | 10.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 25 |
| | | | | C320-2 | 48 | 117 x 40 x 48 | 1471 | 526 | 51 |
| 125 | C125D6D | QSB7-G5 | 10.1 | C319-2 | 24 | 117x40x25 | 809 | 258 | 25 |
| | | | | C320-2 | 48 | 117x40x48 | 1471 | 520 | 51 |
| 150 | C150D6D | | 11.7 | C319-2 | 24 | 117x40x33 | 966 | 350 | 29 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 62 |
| 175 | C175D6D | | 13.3 | C319-2 | 24 | 117x40x33 | 966 | 350 | 26 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 55 |
| 200 | C200D6D | | 14.9 | C319-2 | 24 | 117x40x48 | 1471 | 520 | 34 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 49 |

Note: No OFPV is offered on basic fuel tanks.
* All weights are approximate.

## Regional fuel tanks

**Standard features:**

**UL 142 and ULC-S601 listed** - Minimum 110% secondary IBC 2012 and 2015 certified - All optional features are seismically certified with this range of tanks and generator sets. Requires factory-installed 2 ft vent extensions or higher.

**UL 142 & ULC-S601 listed** - Minimum 125% secondary containment capacity.

**NFPA & IFC** - Capable of meeting NFPA 30, NFPA 110, and IFC codes with available factory-installed optional features.

**Emergency pressure relief vents** - Ensure adequate ventilation of the primary and secondary tank compartments under extreme temperature and emergency conditions.

**Normal atmospheric vent** - "Mushroom" style vent ensures adequate venting of the primary tank during fill, generator set running, and temperature variations. Raised above fuel fill.

**Raised fuel fill** - Includes lockable sealed fuel cap.

**Lifting eyes** - Allow lifting of fuel tank with generator set installed.

**Optional features:**

**Secondary containment basin switch (rupture switch)** - Activates a warning in the event of a primary tank leak. Side Mounted.

**Low fuel level switch** - Activates a warning when 40% of the fuel is left in the tank.

**Fuel level gauge** - Provides direct reading of fuel level. Top mounted.

**Electric fuel level sender with gauge** - Allows remote electrical monitoring of fuel tank level. Flying leads for customer connection.

**Tank to foundation clearance** - 2-inch bolt-thru risers allow visual inspection under tank including rodent barrier.

**Spill containment box for fuel fill** - 5 gallon capacity with integral drain (to tank). Lockable lid.

**Overfill prevention valve** - Shuts off fuel flow during filling at approximately 95% full*. Includes fill down tube, as needed, to terminate within 6" of the bottom of the fuel tank. Uses a 2 inch type "F" cam lock adapter for filling.

**High fuel switch** - Activates at 90% of full fuel level. Flying leads for customer connection.

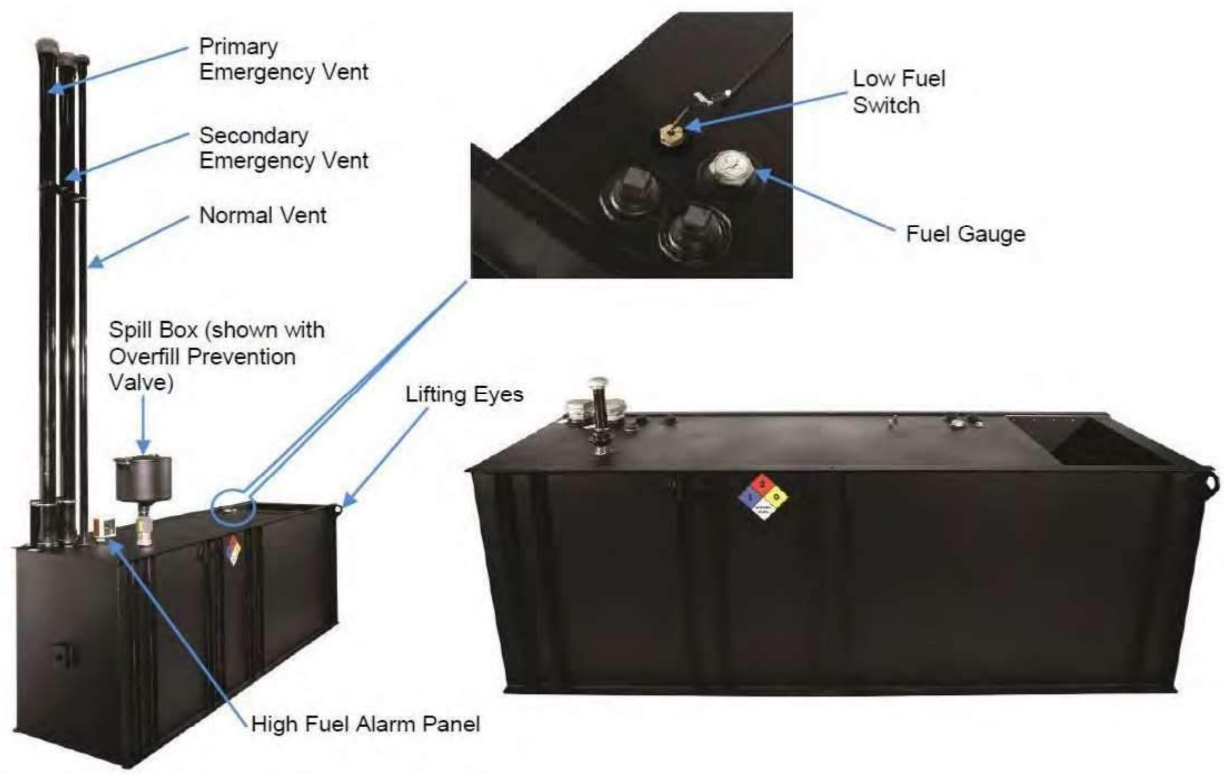
**High fuel alarm panel** - Provides audible & visual alarm when fuel level reaches 90% of full fuel level.

**Fill drop tube** - Terminates fuel fill location within 6" of the bottom of the fuel tank.

**Vent extensions** - Terminate normal and emergency vents (both primary and secondary) a minimum of 12 ft above the bottom of tank.

**Seismic vent extensions** - 2 ft normal and emergency (both primary & secondary) extensions to meet IBC/OSHPD seismic requirements.

* The OFPV inherently shuts off fuel at approximately 2" below the top of the fuel tank. Some tanks will shut off below this 95% fill level.




*Picture is for reference only. See outline drawing for tank specific information by model.

## Regional tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time w/o OFPV | Actual run time w/OFPV |
|---|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr | hr |
| 10 | C10 D6 | D1703M | 1.12 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 66 | 56 |
| | | | | C303-2 | 48 | 87.6 x 34 x 15 | 510 | 74 | 66 | 56 |
| | | | | C305-2 | 72 | 87.6 x 34 x 23 | 723 | 132 | 118 | 107 |
| | | | | C307-2 | 96 | 87.6 x 34 x 23 | 723 | 132 | 118 | 107 |
| 15 | C15 D6 | D1703M | 1.38 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 53 | 45 |
| | | | | C303-2 | 48 | 87.6 x 34 x 15 | 510 | 74 | 53 | 45 |
| | | | | C305-2 | 72 | 87.6 x 34 x 23 | 723 | 132 | 95 | 86 |
| | | | | C307-2 | 96 | 87.6 x 34 x 32 | 962 | 195 | 141 | 132 |
| 20 | C20 D6 | V2203M | 1.81 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 41 | 35 |
| | | | | C303-2 | 48 | 87.6 x 34 x 23 | 723 | 132 | 73 | 66 |
| | | | | C305-2 | 72 | 87.6 x 34 x 32 | 962 | 195 | 108 | 101 |
| | | | | C307-2 | 96 | 87.6 x 34 x 32 | 962 | 195 | 108 | 101 |
| 25 | C25 D6 | 4BT3.3-G5 | 2.42 | C301-2 | 24 | 121 x 34 x 10.5 | 514 | 74 | 31 | 25 |
| | | | | C303-2 | 48 | 121 x 34 x 16.2 | 686 | 132 | 54 | 47 |
| | | | | C305-2 | 72 | 121 x 34 x 22.1 | 879 | 195 | 80 | 73 |
| | | | | C307-2 | 96 | 121 x 34 x 29.5 | 1120 | 263 | 109 | 101 |
| 30 | C30 D6 | 4BT3.3-G5 | 2.81 | C301-2 | 24 | 121 x 34 x 10.5 | 514 | 74 | 26 | 21 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 69 | 63 |
| | | | | C305-2 | 72 | 121 x 34 x 29.5 | 1120 | 263 | 94 | 87 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 138 | 132 |
| 35 | C35 D6 | 4BT3.3-G5 | 3.16 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 42 | 36 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 62 | 56 |
| | | | | C305-2 | 72 | 121 x 34 x 29.5 | 1120 | 263 | 83 | 77 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 123 | 117 |
| 40 | C40 D6 | 4BT3.3-G5 | 3.66 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 36 | 31 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 53 | 48 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 106 | 101 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 106 | 101 |
| 50 | C50 D6 | 4BTAA3.3-G7 | 4.25 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 31 | 27 |
| | | | | C303-2 | 48 | 121 x 34 x 29.5 | 1120 | 263 | 62 | 58 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 92 | 87 |
| 60 | C60 D6 | 4BTAA3.3-G7 | 5.04 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 26 | 23 |
| | | | | C303-2 | 48 | 121 x 34 x 29.5 | 1120 | 263 | 52 | 49 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 77 | 73 |
| 50 | C50D6C | QSB5-G5 | 5.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 47 | 45 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 80 | 76 |
| | | | | C305-2 | 72 | 154 x 40 x 32 | 1657 | 425 | 80 | 76 |
| | | | | C307-2 | 96 | 154 x 40 x 46 | 2096 | 625 | 118 | 112 |
| 60 | C60D6C | QSB5-G5 | 6.10 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 41 | 39 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 70 | 66 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 102 | 97 |
| | | | | C307-2 | 96 | 154 x 40 x 46 | 2096 | 625 | 102 | 97 |
| 80 | C80D6C | QSB5-G5 | 7.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 34 | 33 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 58 | 55 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 85 | 81 |
| 100 | C100D6C | QSB5-G5 | 8.90 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 28 | 27 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 48 | 45 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 70 | 66 |
| 125 | C125D6C | QSB5-G6 | 10.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 24 | 23 |
| | | | | C303-2 | 48 | 154 x 40 x 46 | 2096 | 625 | 60 | 58 |

* All weights are approximate.

## Regional tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time w/o OFPV | Actual run time w/OFPV |
|---|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr | hr |
| 125 | C125D6D | QSB7-G5 | 10.1 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 34 | 30 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 72 | 69 |
| | | | | C305-2 | 72 | 180x40x42 | 2302 | 737 | 72 | 69 |
| | | | | C307-2 | 96 | 180x65.5x35.3 | 3552 | 1055 | 104 | 98 |
| 150 | C150D6D | | 11.7 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 30 | 26 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 63 | 59 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 90 | 84 |
| 175 | C175D6D | | 13.3 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 26 | 23 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 55 | 52 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 79 | 74 |
| 200 | C200D6D | | 14.9 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 24 | 21 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 49 | 47 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 72 | 66 |

## Certifications/standards/codes

**UL 142 Listed** - Cummins dual wall sub-base tanks are UL Listed and constructed in accordance with Underwriters Laboratories Standard UL 142 “steel aboveground tanks for flammable and combustible liquids,” as a “secondary containment generator base tank”

**NFPA** - Cummins tanks are built in accordance with all applicable NFPA codes:

- NFPA 30 - Flammable and Combustible Liquids code
- NFPA 37 - Standard for Installation and use of Stationary Combustible Engine and Gas Turbines
- NFPA 110 - Standard for Emergency and Standby Power Systems

**ISO9001** - This product was designed and manufactured in facilities certified to ISO9001.

**ULC** - Cummins tanks are built in accordance with all applicable ULC codes

**For more information contact your local Cummins distributor or visit power.cummins.com**

**Our energy working for you.™**


NAAC-5868-EN (02/18)

BUILDING ID: RS7

**COMMUNITY DEVELOPMENT DEPARTMENT**
**PLANNING DIVISION**
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http://www.menlopark.org

## APPLICATIONS INVOLVING HAZARDOUS MATERIALS – GENERATOR SUPPLEMENT

The following information is required for hazardous materials applications that include generators.

**GENERATOR PURPOSE** (for example, whether it is an emergency generator dedicated to life safety egress lighting and other life safety devices, or a standby generator to allow continued operations in the event of a power outage)

Generator is intended to provide backup power to Emergency, Legally Required and Optional Standby loads to support continued facility operations in the event of a utility power outage.

| | |
|---|---|
| **FUEL TANK SIZE** (in gallons) **AND FUEL TYPE**<br>Fuel tank size: 270 gallons (approx)<br>Fuel type: diesel | **NOISE RATING**<br>72db(A) @ 7meters |
| **SIZE** (output in both kW (kilowatt) and hp (horsepower) measurements)<br>Power output: 150 kW (approx)<br>Engine output: 324 hp | **ENCLOSURE COLOR**<br>Green or gray |
| **ROUTE FOR FUELING HOSE ACCESS**<br>75ft max distance, direct from fueling truck to generator fuel tank | **PARKING LOCATION OF FUELING TRUCK**<br>Building exterior at drivable surface |
| **FREQUENCY OF REFUELING**<br>2 times / year | **HOURS OF SERVICE ON A FULL TANK**<br>24 hours at generator fully rated load |

**PROPOSED TESTING SCHEDULE** (including frequency, days of week, and time of day)

Monthly, Sunday, AM

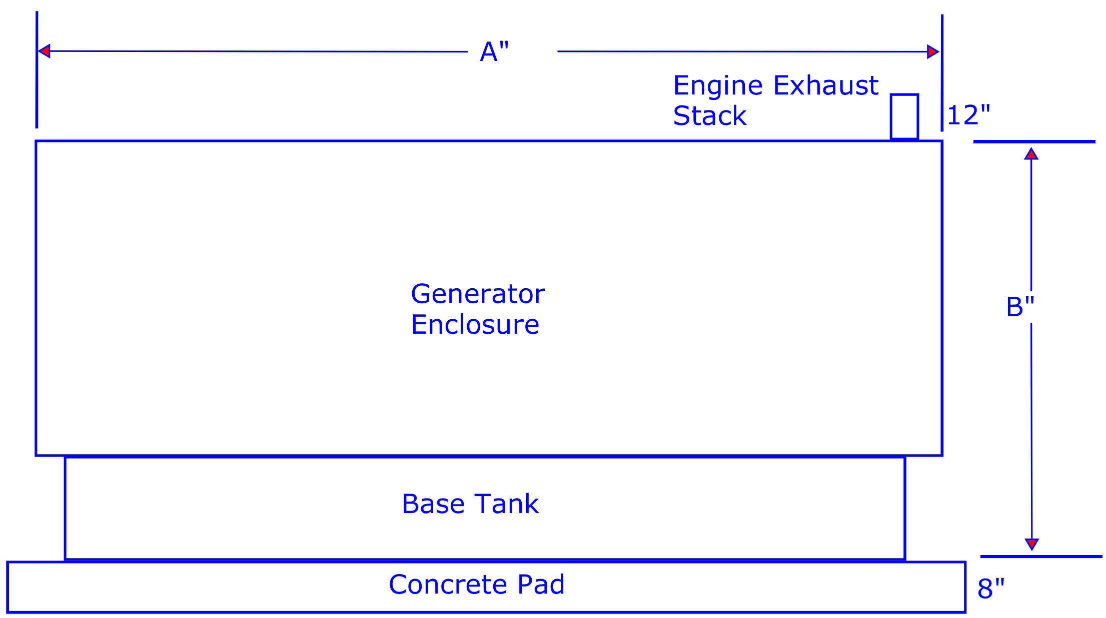
**ALARMS AND/OR AUTOMATIC SHUTOFFS** (for leaks during use and/or spills/over-filling during fueling, if applicable)

Fuel system alarms and/or shutdowns: overfill, low fuel, fuel-in-rupture basin alarm.
Engine alarms and/or shutdowns: overspeed, fail start, low oil pressure, high coolant temp, etc.

**OTHER APPLICATION SUBMITTAL REQUIREMENTS** (please attach)

- Section showing the height of the pad, the isolation base (if there is one), the height of the generator with the appropriate belly (fuel storage tank) and exhaust stack
- Status of required Bay Area Air Qualify Management District (BAAQMD) permit, including confirmation of parental notification for any proposals within 1,000 feet of a school

| GENERATOR SIZE (kW) | DIMENSION 'A' (") | DIMENSION 'B' (") |
|---|---|---|
| 1000 | 315 | 137 |
| 750 | 315 | 137 |
| 500 | 222 | 106 |
| 250 | 222 | 106 |
| 150 | 180 | 93 |




Section
(NTS)

150KW GENERATOR

**Specification sheet**

# Diesel generator set

QSB7 series engine

125-200 kW @ 60 Hz

EPA Tier 3 emissions

## Description

Cummins® generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby applications.

## Features

**Heavy duty engine** - Rugged 4-cycle industrial diesel delivers reliable power and fast response to load changes.

**Alternator** - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

**Control system** - The PowerCommand® 1.1 electronic control is standard equipment and provides total generator set system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

**Cooling system** - Standard cooling package provides reliable running at up to 50 °C (122 °F) ambient temperature.

**Enclosures** - The aesthetically appealing enclosure incorporates special designs that deliver one of the quietest generators of its kind. Aluminium material plus durable powder coat paint provides the best anti-corrosion performance. The generator set enclosure has been evaluated to withstand 180 MPH wind loads in accordance with ASCE7 -10. The design has hinged doors to provide easy access for service and maintenance.

**Fuel tanks** - Dual wall sub-base fuel tanks are offered as optional features, providing economical and flexible solutions to meet extensive code requirements on diesel fuel tanks.

**NFPA** - The generator set accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

**Warranty and service** - Backed by a comprehensive warranty and worldwide distributor network.

| | Standby 60 Hz | | Prime 60 Hz | | |
|---|---|---|---|---|---|
| **Model** | **kW** | **kVA** | **kW** | **kVA** | **Data sheets** |
| C125D6D | 125 | 156 | 113 | 141 | NAD-6371-EN |
| C150D6D | 150 | 188 | 135 | 169 | NAD-6372-EN |
| C175D6D | 175 | 219 | 158 | 197 | NAD-6373-EN |
| C200D6D | 200 | 250 | 180 | 225 | NAD-6374-EN |

## Generator set specifications

| | |
|---|---|
| Governor regulation class | ISO8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | ± 1.0% |
| Random voltage variation | ± 1.0% |
| Frequency regulation | Isochronous |
| Random frequency variation | ± 0.50% |
| Radio frequency emissions compliance | FCC code title 47 part 15 class A and B |

## Engine specifications

| | |
|---|---|
| Design | Turbocharged and charge air cooled |
| Bore | 107 mm (4.21 in.) |
| Stroke | 124 mm (4.88 in.) |
| Displacement | 6.7 L (408 $in^3$) |
| Cylinder block | Cast iron, in-line 6 cylinder |
| Battery capacity | 2 x 850 amps per battery at ambient temperature of 0 ℃ (32 ℉) |
| Battery charging alternator | 100 amps |
| Starting voltage | 2 x 12 volt in parallel, negative ground |
| Lube oil filter type(s) | Spin-on with relief valve |
| Standard cooling system | High ambient radiator |
| Rated speed | 1800 rpm |

## Alternator specifications

| | |
|---|---|
| Design | Brushless, 4 pole, drip proof, revolving field |
| Stator | 2/3 pitch |
| Rotor | Direct coupled, flexible disc |
| Insulation system | Class H per NEMA MG1-1.65 |
| Standard temperature rise | 120 ºC (248 ℉) Standby |
| Exciter type | Torque match (shunt) with PMG as option |
| Alternator cooling | Direct drive centrifugal blower |
| AC waveform Total Harmonic Distortion (THDV) | < 5% no load to full linear load, < 3% for any single harmonic |
| Telephone Influence Factor (TIF) | < 50 per NEMA MG1-22.43 |
| Telephone Harmonic Factor (THF) | < 3% |

## Available voltages

| 1-phase | 3-phase | | | | |
|---|---|---|---|---|---|
| • 120/240 | • 120/208 | • 120/240 | • 277/480 | • 347/600 | • 127/220 |

## Generator set options

**Fuel system**

- Basic fuel tanks
- Regional fuel tanks

**Engine**

- Engine air cleaner – normal or heavy duty
- Shut down – low oil pressure
- Extension – oil drain
- Engine oil heater

**Alternator**

- 120 ℃ temperature rise alternator
- 105 ℃ temperature rise alternator
- PMG excitation
- Alternator heater, 120 V
- Reconnectable full 1 phase output alternator upto 175 kWe

**Control**

- AC output analog meters
- Stop switch – emergency
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)

**Electrical**

- One, two or three circuit breaker configurations
- 80% rated circuit breakers
- 80% or 100% rated LSI circuit breakers
- Battery charger

**Enclosure**

- Aluminium enclosure Sound Level 1 or Level 2, green color
- Aluminium weather protective enclosure with muffler installed, green color

**Cooling system**

- Shutdown – low coolant level
- Warning – low coolant level
- Extension – coolant drain
- Coolant heater options:
  - <4 ℃ (40 ℉) – cold weather
  - <-18 ℃ (0 ℉) – extreme cold

**Exhaust system**

- Exhaust connector NPT
- Exhaust muffler mounted

**Generator set application**

- Base barrier – elevated genset
- Radiator outlet duct adapter

**Warranty**

- Base warranty – 2 year/1000 hours, Standby
- Base warranty – 1 year/unlimited hours, Prime
- 3 & 5 year Standby warranty options

## Generator set accessories

- Coolant heater
- Battery heater kit
- Engine oil heater
- Remote control displays
- Auxiliary output relays (2)
- Auxiliary configurable signal inputs (8) and relay outputs (8)
- Annunciator – RS485
- Audible alarm
- Remote monitoring device – PowerCommand 500/550
- Battery charger – stand-alone, 12 V
- Circuit breakers
- Enclosure Sound Level 1 to Sound Level 2 upgrade kit
- Base barrier – elevated generator set
- Mufflers – industrial, residential or critical
- Alternator PMG excitation
- Alternator heater
- Improved PC1.1 display readability
- Top conduit entry access

## Control system PowerCommand 1.1

**PowerCommand control** is an integrated generator set control system providing voltage regulation, engine protection, operator interface and isochronous governing (optional). Major features include:

- Battery monitoring and testing features and smart starting control system.
- Standard PCCNet interface to devices such as remote annunciator for NFPA 110 applications.
- Control boards potted for environmental protection.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

**Operator/display panel**

- Manual off switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating generator set running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -40 °C to +70 °C
- Bargraph display (optional)

**AC protection**

- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload

**Engine protection**

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown

**Alternator data**

- Line-to-Line and Line-to-neutral AC volts
- 3-phase AC current
- Frequency
- Total kVa

**Engine data**

- DC voltage
- Lube oil pressure
- Coolant temperature
- Engine speed

**Other data**

- Generator set model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)

**Digital governing (optional)**

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

**Digital voltage regulation**

- Integrated digital electronic voltage regulator
- 2-phase Line-to-Line sensing
- Configurable torque matching

**Control functions**

- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- (2) Configurable inputs
- (2) Configurable outputs
- Remote emergency stop
- Automatic Transfer Switch (ATS) control
- Generator set exercise, field adjustable

**Options**

- Auxiliary output relays (2)
- Remote annunciator with (3) configurable inputs and (4) configurable outputs
- PMG alternator excitation
- PowerCommand 500/550 for remote monitoring and alarm notification (accessory)
- Auxiliary, configurable signal inputs (8) and configurable relay outputs (8)
- AC output analog meters (bargraph)
  - Color-coded graphical display of:
    - 3-phase AC voltage
    - 3-phase current
    - Frequency
    - kVa
- Remote operator panel
- PowerCommand 2.3 control with AmpSentry protection

## Ratings definitions

**Emergency Standby Power (ESP):**

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Limited-Time Running Power (LTP):**

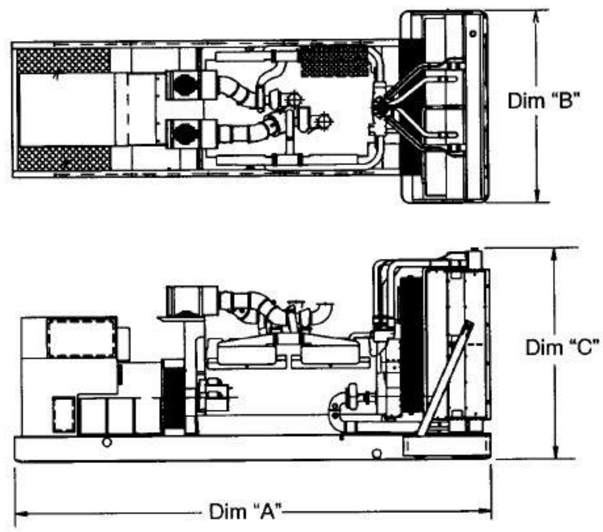
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

**Prime Power (PRP):**

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

**Base Load (Continuous) Power (COP):**

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.




This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

**Do not use for installation design**

| Model | Dim "A" mm (in.) | Dim "B" mm (in.) | Dim "C" mm (in.) | Set weight*wet kg (lbs.) |
|---|---|---|---|---|
| **Open set** | | | | |
| **C125D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C150D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C175D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **C200D6D** | 2867 (113) | 1016 (40) | 1415 (56) | 1470 (3240) |
| **Weather protective enclosure** | | | | |
| **C125D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C150D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C175D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **C200D6D** | 2867 (113) | 1016 (40) | 1836 (72) | 1600 (3527) |
| **Sound attenuated enclosure Level 1** | | | | |
| **C125D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C150D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C175D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **C200D6D** | 3621 (143) | 1016 (40) | 1836 (72) | 1649 (3635) |
| **Sound attenuated enclosure Level 2** | | | | |
| **C125D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C150D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C175D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |
| **C200D6D** | 4061 (160) | 1016 (40) | 1836 (72) | 1665 (3671) |

* Weights above are average. Actual weight varies with product configuration.

## Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

| | | | |
|---|---|---|---|
| ISO 9001 | This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002. | UL | The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. |
| PTS | The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems. | **U.S. EPA** | Engine certified to U.S. EPA SI Stationary Emission Regulation 40 CFR, Part 60. |
| CSA | All low voltage models are CSA certified to product class 4215-01. | **International Building Code** | The generator set is certified to International Building Code (IBC) 2012. |

**Warning:** Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

**Our energy working for you.™**

## Generator Set Data Sheet

| | |
|---|---|
| Model: | C150D6D |
| Frequency: | 60 Hz |
| Fuel Type: | Diesel |
| KW Rating: | 150 Standby<br>135 Prime |
| Emissions level: | EPA Tier 3, Stationary Emergency |

| | |
|---|---|
| Exhaust Emission Data Sheet: | EDS-3044 |
| Exhaust Emission Compliance Sheet: | EPA-2033 |
| Sound Performance Data Sheet: | MSP-4008 |
| Cooling Performance Data Sheet: | MCP-2048 |
| Prototype Test Summary Data Sheet: | PTS-636 |

## Fuel Consumption

| | Standby | | | | Prime | | | |
|---|---|---|---|---|---|---|---|---|
| | kW (kVA) | | | | kW (kVA) | | | |
| Ratings | 150 (188) | | | | 135 (169) | | | |
| Load | 1/4 | 1/2 | 3/4 | Full | 1/4 | 1/2 | 3/4 | Full |
| US gph | 4.7 | 6.9 | 9.2 | 11.7 | 4.4 | 6.4 | 8.4 | 10.7 |
| L/hr | 17.78 | 26.11 | 34.82 | 44.28 | 16.65 | 24.22 | 31.79 | 40.49 |

## Engine

| Engine | Standby rating | Prime rating |
|---|---|---|
| Engine Manufacturer | Cummins Inc. | |
| Engine Model | QSB7-G5 | |
| Configuration | Cast iron, in-line, 6 cylinders | |
| Aspiration | Turbocharged and charge air cooled | |
| Gross Engine Power Output, kWm (bhp) | 242 (324) | 208 (279) |
| BMEP at set rated load, kPa (psi) | 1763 (255.7) | 1601 (232) |
| Bore, mm (in) | 107 (4.21) | |
| Stroke, mm (in) | 124 (4.88) | |
| Rated Speed, rpm | 1800 | |
| Piston Speed, m/s (ft/min) | 7.44 (1464) | |
| Compression Ratio | 17.2:1 | |
| Lube Oil Capacity, L (qt) | 17.4 (18.38) | |
| Overspeed Limit, rpm | 2250 | |

## Fuel Flow

| | |
|---|---|
| Maximum Fuel Flow, L/hr (US gph) | 103 (27.0) |
| Maximum Fuel Inlet Restriction with Clean Filter, mm Hg (in Hg) | 127 (5.0) |

## Air

| Air | Standby rating | Prime rating |
|---|---|---|
| Combustion Air, m3/min (scfm) | 14.78 (522) | 14.22 (502) |
| Maximum Air Cleaner Restriction with Clean Filter, kPa (in H2O) | 3.7 (15) | |

## Exhaust

| | | |
|---|---|---|
| Exhaust Flow at set rated load, $m^3$/min (cfm) | 35.62 (1258) | 33.66 (1189) |
| Exhaust Temperature, °C (°F) | 466.67 (872) | 453.89 (849) |
| Maximum Back Pressure, kPa (in $H_2O$) | 10 (40.19) | 10 (40.19) |
| Actual Exhaust Back Pressure with CPG Sound level 2 Enclosure Muffler, kPa (in $H_2O$) | 9.5 (38.18) | 8.6 (34.36) |
| Actual Exhaust Back Pressure with CPG Weather Enclosure Muffler, kPa (in $H_2O$) | 7.2 (28.93) | 6.5 (26) |

## Standard Set-mounted Radiator Cooling

| | | |
|---|---|---|
| Ambient Design, ° C (° F) | 50 (122) | |
| Fan Load, $kW_m$ (HP) | 14.02 (18.8) | |
| Coolant Capacity (with radiator), L (US Gal) | 22 (5.9) | |
| Cooling System Air Flow, $m^3$/min (scfm) | 305.82 (10800) | |
| Total Heat Rejection, MJ/min (Btu/min) | 7.91 (7499) | 7.25 (6871) |
| Maximum Cooling Air Flow Static Restriction, kPa (in $H_2O$) | 0.12 (0.5) | |

## Weight[2]

| | |
|---|---|
| Unit Wet Weight kgs (lbs) | 1390 (3064) |

Notes:

[1] For non-standard remote installations contact your local Cummins Power Generation representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating Factors

| | |
|---|---|
| Standby | Engine power available up to 3425 m (11237 ft.) at ambient temperatures up to 40° C (104° F) and 2298 m (7540 ft.) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters. |
| Prime | Engine power available up to 2743 m (9000 ft.) at ambient temperatures up to 40° C (104° F) and 2151 m (7057 ft.) at 50° C (122° F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters. |

## Ratings Definitions

| Emergency Standby Power (ESP): | Limited-time Running Power (LTP): | Prime Power (PRP): | Base Load (continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

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## Alternator Data

| Standard Alternators | Single phase[2] | Three Phase[1] | | | | | |
|---|---|---|---|---|---|---|---|
| Maximum Temperature Rise above 40 °C Ambient | 120 °C | 120 °C | | | | | |
| Feature Code | BB88-2 | B946-2 | B986-2 | B952-2 | B943-2 | BB86-2 | BB88-2 |
| Alternator Data Sheet Number | ADS212 | ADS-210 | ADS-210 | ADS-209 | ADS-209 | ADS-210 | ADS-212 |
| Voltage Ranges | 120/240 | 120/208 | 120/240 | 347/600 | 277/480 | 127/220 | 120/208, 127/220, 277/480 |
| Voltage Feature Code | R104 | R098-2 | R106-2 | R114-2 | R002-2 | R020-2 | R098-2, R020-2, R106-2, R002-2 |
| Surge kW | 205.9 | 210.2 | 211.4 | 211.1 | 211.4 | 210.7 | 211.6 |
| Motor Starting kVA (at 90% sustained voltage) Shunt | 770 | 563 | 563 | 516 | 516 | 563 | 770 |
| Motor Starting kVA (at 90% sustained voltage) PMG | 920 | 663 | 663 | 607 | 607 | 663 | 920 |
| Full Load Current Amps at Standby Rating | 625 | 520 | 451 | 180 | 226 | 492 | 226 to 520 |

## Alternator Data

| Standard Alternators | Single phase[2] | Three phase[1] | | | | |
|---|---|---|---|---|---|---|
| Maximum Temperature Rise above 40 °C Ambient | 105 °C | 105 °C | 105 °C | 105 °C | 105 °C | 105 °C |
| Feature Code | BB87-2 | BB93-2 | BB94-2 | BB95-2 | BB92-2 | BB85-2 |
| Alternator Data Sheet Number | ADS-212 | ADS-210 | ADS-210 | ADS-209 | ADS-209 | ADS-210 |
| Voltage Ranges | 120/208, 120/240, 127/220, 277/480, 347/600 | 120/208 | 120/240 | 277/480 | 347/600 | 127/220 |
| Voltage Feature Code | R098-2, R020-2, R002-2, R104-2, R106-2, R114-2 | R098-2 | R106-2 | R002-2 | R114-2 | R020-2 |
| Surge kW | 205.9 | 210.2 | 211.4 | 211.4 | 210.7 | 211.6 |
| Motor Starting kVA (at 90% sustained voltage) Shunt | 770 | 563 | 563 | 516 | 516 | 563 |
| Motor Starting kVA (at 90% sustained voltage) PMG | 920 | 663 | 663 | 607 | 607 | 663 |
| Full Load Current Amps at Standby Rating | 625 | 520 | 451 | 226 | 180 | 492 |

Notes:
[1] Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor
[2] Full single phase output up to full set rated 3-phase kW at 1.0 power factor

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## Formulas for Calculating Full Load Currents:

| Three phase output | Single phase output |
| --- | --- |
| $\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$ | $\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$ |

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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# Sound Data
## C150D6D
## QSB7-G5 NR3 60Hz Diesel

### A-weighted Sound Pressure Level @ 7 meters, dB(A)

See notes 2, 5 and 7-11 listed below

| Configuration | Exhaust | Applied Load | Position (Note 2) | | | | | | | | 8 Position Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | 84 | 86 | 88 | 88 | 83 | 90 | 88 | 88 | 87 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | 86 | 85 | 83 | 87 | 84 | 89 | 83 | 86 | 86 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | 83 | 79 | 74 | 74 | 74 | 75 | 75 | 80 | 78 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | 72 | 72 | 71 | 72 | 73 | 72 | 71 | 73 | 72 |

### Average A-weighted Sound Pressure Level @ 1 meter, dB(A)

See notes 1, 5 and 7-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Pressure Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 46 | 68 | 81 | 89 | 91 | 91 | 90 | 88 | 86 | 90 | 98 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 42 | 67 | 83 | 90 | 89 | 90 | 87 | 84 | 80 | 81 | 96 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 45 | 62 | 74 | 80 | 80 | 81 | 79 | 76 | 77 | 73 | 88 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 45 | 63 | 72 | 77 | 76 | 77 | 76 | 73 | 71 | 65 | 84 |

### A-weighted Sound Pressure Level @ Operator Location, dB(A)

See notes 1, 3, 5 and 7-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Pressure Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 43 | 68 | 79 | 85 | 89 | 89 | 90 | 89 | 88 | 95 | 99 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 42 | 67 | 79 | 84 | 84 | 82 | 81 | 78 | 75 | 78 | 90 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 50 | 66 | 75 | 81 | 82 | 81 | 78 | 75 | 74 | 69 | 87 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 50 | 67 | 76 | 80 | 79 | 79 | 76 | 73 | 72 | 61 | 86 |

# Sound Data
## C150D6D
## QSB7-G5 NR3 60Hz Diesel

## A-weighted Sound Power Level, dB(A)

See notes 1, 3 and 6-14 listed below

| Configuration | Exhaust | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Power Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Standard – Unhoused | Infinite Exhaust | 100% Standby | N/A | 63 | 86 | 98 | 106 | 108 | 109 | 107 | 106 | 103 | 107 | 116 |
| F216-2 Weather Aluminum | Mounted | 100% Standby | N/A | 60 | 85 | 101 | 108 | 107 | 107 | 105 | 102 | 97 | 99 | 114 |
| F231-2 Sound Attenuated Level 1, Aluminum | Mounted | 100% Standby | N/A | 63 | 80 | 92 | 99 | 99 | 99 | 97 | 94 | 95 | 91 | 106 |
| F217-2 Sound Attenuated Level 2, Aluminum | Mounted | 100% Standby | N/A | 64 | 81 | 91 | 95 | 94 | 95 | 94 | 91 | 90 | 84 | 102 |

## Exhaust Sound Power Level, dB(A)

See notes 4 and 6-14 listed below

| Configuration | Applied Load | Octave Band Center Frequency (Hz) | | | | | | | | | | | Overall Sound Power Level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 | |
| Open Exhaust (No Muffler) | 100% Standby | N/A | 64 | 93 | 106 | 115 | 117 | 114 | 113 | 113 | 105 | 94 | 122 |

Global Notes:

**1.** Sound pressure levels at 1 meter are measured per the requirements of ISO 3744, ISO 8528-10, and European Communities Directive 2000/14/EC as applicable. The microphone measurement locations are 1 meter from a reference parallelepiped just enclosing the generator set (enclosed or unenclosed).

**2.** Seven-meter measurement location 1 is 7 meters (23 feet) from the generator (alternator) end of the generator set, and the locations proceed counterclockwise around the generator set at 45° angles at a height of 1.2 meters (48 inches) above the ground surface.

**3.** Sound Power Levels are calculated according to ISO 3744, ISO 8528-10, and/or CE (European Union) requirements.

**4.** Exhaust Sound Levels are measured and calculated per ISO 6798, Annex A.

**5.** Reference Sound Pressure Level is 20 μPa

**6.** Reference Sound Power Level is 1 pW ($10^{-12}$ Watt)

**7.** Sound data for remote-cooled generator sets are based on rated load without cooling fan noise.

**8.** Sound data for the generator set with infinite exhaust do not include the exhaust noise contribution

**9.** Published sound levels are measured at CE certified test site and are subject to instrumentation measurement, installation, and manufacturing variability.

**10.** Unhoused/Open configuration generator sets refers to generator sets with no sound enclosures of any kind.

**11.** Housed/Enclosed/Closed/Canopy configuration generator sets refer to generator sets that have noise reduction sound enclosure installed over the generator set and usually integrally attached to the skid base/base frame/fuel container base of the generator set.

**12.** Published sound levels meet the requirements India's Central Pollution Control Board (Ministry of Environment & Forests), vide GSR 371 (E), which states the A-weighted sound level at 1 meter from any diesel generator set up to a power output rating of 1000kVA shall not exceed 75 dB(A).

**13.** For updated noise pollution information for India see website: http://www.envfor.nic.in/legis/legis.html

**14.** Sound levels must meet India's Ambient Air Noise Quality Standards detailed for Daytime/Nighttime operation in Noise Pollution (Regulation and Control) Rules, 2000

Specification sheet

# Dual wall sub-base diesel fuel tanks -

## 10-200 kW generator sets

## Description

Cummins® offers two series of fuel tanks (basic series and regional series) for the 10~125 kW diesel generator sets. The “basic” series of fuel tanks provide economical solutions for areas with no or minimal local/regional code requirements on diesel fuel tanks. The footprint of “basic” tanks matches the generator set’s footprint. The “regional” series of fuel tanks provide flexible and upgradable solutions for areas with extensive local/regional code requirements on diesel fuel tanks. The footprint of the “regional” series of fuel tanks extends beyond the generator set to allow room for installation of optional features at factory or accessories in the field for meeting local/regional code requirements or customer specification on diesel fuel tanks. All fuel tanks and optional features are compatible with factory installed enclosures.

These tanks are constructed of heavy gauge steel and include an internally reinforced baffle structure for supporting the generator set. The fuel tank design features fewer seams and welds for better corrosion resistance performance.

These tanks are pre-treated with a conversion coating and then finished with a textured powder paint. The paint has superior UV and chemical resistance with best-in-class adhesion, flexibility, and durability to resist chipping and substrate corrosion. Both interior compartments are treated with a rust preventative for extended corrosion protection.

These tanks are UL and ULC Listed as secondary containment generator base tanks. Inner and outer containments are leak checked per UL and ULC testing procedures to ensure their integrity.

These fuel tanks are offered in various sizes to satisfy different fuel capacities requirements.

## Compatible generator set model

| Engine | D1703M | V2203M | 4BT3.3-G5 | 4BTAA3.3-G7 | QSB5-G5 | QSB7-G5 |
|---|---|---|---|---|---|---|
| Generator set model names | C10D6 | C20D6 | C25D6 | C50D6 | C50D6C | C125D6D |
| | C15D6 | | C30D6 | C60D6 | C60D6C | C150D6D |
| | | | C35D6 | | C80D6C | C175D6D |
| | | | C40D6 | | C100D6C | C200D6D |
| | | | | | C125D6C | |
| | | | | | | |

## Basic fuel tanks

**Standard features:**

**UL 142 and ULC-S601 listed** - Minimum 110% secondary containment capacity.

**NFPA and IFC** - Capable of meeting NFPA 30 and NFPA 110 codes with available factory installed optional features.

**Emergency pressure relief vents** - Ensure adequate ventilation of the primary and secondary tank compartments under extreme temperature and emergency conditions.

**Normal atmospheric vent** - "Mushroom" style vent ensures adequate venting of the primary tank during fill, generator set running and temperature variations. Raised above fuel fill.

**Raised fuel fill** - includes lockable sealed fuel cap.

**Lifting eyes** - Allow lifting of fuel tank with generator set installed.

**Optional features:**

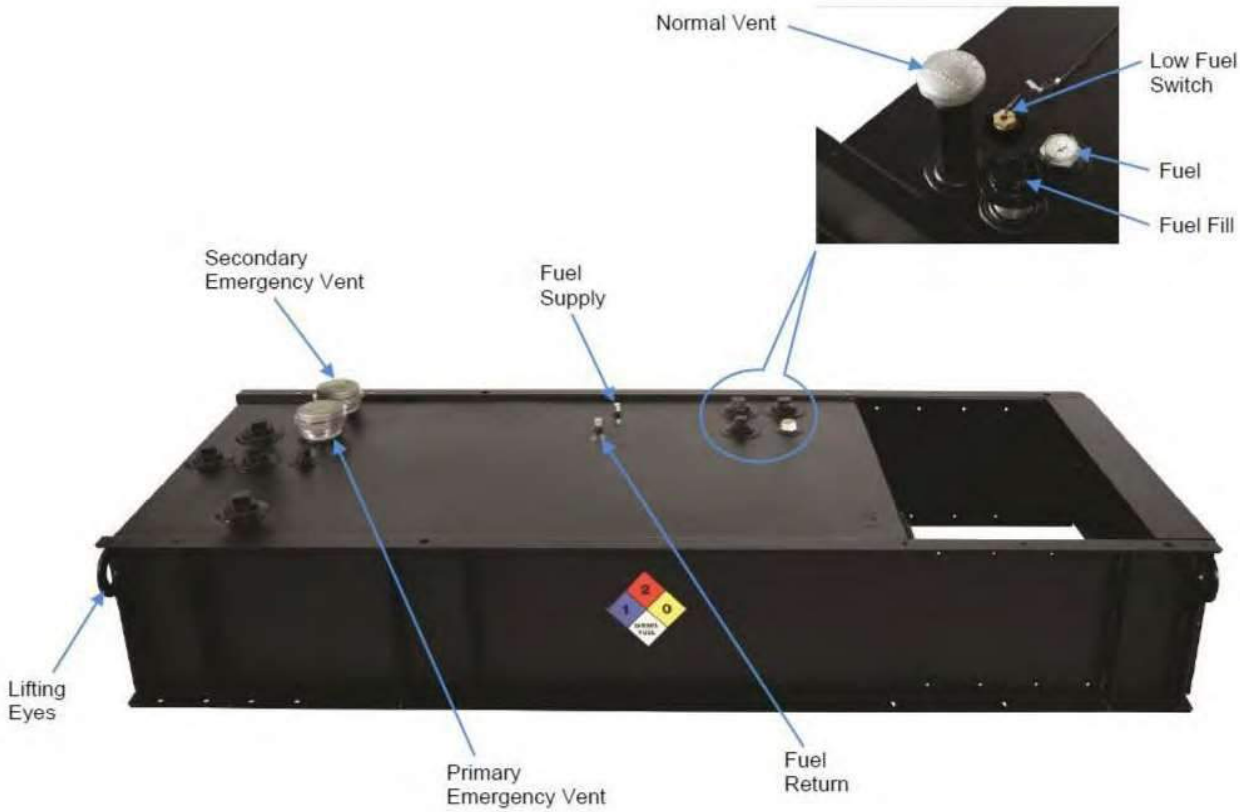
**Secondary containment basin switch (rupture switch)** - Activates a warning in the event of a primary tank leak. Side mounted.

**Low fuel level switch** - Activates a warning when 40% of the fuel is left in the tank.

**Fuel level gauge** - Provides direct reading of fuel level. Top mounted.

**Electric fuel level sender with gauge** - Allows remote electrical monitoring of fuel tank level. Flying leads for customer connection.

**Tank to foundation clearance** - 2-inch bolt-thru risers allow visual inspection under tank including rodent barrier.




*Picture is for reference only. See outline drawing for tank specific information by model.

## Basic tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time |
|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr |
| 10 | C10D6 | D1703M | 1.12 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 41 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 81 |
| 15 | C15D6 | D1703M | 1.38 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 33 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 66 |
| 20 | C20D6 | V2203M | 1.81 | C319-2 | 24 | 65.7 x 34 x 13 | 310 | 46 | 25 |
| | | | | C320-2 | 48 | 65.7 x 34 x 23 | 583 | 91 | 50 |
| 25 | C25D6 | 4BT3.3-G5 | 2.42 | C319-2 | 24 | 87.6 x 34 x 15 | 456 | 74 | 31 |
| | | | | C320-2 | 48 | 87.6 x 34 x 23 | 669 | 132 | 54 |
| 30 | C30D6 | 4BT3.3-G5 | 2.81 | C319-2 | 24 | 87.6 x 34 x 15 | 456 | 74 | 26 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 69 |
| 35 | C35D6 | 4BT3.3-G5 | 3.16 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 42 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 62 |
| 40 | C40D6 | 4BT3.3-G5 | 3.66 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 36 |
| | | | | C320-2 | 48 | 87.6 x 34 x 32 | 908 | 195 | 53 |
| 50 | C50D6 | 4BTAA3.3-G7 | 4.25 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 31 |
| | | | | C320-2 | 48 | 87.6 x 34 x 42 | 977 | 263 | 62 |
| 60 | C60D6 | 4BTAA3.3-G7 | 5.04 | C319-2 | 24 | 87.6 x 34 x 23 | 669 | 132 | 26 |
| | | | | C320-2 | 48 | 87.6 x 34 x 42 | 977 | 263 | 52 |
| 50 | C50D6C | QSB5-G5 | 5.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 49 |
| | | | | C320-2 | 48 | 117 x 40 x 25 | 809 | 260 | 49 |
| 60 | C60D6C | QSB5-G5 | 6.10 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 42 |
| | | | | C320-2 | 48 | 117 x 40 x 33 | 966 | 353 | 57 |
| 80 | C80D6C | QSB5-G5 | 7.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 35 |
| | | | | C320-2 | 48 | 117 x 40 x 33 | 966 | 353 | 48 |
| 100 | C100D6C | QSB5-G5 | 8.90 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 29 |
| | | | | C320-2 | 48 | 117 x 40 x 48 | 1471 | 526 | 59 |
| 125 | C125D6C | QSB5-G6 | 10.30 | C319-2 | 24 | 117 x 40 x 25 | 809 | 260 | 25 |
| | | | | C320-2 | 48 | 117 x 40 x 48 | 1471 | 526 | 51 |
| 125 | C125D6D | QSB7-G5 | 10.1 | C319-2 | 24 | 117x40x25 | 809 | 258 | 25 |
| | | | | C320-2 | 48 | 117x40x48 | 1471 | 520 | 51 |
| 150 | C150D6D | | 11.7 | C319-2 | 24 | 117x40x33 | 966 | 350 | 29 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 62 |
| 175 | C175D6D | | 13.3 | C319-2 | 24 | 117x40x33 | 966 | 350 | 26 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 55 |
| 200 | C200D6D | | 14.9 | C319-2 | 24 | 117x40x48 | 1471 | 520 | 34 |
| | | | | C320-2 | 48 | 180x40x42 | 2302 | 737 | 49 |

Note: No OFPV is offered on basic fuel tanks.
* All weights are approximate.

## Regional fuel tanks

**Standard features:**

**UL 142 and ULC-S601 listed** - Minimum 110% secondary IBC 2012 and 2015 certified - All optional features are seismically certified with this range of tanks and generator sets. Requires factory-installed 2 ft vent extensions or higher.

**UL 142 & ULC-S601 listed** - Minimum 125% secondary containment capacity.

**NFPA & IFC** - Capable of meeting NFPA 30, NFPA 110, and IFC codes with available factory-installed optional features.

**Emergency pressure relief vents** - Ensure adequate ventilation of the primary and secondary tank compartments under extreme temperature and emergency conditions.

**Normal atmospheric vent** - "Mushroom" style vent ensures adequate venting of the primary tank during fill, generator set running, and temperature variations. Raised above fuel fill.

**Raised fuel fill** - Includes lockable sealed fuel cap.

**Lifting eyes** - Allow lifting of fuel tank with generator set installed.

**Optional features:**

**Secondary containment basin switch (rupture switch)** - Activates a warning in the event of a primary tank leak. Side Mounted.

**Low fuel level switch** - Activates a warning when 40% of the fuel is left in the tank.

**Fuel level gauge** - Provides direct reading of fuel level. Top mounted.

**Electric fuel level sender with gauge** - Allows remote electrical monitoring of fuel tank level. Flying leads for customer connection.

**Tank to foundation clearance** - 2-inch bolt-thru risers allow visual inspection under tank including rodent barrier.

**Spill containment box for fuel fill** - 5 gallon capacity with integral drain (to tank). Lockable lid.

**Overfill prevention valve** - Shuts off fuel flow during filling at approximately 95% full*. Includes fill down tube, as needed, to terminate within 6" of the bottom of the fuel tank. Uses a 2 inch type "F" cam lock adapter for filling.

**High fuel switch** - Activates at 90% of full fuel level. Flying leads for customer connection.

**High fuel alarm panel** - Provides audible & visual alarm when fuel level reaches 90% of full fuel level.

**Fill drop tube** - Terminates fuel fill location within 6" of the bottom of the fuel tank.

**Vent extensions** - Terminate normal and emergency vents (both primary and secondary) a minimum of 12 ft above the bottom of tank.

**Seismic vent extensions** - 2 ft normal and emergency (both primary & secondary) extensions to meet IBC/OSHPD seismic requirements.

* The OFPV inherently shuts off fuel at approximately 2" below the top of the fuel tank. Some tanks will shut off below this 95% fill level.


*Picture is for reference only. See outline drawing for tank specific information by model.

## Regional tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time w/o OFPV | Actual run time w/OFPV |
|---|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr | hr |
| 10 | C10 D6 | D1703M | 1.12 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 66 | 56 |
| | | | | C303-2 | 48 | 87.6 x 34 x 15 | 510 | 74 | 66 | 56 |
| | | | | C305-2 | 72 | 87.6 x 34 x 23 | 723 | 132 | 118 | 107 |
| | | | | C307-2 | 96 | 87.6 x 34 x 23 | 723 | 132 | 118 | 107 |
| 15 | C15 D6 | D1703M | 1.38 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 53 | 45 |
| | | | | C303-2 | 48 | 87.6 x 34 x 15 | 510 | 74 | 53 | 45 |
| | | | | C305-2 | 72 | 87.6 x 34 x 23 | 723 | 132 | 95 | 86 |
| | | | | C307-2 | 96 | 87.6 x 34 x 32 | 962 | 195 | 141 | 132 |
| 20 | C20 D6 | V2203M | 1.81 | C301-2 | 24 | 87.6 x 34 x 15 | 510 | 74 | 41 | 35 |
| | | | | C303-2 | 48 | 87.6 x 34 x 23 | 723 | 132 | 73 | 66 |
| | | | | C305-2 | 72 | 87.6 x 34 x 32 | 962 | 195 | 108 | 101 |
| | | | | C307-2 | 96 | 87.6 x 34 x 32 | 962 | 195 | 108 | 101 |
| 25 | C25 D6 | 4BT3.3-G5 | 2.42 | C301-2 | 24 | 121 x 34 x 10.5 | 514 | 74 | 31 | 25 |
| | | | | C303-2 | 48 | 121 x 34 x 16.2 | 686 | 132 | 54 | 47 |
| | | | | C305-2 | 72 | 121 x 34 x 22.1 | 879 | 195 | 80 | 73 |
| | | | | C307-2 | 96 | 121 x 34 x 29.5 | 1120 | 263 | 109 | 101 |
| 30 | C30 D6 | 4BT3.3-G5 | 2.81 | C301-2 | 24 | 121 x 34 x 10.5 | 514 | 74 | 26 | 21 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 69 | 63 |
| | | | | C305-2 | 72 | 121 x 34 x 29.5 | 1120 | 263 | 94 | 87 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 138 | 132 |
| 35 | C35 D6 | 4BT3.3-G5 | 3.16 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 42 | 36 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 62 | 56 |
| | | | | C305-2 | 72 | 121 x 34 x 29.5 | 1120 | 263 | 83 | 77 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 123 | 117 |
| 40 | C40 D6 | 4BT3.3-G5 | 3.66 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 36 | 31 |
| | | | | C303-2 | 48 | 121 x 34 x 22.1 | 879 | 195 | 53 | 48 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 106 | 101 |
| | | | | C307-2 | 96 | 121 x 34 x 42.0 | 1461 | 389 | 106 | 101 |
| 50 | C50 D6 | 4BTAA3.3-G7 | 4.25 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 31 | 27 |
| | | | | C303-2 | 48 | 121 x 34 x 29.5 | 1120 | 263 | 62 | 58 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 92 | 87 |
| 60 | C60 D6 | 4BTAA3.3-G7 | 5.04 | C301-2 | 24 | 121 x 34 x 16.2 | 686 | 132 | 26 | 23 |
| | | | | C303-2 | 48 | 121 x 34 x 29.5 | 1120 | 263 | 52 | 49 |
| | | | | C305-2 | 72 | 121 x 34 x 42.0 | 1461 | 389 | 77 | 73 |
| 50 | C50D6C | QSB5-G5 | 5.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 47 | 45 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 80 | 76 |
| | | | | C305-2 | 72 | 154 x 40 x 32 | 1657 | 425 | 80 | 76 |
| | | | | C307-2 | 96 | 154 x 40 x 46 | 2096 | 625 | 118 | 112 |
| 60 | C60D6C | QSB5-G5 | 6.10 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 41 | 39 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 70 | 66 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 102 | 97 |
| | | | | C307-2 | 96 | 154 x 40 x 46 | 2096 | 625 | 102 | 97 |
| 80 | C80D6C | QSB5-G5 | 7.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 34 | 33 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 58 | 55 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 85 | 81 |
| 100 | C100D6C | QSB5-G5 | 8.90 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 28 | 27 |
| | | | | C303-2 | 48 | 154 x 40 x 32 | 1657 | 425 | 48 | 45 |
| | | | | C305-2 | 72 | 154 x 40 x 46 | 2096 | 625 | 70 | 66 |
| 125 | C125D6C | QSB5-G6 | 10.30 | C301-2 | 24 | 154 x 40 x 22 | 1388 | 250 | 24 | 23 |
| | | | | C303-2 | 48 | 154 x 40 x 46 | 2096 | 625 | 60 | 58 |

* All weights are approximate.

## Regional tanks

| Generator set Standby power output | Generator set model | Engine model | Fuel consumption (100% load, Standby) | Tank feature code | Minimum run time feature | Tank dimensions (L x W x H) | Nominal dry weight* | Tank usable volume | Actual run time w/o OFPV | Actual run time w/OFPV |
|---|---|---|---|---|---|---|---|---|---|---|
| kW | | | gal/hr | | hr | inch | lbs | gal | hr | hr |
| 125 | C125D6D | QSB7-G5 | 10.1 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 34 | 30 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 72 | 69 |
| | | | | C305-2 | 72 | 180x40x42 | 2302 | 737 | 72 | 69 |
| | | | | C307-2 | 96 | 180x65.5x35.3 | 3552 | 1055 | 104 | 98 |
| 150 | C150D6D | | 11.7 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 30 | 26 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 63 | 59 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 90 | 84 |
| 175 | C175D6D | | 13.3 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 26 | 23 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 55 | 52 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 79 | 74 |
| 200 | C200D6D | | 14.9 | C301-2 | 24 | 180x40x21 | 1477 | 351 | 24 | 21 |
| | | | | C303-2 | 48 | 180x40x42 | 2302 | 737 | 49 | 47 |
| | | | | C305-2 | 72 | 180x65.5x35.3 | 3552 | 1055 | 72 | 66 |

## Certifications/standards/codes

**UL 142 Listed** - Cummins dual wall sub-base tanks are UL Listed and constructed in accordance with Underwriters Laboratories Standard UL 142 “steel aboveground tanks for flammable and combustible liquids,” as a “secondary containment generator base tank”

**NFPA** - Cummins tanks are built in accordance with all applicable NFPA codes:

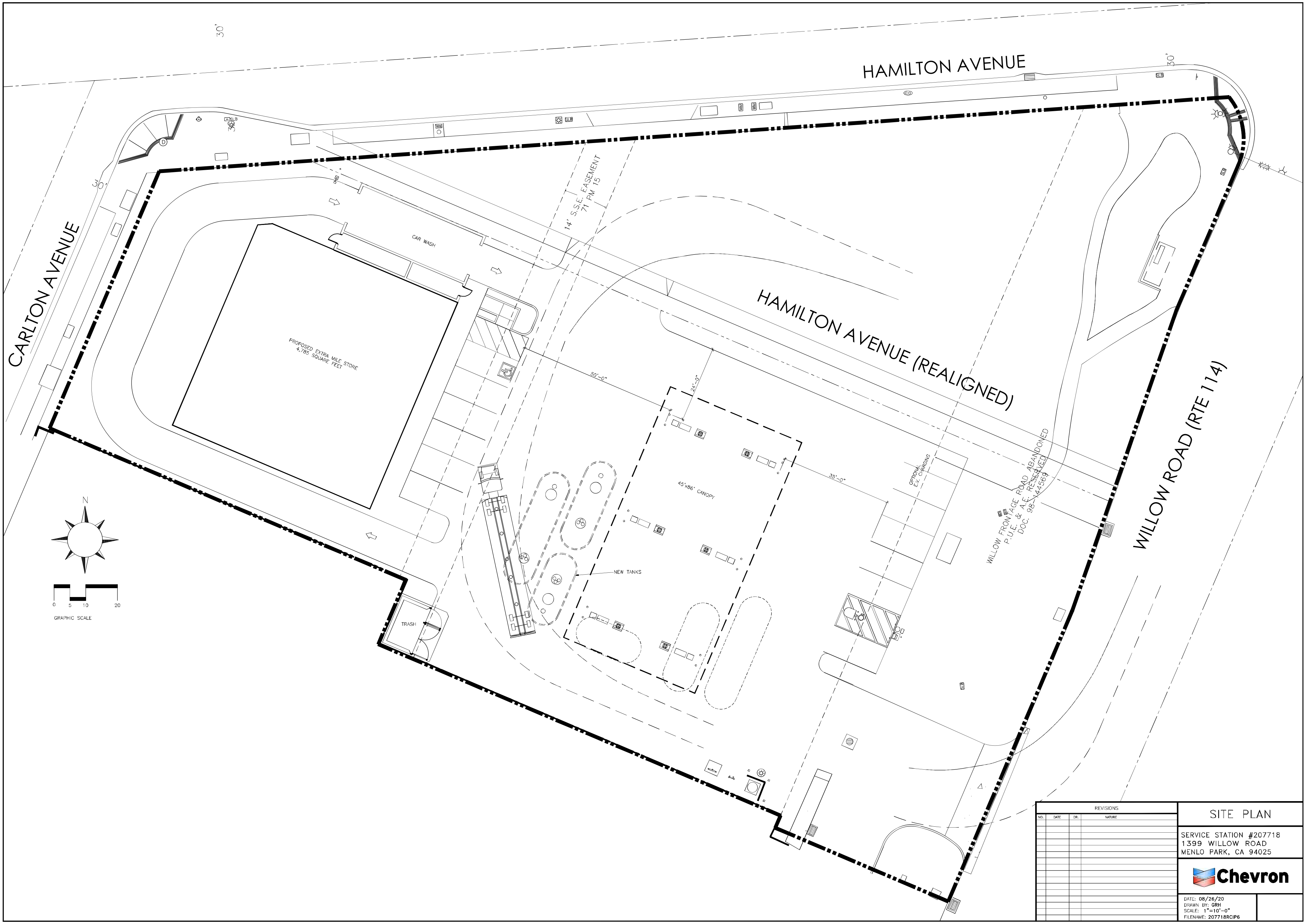
- NFPA 30 - Flammable and Combustible Liquids code
- NFPA 37 - Standard for Installation and use of Stationary Combustible Engine and Gas Turbines
- NFPA 110 - Standard for Emergency and Standby Power Systems

**ISO9001** - This product was designed and manufactured in facilities certified to ISO9001.

**ULC** - Cummins tanks are built in accordance with all applicable ULC codes

**For more information contact your local Cummins distributor or visit power.cummins.com**

**Our energy working for you.™**




| REVISIONS | | | |
|---|---|---|---|
| NO. | DATE | DR. | NATURE |

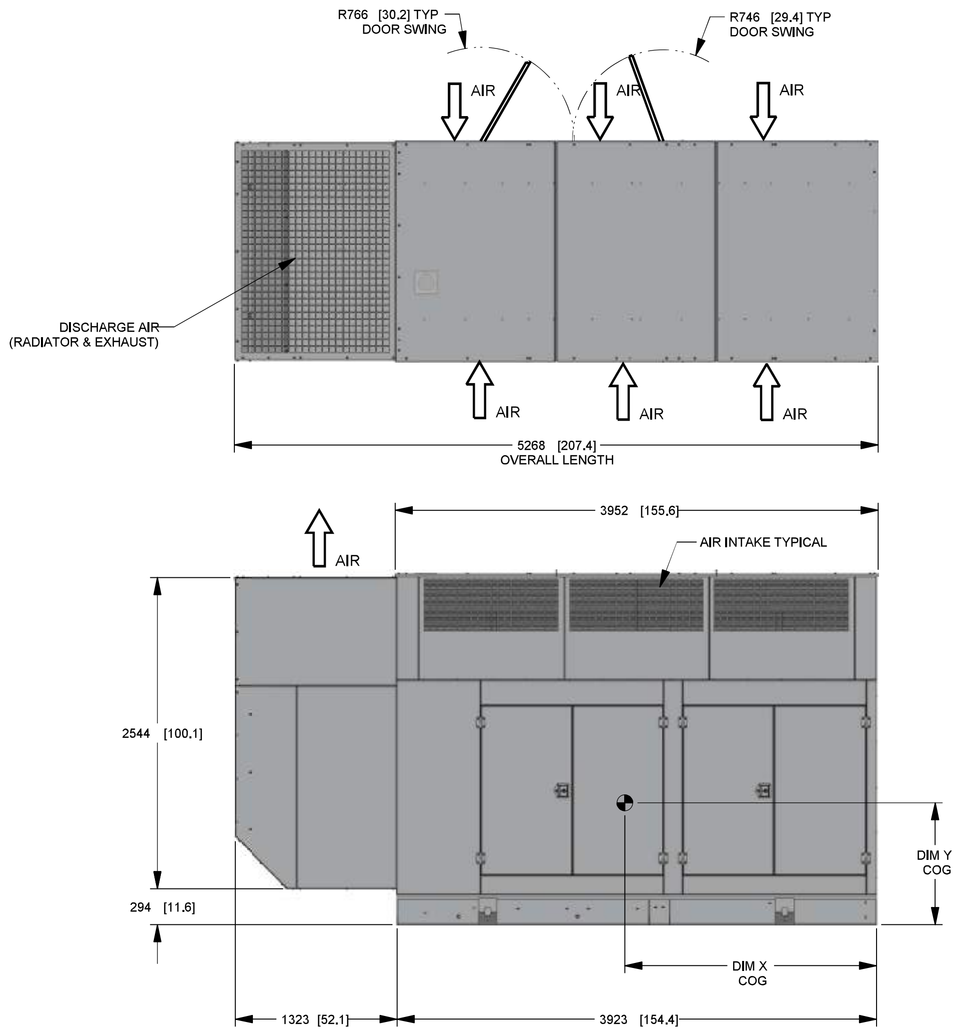
SITE PLAN

SERVICE STATION #207718
1399 WILLOW ROAD
MENLO PARK, CA 94025

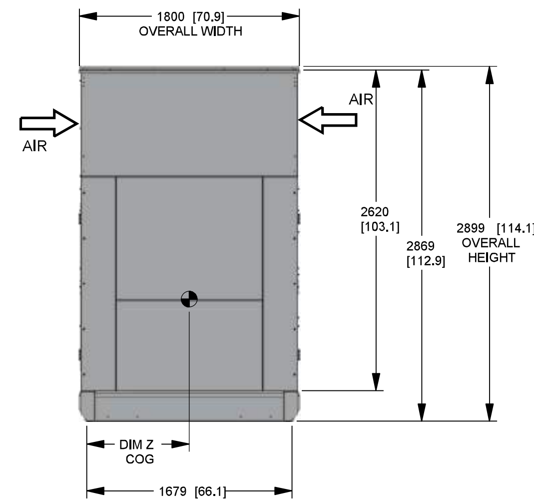
Chevron

DATE: 08/26/20
DRAWN BY: GRH
SCALE: 1"=10'-0"
FILENAME: 207718RCIP6

| SH | 1/1 | REV | D | WINDCHILL VERSION | D.1 |
|---|---|---|---|---|---|




FOR ALL STUB-UP, WEIGHT, AND COG DETAILS, SEE CORRESPONDING OPEN SET DRAWING PER UNIT CONFIGURATION.




DIMENSIONS ARE IN MILLIMETERS [INCHES]

DRAWING CREATED FROM PRO/ENGINEER 3D FILE. ECO MODIFICATION TO BE APPLIED TO SOLID MODEL ONLY.

# INSTALLATION DRAWING



ELECTRONICALLY APPROVED INSIDE WINDCHILL

GENERAC

TITLE
L2A ENCLOSURE
D15.2L SD/MD 500 & SB/MB 500
PD/WD 450 & PB/WB 450

| ISSUE DATE: | 03/21/14 | | |
|---|---|---|---|
| SIZE B | CAGE NO N/A | DWG NO 0K1606C | REV D |
| SCALE 0.025 | WT-KG | SHEET 1 of 1 | |

# SD500 | 15.2L | 500 kW

INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

**Standby Power Rating**

500 kW, 625 kVA, 60 Hz

**Prime Power Rating***

450 kW, 563 kVA, 60 Hz

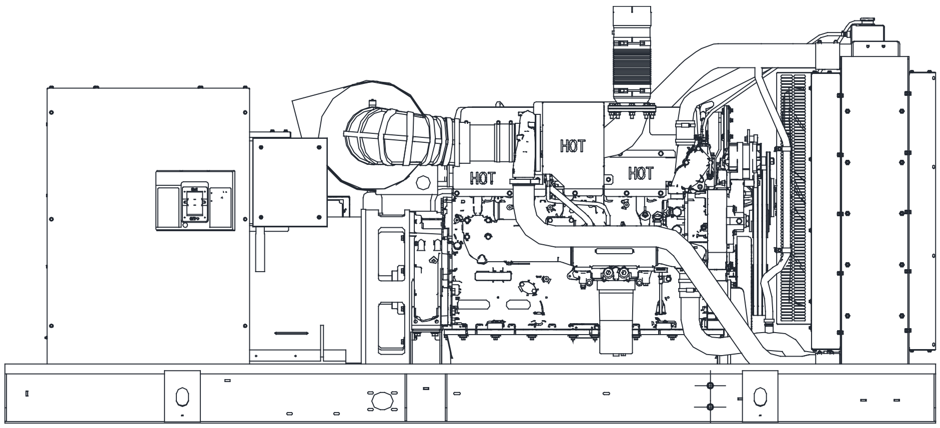



Image used for illustration purposes only

*Assembled in the USA using domestic and foreign parts

*EPA Certified Prime ratings are not available in the US or its Territories

## Codes and Standards

**Not all codes and standards apply to all configurations. Contact factory for details.**

UL2200, UL6200, UL1236, UL142

CSA C22.2

BS5514 and DIN 6271

SAE J1349

NFPA 37, 70, 99, 110

NEC700, 701, 702, 708

ISO 3046, 7637, 8528, 9001

NEMA ICS10, MG1, 250, ICS6, AB1

ANSI C62.41

IBC 2009, CBC 2010, IBC 2012, ASCE 7-05, ASCE 7-10, ICC-ES AC-156 (2012)

## Powering Ahead

For over 50 years, Generac has provided innovative design and superior manufacturing.

Generac ensures superior quality by designing and manufacturing most of its generator components, including alternators, enclosures and base tanks, control systems and communications software.

Generac gensets utilize a wide variety of options, configurations and arrangements, allowing us to meet the standby power needs of practically every application.

Generac searched globally to ensure the most reliable engines power our generators. We choose only engines that have already been proven in heavy-duty industrial applications under adverse conditions.

Generac is committed to ensuring our customers' service support continues after their generator purchase.

SPEC SHEET

# SD500 | 15.2L | 500 kW

INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

GENERAC | INDUSTRIAL POWER

## STANDARD FEATURES

### ENGINE SYSTEM

- Oil Drain Extension
- Heavy Duty Air Cleaner
- Fan Guard
- Stainless Steel Flexible Exhaust Connection
- Critical Silencer (Enclosed Units Only)
- Factory Filled Oil and Coolant
- Radiator Duct Adapter (Open Set Only)

### Fuel System

- Primary Fuel Filter

### Cooling System

- Closed Coolant Recovery System
- UV/Ozone Resistant Hoses
- Factory-Installed Radiator
- 50/50 Ethylene Glycol Antifreeze
- Radiator Drain Extension

### Electrical System

- Battery Charging Alternator
- Battery Cables
- Battery Tray
- Rubber-Booted Engine Electrical Connections
- Solenoid Activated Starter Motor

### ALTERNATOR SYSTEM

- UL2200 GENprotect™
- Class H Insulation Material
- Vented Rotor
- 2/3 Pitch
- Skewed Stator
- Amortisseur Winding
- Permanent Magnet Excitation
- Sealed Bearing
- Full Load Capacity Alternator
- Protective Thermal Switch

### GENERATOR SET

- Internal Genset Vibration Isolation
- Separation of Circuits - High/Low Voltage
- Separation of Circuits - Multiple Breakers
- Wrapped Exhaust Piping (Enclosed Units Only)
- Standard Factory Testing
- 2 Year Limited Warranty (Standby Rated Units)
- 1 Year Limited Warranty (Prime Rated Units)
- Silencer Mounted in the Discharge Hood (Enclosed Units Only)

### ENCLOSURE (If Selected)

- Rust-Proof Fasteners with Nylon Washers to Protect Finish
- High Performance Sound-Absorbing Material (Sound Attenuated Enclosures)
- Gasketed Doors
- Stamped Air-Intake Louvers
- Upward Facing Discharge Hoods (Radiator and Exhaust)
- Stainless Steel Lift Off Door Hinges
- Stainless Steel Lockable Handles
- RhinoCoat™ - Textured Polyester Powder Coat Paint

### FUEL TANKS (If Selected)

- UL 142/ULC S-601
- Double Wall
- Vents
- Sloped Top
- Sloped Bottom
- Factory Pressure Tested (2 psi)
- Rupture Basin Alarm
- Fuel Level
- Check Valve in Supply and Return Lines
- RhinoCoat™ - Textured Polyester Powder Coat Paint
- Stainless Hardware

### CONTROL SYSTEM


### Digital H Control Panel- Dual 4x20 Display

### Program Functions

- Programmable Crank Limiter
- 7-Day Programmable Exerciser
- Special Applications Programmable Logic Controller
- RS-232/485 Communications
- All Phase Sensing Digital Voltage Regulator
- 2-Wire Start Capability
- Date/Time Fault History (Event Log)
- Isochronous Governor Control
- Waterproof/Sealed Connectors
- Audible Alarms and Shutdowns
- Not in Auto (Flashing Light)
- Auto/Off/Manual Switch
- E-Stop (Red Mushroom-Type)
- NFPA110 Level I and II (Programmable)
- Customizable Alarms, Warnings, and Events
- Modbus® protocol
- Predictive Maintenance Algorithm
- Sealed Boards
- Password Parameter Adjustment Protection
- Single Point Ground
- 16 Channel Remote Trending
- 0.2 msec High Speed Remote Trending
- Alarm Information Automatically Annunciated on the Display

### Full System Status Display

- Power Output (kW)
- Power Factor
- kW Hours, Total and Last Run
- Real/Reactive/Apparent Power
- All Phase AC Voltage
- All Phase Currents
- Oil Pressure
- Coolant Temperature
- Coolant Level
- Engine Speed
- Battery Voltage
- Frequency

### Alarms and Warnings

- Oil Pressure
- Coolant Temperature
- Coolant Level
- Low Fuel Pressure
- Engine Overspeed
- Battery Voltage
- Alarms and Warnings Time and Date Stamped
- Snap Shots of Key Operation Parameters During Alarms and Warnings
- Alarms and Warnings Spelled Out (No Alarm Codes)

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## CONFIGURABLE OPTIONS

### ENGINE SYSTEM

- Engine Coolant Heater
- Oil Heater
- Level 1 Fan and Belt Guards (Open Set Only)
- Radiator Stone Guard (Open Set Only)

### FUEL SYSTEM

- NPT Flexible Fuel Line

### ELECTRICAL SYSTEM

- 10A UL Listed Battery Charger
- Battery Warmer

### ALTERNATOR SYSTEM

- Alternator Upsizing
- Anti-Condensation Heater

### CIRCUIT BREAKER OPTIONS

- Main Line Circuit Breaker
- 2nd Main Line Circuit Breaker
- Shunt Trip and Auxiliary Contact
- Electronic Trip Breakers

### GENERATOR SET

- 12 Position Load Center
- Extended Factory Testing

### ENCLOSURE

- Weather Protected Enclosure
- Level 1 Sound Attenuated
- Level 2 Sound Attenuated
- Level 2 Sound Attenuated with Motorized Dampers
- Steel Enclosure
- Aluminum Enclosure
- IBC Seismic Certification/OSHPD Preapproval
- Up to 200 MPH Wind Load Rating (Contact Factory for Availability)
- AC/DC Enclosure Lighting Kit
- Enclosure Heater

### FUEL TANKS (Size On Last Page)

- 8 in Fill Extension
- 13 in Fill Extension
- 19 in Fill Extension

### CONTROL SYSTEM

- NFPA 110 Compliant 21-Light Remote Annunciator
- Remote Relay Assembly (8 or 16)
- Oil Temperature Indication and Alarm
- Ground Fault Annunciator
- 10A Engine Run Relay
- 120V GFCI and 240V Outlets
- Remote E-Stop (Break Glass-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Flush Mount)
- Damper Alarm Contacts (Motorized Dampers Only)
- 100dB Alarm Horn

### WARRANTY (Standby Gensets Only)

- 2 Year Extended Limited Warranty
- 5 Year Limited Warranty
- 5 Year Extended Limited Warranty
- 7 Year Extended Limited Warranty
- 10 Year Extended Limited Warranty

## ENGINEERED OPTIONS

### ENGINE SYSTEM

- Fluid Containment Pan
- Coolant Heater Ball Valves

### ALTERNATOR SYSTEM

- 3rd Breaker Systems

### CONTROL SYSTEM

- Spare Inputs (x4) / Outputs (x4)
- Battery Disconnect Switch

### GENERATOR SET

- Special Testing
- Battery Box

### ENCLOSURE

- Door Open Alarm Switch

### TANKS

- Overfill Protection Valve
- UL 2085 Tank
- Stainless Steel Tank
- Special Fuel Tanks
- Vent Extensions
- 5 Gallon Spill Containment Box
- Dealer Supplied AHJ Requirements

## APPLICATION AND ENGINEERING DATA

### ENGINE SPECIFICATIONS

#### General

| | |
|---|---|
| Make | Perkins |
| EPA Emissions Compliance | Stationary Emergency |
| EPA Emission Reference | See Emission Data Sheet |
| Cylinder # | 6 |
| Type | In-Line |
| Displacement - in$^3$ (L) | 927.56 (15.2) |
| Bore - in (mm) | 5.39 (137) |
| Stroke - in (mm) | 6.73 (171) |
| Compression Ratio | 16.0:1 |
| Intake Air Method | Turbocharged/Aftercooled |
| Cylinder Head Type | 4-Valve |
| Piston Type | Aluminum |
| Crankshaft Type | I-Beam Section |

#### Engine Governing

| | |
|---|---|
| Governor | Electronic Isochronous |
| Frequency Regulation (Steady State) | ±0.25% |

#### Lubrication System

| | |
|---|---|
| Oil Pump Type | Gear |
| Oil Filter Type | Full-Flow |
| Crankcase Capacity - qt (L) | 47.55 (45) |

#### Cooling System

| | |
|---|---|
| Cooling System Type | Closed Recovery |
| Water Pump Type | Centrifugal Type, Belt-Driven |
| Fan Type | Pusher |
| Fan Speed - RPM | 1,658 |
| Fan Diameter - in (mm) | 36.5 (927) |

#### Fuel System

| | |
|---|---|
| Fuel Type | Ultra Low Sulfur Diesel #2 |
| Carburetor | ASTM |
| Fuel Filtering (Microns) | Primary 10 - Secondary 2 |
| Fuel Inject Pump Make | Electronic |
| Injector Type | MEUI |
| Engine Type | Pre-Combustion |
| Fuel Supply Line - in (mm) | 0.5 (12.7) NPT |
| Fuel Return Line - in (mm) | 0.5 (12.7) NPT |

#### Engine Electrical System

| | |
|---|---|
| System Voltage | 24 VDC |
| Battery Charger Alternator | Standard |
| Battery Size | See Battery Index 0161970SBY |
| Battery Voltage | (2)-12 VDC |
| Ground Polarity | Negative |

### ALTERNATOR SPECIFICATIONS

| | |
|---|---|
| Standard Model | K0500124Y23 |
| Poles | 4 |
| Field Type | Revolving |
| Insulation Class - Rotor | H |
| Insulation Class - Stator | H |
| Total Harmonic Distortion | <3% (3-Phase) |
| Telephone Interference Factor (TIF) | <50 |

| | |
|---|---|
| Standard Excitation | Permanent Magnet |
| Bearings | Single Sealed Cartridge |
| Coupling | Direct via Flexible Disc |
| Prototype Short Circuit Test | Yes |
| Voltage Regulator Type | Digital |
| Number of Sensed Phases | All |
| Regulation Accuracy (Steady State) | ±0.25% |

## OPERATING DATA

### POWER RATINGS - DIESEL

| | | Standby |
|---|---|---|
| Three-Phase 120/208 VAC @0.8pf | 500 kW | Amps: 1,735 |
| Three-Phase 120/240 VAC @0.8pf | 500 kW | Amps: 1,504 |
| Three-Phase 277/480 VAC @0.8pf | 500 kW | Amps: 752 |
| Three-Phase 346/600 VAC @0.8pf | 500 kW | Amps: 601 |

### MOTOR STARTING CAPABILITIES (skVA)

skVA vs. Voltage Dip

| 277/480 VAC | 30% | 208/240 VAC | 30% |
|---|---|---|---|
| K0500124Y23 | 1,050 | K0600124Y23 | 1,120 |
| K0600124Y23 | 1,560 | K0792124Y23 | 2,130 |
| K0832124Y23 | 2,800 | K0832124Y23 | 2,090 |

### FUEL CONSUMPTION RATES*

| Fuel Pump Lift - ft (m) |
|---|
| 12 (3.7) |

| Total Fuel Pump Flow (Combustion + Return) gph (Lph) |
|---|
| 121 (457) |

Diesel - gph (Lph)

| Percent Load | Standby |
|---|---|
| 25% | 11.2 (42.3) |
| 50% | 17.5 (66.3) |
| 75% | 24.2 (91.4) |
| 100% | 32.0 (121.1) |

* Fuel supply installation must accommodate fuel consumption rates at 100% load.

### COOLING

| | | Standby |
|---|---|---|
| Coolant Flow | gpm (Lpm) | 114.1 (432) |
| Coolant System Capacity | gal (L) | 15.5 (586) |
| Heat Rejection to Coolant | BTU/hr (kW) | 648,307 (190) |
| Inlet Air | scfm ($m^3$/min) | 30,582 (866) |
| Maximum Radiator Backpressure | in $H_2O$ (kPa) | 0.5 (0.12) |

### COMBUSTION AIR REQUIREMENTS

| | Standby |
|---|---|
| Flow at Rated Power scfm ($m^3$/min) | 1,483 (42) |

### ENGINE

| | | Standby |
|---|---|---|
| Rated Engine Speed | RPM | 1,800 |
| Horsepower at Rated kW** | hp | 755 |
| Piston Speed | ft/min (m/min) | 2,020 (616) |
| BMEP | psi (kPa) | 358 (2,468) |

** Refer to “Emissions Data Sheet” for maximum bHP for EPA and SCAQMD permitting purposes.

### EXHAUST

| | | Standby |
|---|---|---|
| Exhaust Flow (Rated Output) | scfm ($m^3$/min) | 3,955 (112) |
| Maximum Exhaust Backpressure | inHg (kPa) | 2.01 (6.8) |
| Exhaust Temp (Rated Output - Post Silencer) | °F (°C) | 1,022 (550) |

Deration – Operational characteristics consider maximum ambient conditions. Derate factors may apply under atypical site conditions.
Please contact a Generac Power Systems Industrial Dealer for additional details. All performance ratings in accordance with ISO3046, BS5514, ISO8528, and DIN6271 standards.

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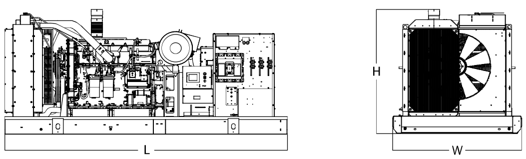
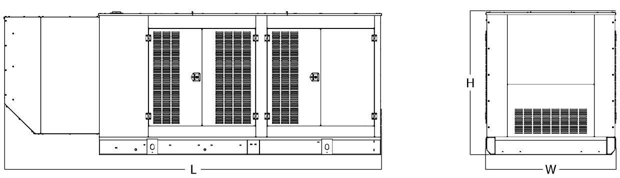
## DIMENSIONS AND WEIGHTS*



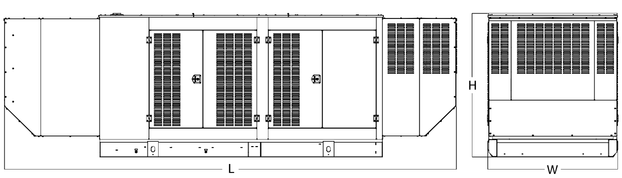

### OPEN SET (Includes Exhaust Flex)

| Run Time Hours | Usable Capacity Gal (L) | L x W x H - in (mm) | Weight - lbs (kg) |
|---|---|---|---|
| No Tank | - | 154.4 (3,923) x 71.0 (1,803) x 67.3 (1,709) | 10,435 (4,733) |
| 9 | 334 | 158.5 (4,025) x 71.0 (1,803) x 81.3 (2,065) | 12,110 (5,493) |
| 28 | 1,001 | 158.5 (4,025) x 71.0 (1,803) x 103.3 (2,623) | 15,272 (6,927) |
| 28 | 1,001 | 228.0 (5,791) x 71.0 (1,803) x 92.3 (2,344) | 13,585 (6,162) |
| 57 | 2,002 | 290.0 (7,366) x 71.0 (1,803) x 103.3 (2,623) | 15,285 (6,933) |



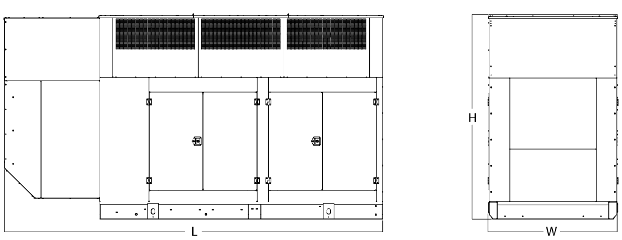

### WEATHER PROTECTED ENCLOSURE

| Run Time Hours | Usable Capacity Gal (L) | L x W x H - in (mm) | Weight - lbs (kg) | |
|---|---|---|---|---|
| | | | Steel | Aluminum |
| No Tank | - | 207.4 (5,268) x 70.9 (1,800) x 79.9 (2,031) | 12,672 (5,748) | 12,017 (5,451) |
| 9 | 334 | 207.4 (5,268) x 70.9 (1,800) x 93.9 (2,387) | 14,347 (6,508) | 13,692 (6,211) |
| 28 | 1,001 | 207.4 (5,268) x 70.9 (1,800) x 115.9 (2,945) | 15,272 (6,927) | 14,617 (6,630) |
| 28 | 1,001 | 228.0 (5,791) x 70.9 (1,800) x 104.9 (2,666) | 15,822 (7,177) | 15,167 (6,880) |
| 57 | 2,002 | 290.0 (7,366) x 70.9 (1,803) x 115.9 (2,945) | 17,522 (7,948) | 16,867 (7,651) |




### LEVEL 1 SOUND ATTENUATED ENCLOSURE

| Run Time Hours | Usable Capacity Gal (L) | L x W x H - in (mm) | Weight - lbs (kg) | |
|---|---|---|---|---|
| | | | Steel | Aluminum |
| No Tank | - | 247.5 (6,285) x 70.9 (1,800) x 80.0 (2,032) | 13,677 (6,204) | 12,017 (5,451) |
| 9 | 334 | 247.5 (6,285) x 70.9 (1,800) x 94.0 (2,388) | 15,352 (6,964) | 13,692 (6,211) |
| 28 | 1,001 | 247.5 (6,285) x 70.9 (1,800) x 116.0 (2,946) | 16,277 (7,383) | 14,617 (6,630) |
| 28 | 1,001 | 247.5 (6,285) x 70.9 (1,800) x 105.0 (2,667) | 16,827 (7,633) | 15,167 (6,880) |
| 57 | 2,002 | 290.0 (7,366) x 70.9 (1,800) x 116.0 (2,946) | 18,527 (8,404) | 16,867 (7,651) |




### LEVEL 2 SOUND ATTENUATED ENCLOSURE

| Run Time Hours | Usable Capacity Gal (L) | L x W x H - in (mm) | Weight - lbs (kg) | |
|---|---|---|---|---|
| | | | Steel | Aluminum |
| No Tank | - | 207.4 (5,268) x 70.9 (1,800) x 114.1 (2,899) | 14,016 (6,357) | 12,161 (5,516) |
| 9 | 334 | 207.4 (5,268) x 70.9 (1,800) x 128.1 (3,255) | 15,691 (7,117) | 13,836 (6,276) |
| 28 | 1,001 | 207.4 (5,268) x 70.9 (1,800) x 150.1 (3,813) | 16,616 (7,536) | 14,761 (6,695) |
| 28 | 1,001 | 228.0 (5,791) x 70.9 (1,800) x 139.1 (3,534) | 17,166 (7,786) | 15,311 (6,945) |
| 57 | 2,002 | 290.0 (7,366) x 70.9 (1,800) x 150.1 (3,813) | 18,866 (8,557) | 17,011 (7,716) |

* All measurements are approximate and for estimation purposes only.

| YOUR FACTORY RECOGNIZED GENERAC INDUSTRIAL DEALER |
|---|
| |

Specification characteristics may change without notice. Dimensions and weights are for preliminary purposes only. Please contact a Generac Power Systems Industrial Dealer for detailed installation drawings.

SPEC SHEET



Generac Power Systems, Inc. | P.O.Box 8 | Waukesha, WI 53189
P: (262) 544-4811 

## Sarah Manzano

**From:** Faye Brandin <fbrandin@signaturedevelopment.com>
**Sent:** Tuesday, October 26, 2021 10:34 PM
**To:** Sarah Manzano
**Cc:** Eric Harrison
**Subject:** RE: Backup Generator for Pump Station

Hi Sarah,

Here is a crude map of where the pump station generator is located. It is at the southwestern corner of the public park. Do you need something more formal?


**Faye Brandin**
Direct 510.251.9284 | Cell 510.862.5629

---

**From:** Sarah Manzano <smanzano@ramboll.com>
**Sent:** Tuesday, October 26, 2021 4:11 PM
**To:** Faye Brandin <fbrandin@signaturedevelopment.com>
**Cc:** Eric Harrison <eharrison@signaturedevelopment.com>
**Subject:** RE: Backup Generator for Pump Station

Hi Faye,

Thank you for sending along the information. Can you provide a map of where the generator would be? All we need is a dot on the site plan.

Thanks!

# Electricity, Data Analysis and Trends

**Jan 2019 - Dec 2019**

**Usage(kWh)**

| Site Name | Site Code | Jan 2019 | Feb 2019 | Mar 2019 | Apr 2019 | May 2019 | Jun 2019 | Jul 2019 | Aug 2019 | Sep 2019 | Oct 2019 | Nov 2019 | Dec 2019 | Total | ENERGY STAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1050 HAMILTON CT | MPK 40 | 145,953 | 145,263 | 162,013 | 156,527 | 162,933 | 175,343 | 178,721 | 187,565 | 179,652 | 135,045 | 107,455 | 107,514 | 1,843,983 | 87 |
| 1100 HAMILTON CT | MPK 41 | 50,950 | 46,370 | 49,638 | 46,095 | 45,923 | 50,824 | 53,887 | 54,247 | 49,813 | 42,988 | 39,645 | 41,132 | 571,511 | 98 |
| 1200 HAMILTON CT | MPK 42 | 23,512 | 23,448 | 28,449 | 27,082 | 28,417 | 29,779 | 30,041 | 30,721 | 28,957 | 28,102 | 27,168 | 28,547 | 334,223 | 100 |
| 1010 HAMILTON CT | MPK 43 | 50,250 | 46,498 | 53,941 | 55,193 | 56,699 | 59,805 | 63,222 | 61,207 | 55,127 | 56,244 | 49,385 | 50,766 | 658,339 | 55 |
| 1205 HAMILTON CT | MPK 44 | 49,721 | 45,058 | 40,020 | 32,497 | 30,693 | 32,089 | 35,474 | 36,586 | 35,386 | 34,089 | 32,930 | 37,316 | 441,861 | 88 |
| 1105 HAMILTON CT | MPK 45 | 61,723 | 57,876 | 58,759 | 55,056 | 57,157 | 61,179 | 63,880 | 67,915 | 67,461 | 64,228 | 60,035 | 64,794 | 740,064 | 54 |
| 1005 HAMILTON CT | MPK 46 | 87,803 | 80,066 | 92,308 | 89,897 | 76,744 | 88,837 | 87,501 | 92,777 | 89,462 | 87,672 | 68,530 | 68,144 | 1,009,741 | 99 |
| 959-967 HAMILTON AV | MPK 47 | 19,152 | 20,803 | 20,239 | 19,620 | 23,368 | 23,990 | 23,890 | 26,746 | 25,471 | 24,240 | 23,985 | 22,970 | 274,475 | 5 |
| 927 HAMILTON AVE | MPK 48 | 25,025 | 23,807 | 26,911 | 26,542 | 27,515 | 30,947 | 31,945 | 32,896 | 31,616 | 32,054 | 28,709 | 28,156 | 346,123 | 57 |
| 923-925 HAMILTON AV | MPK 49 | 44,952 | 45,281 | 51,081 | 49,454 | 47,717 | 48,510 | 50,052 | 51,565 | 47,896 | 44,900 | 40,546 | 40,344 | 562,298 | 1 |
| 1390 WILLOW RD | MPK 50 | 10,763 | 9,749 | 11,591 | 11,433 | 12,161 | 10,679 | 8,127 | 7,921 | 7,090 | 7,277 | 8,041 | 9,123 | 113,956 | 91 |
| 1394 HAMILTON CT | MPK 51 | 1,504 | 1,296 | 1,007 | 970 | 1,146 | 1,416 | 1,446 | 1,022 | 898 | 2,540 | 3,967 | 4,422 | 21,633 | 100 |
| 1380 WILLOW ROAD # | MPK 52 | 40,830 | 38,180 | 43,811 | 43,022 | 43,499 | 45,486 | 44,014 | 47,182 | 44,070 | 42,519 | 35,516 | 35,888 | 504,017 | 100 |
| | MPK 53 | | | | | | | | | | 22,560 | 64,640 | 88,640 | 175,840 | |
| 1370-1380 WILLOW RD | MPK 54 | 15,738 | 21,766 | 24,498 | 23,787 | 24,551 | 29,974 | 29,697 | 31,022 | 29,810 | 25,061 | 20,117 | 20,806 | 296,826 | 57 |
| 1374 WILLOW ROAD | MPK 55 | 9,684 | 8,828 | 9,787 | 9,431 | 9,675 | 9,306 | 9,363 | 9,078 | 9,170 | 9,101 | 8,472 | 8,655 | 110,550 | 100 |
| 980 HAMILTON AVE | MPK 56 | 110,472 | 105,821 | 125,000 | 115,740 | 110,782 | 121,348 | 126,895 | 126,359 | 118,548 | 125,756 | 107,663 | 115,299 | 1,409,683 | |
| 1350 WILLOW RD | MPK 57 | 76,444 | 78,905 | 86,172 | 78,428 | 89,544 | 95,149 | 102,594 | 111,826 | 109,011 | 105,362 | 97,645 | 94,947 | 1,126,027 | 99 |
| 1360 WILLOW RD | MPK 58 | 60,443 | 55,346 | 61,902 | 60,953 | 60,442 | 60,565 | 65,172 | 68,043 | 66,940 | 82,510 | 69,082 | 70,329 | 781,726 | 100 |
| 990-998 HAMILTON AV | MPK 59 | 73,800 | 66,883 | 73,712 | 71,491 | 74,473 | 78,242 | 82,210 | 85,704 | 80,398 | 78,601 | 68,707 | 68,701 | 902,924 | 88 |
| **Total** | | 958,719 | 921,244 | 1,020,840 | 973,219 | 983,439 | 1,053,469 | 1,088,132 | 1,130,382 | 1,076,777 | 1,028,290 | 897,598 | 917,852 | 12,049,961 | 73 |

# Natural Gas, Data Analysis and Trends

**Jan 2019 - Dec 2019**

**Usage(therms)**

| Site Code | Site Name | Jan 2019 | Feb 2019 | Mar 2019 | Apr 2019 | May 2019 | Jun 2019 | Jul 2019 | Aug 2019 | Sep 2019 | Oct 2019 | Nov 2019 | Dec 2019 | Total | ENERGY STAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1050 HAMILTON CT | MPK 40 | 6,877 | 7,864 | 7,752 | 6,228 | 6,187 | 5,279 | 5,572 | 5,485 | 5,270 | 3,268 | 3,017 | 3,526 | 66,326 | 87 |
| 1100 HAMILTON CT | MPK 41 | 3,132 | 2,852 | 2,079 | 818 | 214 | 23 | 4 | 4 | 51 | 298 | 571 | 782 | 10,829 | 98 |
| 1200 HAMILTON CT | MPK 42 | 379 | 379 | 268 | 115 | 1 | 0 | 0 | 0 | 7 | 39 | 242 | 197 | 1,629 | 100 |
| 1010 HAMILTON CT | MPK 43 | 2,983 | 2,865 | 2,310 | 1,541 | 1,500 | 781 | 654 | 462 | 436 | 1,123 | 1,721 | 2,253 | 18,628 | 55 |
| 1205 HAMILTON CT | MPK 44 | 1,198 | 902 | 1,183 | 513 | 142 | 33 | 29 | 15 | 21 | 98 | 1,319 | 1,267 | 6,722 | 88 |
| 1105 HAMILTON CT | MPK 45 | 2,846 | 2,817 | 2,053 | 1,245 | 473 | 123 | 11 | 0 | 0 | 25 | 381 | 1,016 | 10,990 | 54 |
| 1005 HAMILTON CT | MPK 46 | 6,047 | 5,407 | 5,697 | 3,983 | 2,093 | 1,633 | 1,297 | 1,169 | 1,552 | 3,647 | 4,969 | 6,001 | 43,495 | 99 |
| 959-967 HAMILTON A\ | MPK 47 | 1,661 | 1,525 | 1,637 | 1,546 | 1,342 | 482 | 11 | 11 | 11 | 13 | 13 | 13 | 8,265 | 5 |
| 927 HAMILTON AVE | MPK 48 | 1,530 | 1,375 | 1,111 | 565 | 277 | 121 | 112 | 97 | 165 | 341 | 511 | 640 | 6,846 | 57 |
| 923-925 HAMILTON A\ | MPK 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1390 WILLOW RD | MPK 50 | 74 | 345 | 379 | 128 | 62 | 2 | 0 | 1 | 12 | 96 | 158 | 11 | 1,267 | 91 |
| | MPK 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 1380 WILLOW ROAD # | MPK 52 | 3,158 | 2,738 | 2,820 | 1,920 | 1,685 | 1,195 | 694 | 623 | 676 | 1,072 | 1,151 | 1,316 | 19,047 | 100 |
| | MPK 53 | 1,466 | 1,473 | 1,565 | 1,481 | 1,560 | 161 | 10 | 10 | 10 | 12 | 10 | 17 | 7,775 | |
| 1370-1380 WILLOW R | MPK 54 | 493 | 425 | 290 | 89 | 13 | 12 | 13 | 13 | 13 | 22 | 217 | 374 | 1,972 | 57 |
| 1374 WILLOW ROAD | MPK 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 980 HAMILTON AVE | MPK 56 | 4,379 | 3,504 | 3,654 | 3,027 | 2,533 | 2,312 | 2,529 | 2,424 | 2,192 | 2,508 | 2,377 | 2,514 | 33,953 | |
| 1350 WILLOW RD | MPK 57 | 2,531 | 3,029 | 2,638 | 1,843 | 1,397 | 908 | 927 | 881 | 972 | 1,207 | 2,929 | 2,932 | 22,194 | 99 |
| 1360 WILLOW RD | MPK 58 | 4,138 | 3,458 | 3,553 | 2,653 | 2,025 | 1,700 | 1,576 | 1,820 | 2,423 | 2,775 | 2,707 | 2,916 | 31,744 | 100 |
| 990-998 HAMILTON A\ | MPK 59 | 2,341 | 2,563 | 2,533 | 1,787 | 1,025 | 492 | 365 | 703 | 794 | 1,128 | 1,299 | 1,457 | 16,487 | 88 |
| | **Total** | 43,767 | 42,049 | 39,958 | 28,002 | 20,970 | 15,095 | 13,795 | 13,708 | 14,596 | 17,659 | 23,581 | 27,214 | 300,393 | 73 |

| Site Code | Site Name |
|---|---|
| 1 FACEBOOK WAY - MPK 20 | MPK0020 |
| 1 HACKER BLDG 10 | MPK0010 |
| 1 HACKER BLDG 11 | MPK0011 |
| 1 HACKER BLDG 12 | MPK0012 |
| 1 HACKER BLDG 14 | MPK0014 |
| 1 HACKER BLDG 15 | MPK0015 |
| 1 HACKER BLDG 16 | MPK0016 |
| 1 HACKER BLDG 17 | MPK0017 |
| 1 HACKER BLDG 18 | MPK0018 |
| 1 HACKER BLDG 19 | MPK0019 |
| 100 INDEPENDENCE DR | MPK0061 |
| 1005 HAMILTON CT | MPK 46 |
| 1010 HAMILTON CT | MPK 43 |
| 1010 O BRIEN | 84 1010 O BRIEN |
| 1010 OBRIEN DR | MPK0400 |
| 105 CONSTITUTION PARKING STRUC | MPK00P1 |
| 1050 HAMILTON CT | MPK 40 |
| 1100 HAMILTON CT | MPK 41 |
| 1105 HAMILTON CT | MPK 45 |
| 1180 DISCOVERY WAY STE A | SUN0102 |
| 1190 DISCOVERY WAY | SUN0102 |
| 1200 HAMILTON CT | MPK 42 |
| 1200 MISSISSIPPI ST | SAF1200 |
| 1205 HAMILTON CT | MPK 44 |
| 125 CONSTITUTION DR A | MPK0062 |
| 135 COMMONWEALTH DR | MPK0064 |
| 135 CONSTITUTION DR B | MPK0063 |
| 1350 WILLOW RD | MPK 57 |
| 1360 WILLOW RD | MPK 58 |
| 1370-1380 WILLOW RD | MPK 54 |
| 1374 WILLOW ROAD | MPK 55 |
| 1380 WILLOW ROAD #1 | MPK 52 |
| 1390 WILLOW RD | MPK 50 |
| 1394 HAMILTON CT | MPK 51 |
| 150 INDEPENDENCE DR | MPK0060 |
| 155 CONSTITUTION PARKING GARAG | MPK00P2 |
| 162 JEFFERSON DR | MPK0027 |
| 164 JEFFERSON DR | MPK0028 |
| 171 JEFFERSON DR - BU 37 | MPK0280 |
| 173 JEFFERSON DR - BU 37 | 37 BOH 173 |
| 175 JEFFERSON DR - BU 02 | 02 BOH 175 |
| 177 JEFFERSON DR - BU 02 | 02 BOH 177 |
| 179 JEFFERSON DR - BU 37 | MPK0280 |
| 180 JEFFERSON DR | MPK0026 |
| 1831 E BAYSHORE ROAD - BU 83 | RWC0860 |
| 190 JEFFERSON DR | MPK0025 |

| | |
|---|---|
| 191 JEFFERSON DR - BU77 | MPK0281 |
| 193 JEFFERSON DR - BU77 | MPK0281 |
| 195 JEFFERSON DR - BU77 | MPK0281 |
| 199 JEFFERSON DR - BU77 | MPK0281 |
| 200 JEFFERSON DR | MPK0024 |
| 205 CONSTITUTION DR - BU 02 | 02 BOH 205 |
| 209 CONSTITUTION DR - BU 37 | MPK0284 |
| 220 JEFFERSON DR | MPK0029 |
| 250 BRYANT ST | 32 250 BRYANT |
| 300 CONSTITUTION DR | MPK0023 |
| 322 AIRPORT BLVD | BUR0102 |
| 333 AIRPORT BLVD | BUR0101 |
| 34700 CAMPUS DR | FRE0113 |
| 34750 CAMPUS DR | FRE0112 |
| 34800 CAMPUS DR | FRE0111 |
| 42700 BOYCE RD | NEW8130 |
| 6422 COMMERCE DR | FRE6422 |
| 6503 DUMBARTON CIR | FRE0124 |
| 6504 KAISER DR # H | FRE0120 |
| 6511 DUMBARTON CIR | FRE0124 |
| 6512 KAISER DR | FRE0120 |
| 6519 DUMBARTON CIR # A | FRE0123 |
| 6520 KAISER DR | FRE0119 |
| 6524 KAISER DR | FRE0119 |
| 6530 PASEO PADRE PKWY | FRE6530 |
| 6536 KAISER DR | 35 FRE 115 |
| 6539 DUMBARTON CIR | FRE0122 |
| 6540 KAISER DR | FRE0115 |
| 6552 KAISER DR | FRE0114 |
| 6591 DUMBARTON CIR | FRE0118 |
| 6607 DUMBARTON CIR | FRE0117 |
| 6700 DUMBARTON CIR | 36 FRE 125 |
| 6700 DUMBARTON CIR # 200 | FRE0125 |
| 6700 DUMBARTON CIR #100 | FRE0125 |
| 6750 DUMBARTON CIR | FRE0125 |
| 6800 DUMBARTON CIR | FRE0125 |
| 6900 DUMBARTON CIR | FRE0125 |
| 7380 MORTON AVE | NEW0100 |
| 7601 DUMBARTON CIR | FRE0110 |
| 8130 ENTERPRISE DR | NEW8130 |
| 860 CHARTER ST - BU 83 | RWC0860 |
| 879 HAMILTION AVE. - BU 01 | 01 BELLE HAVEN |
| 900 VILLA ST | 31 900 VILLA |
| 923-925 HAMILTON AVE | MPK 49 |
| 927 HAMILTON AVE | MPK 48 |
| 950 5TH AVE PARKING STRUCTUREC | SUN0102 |
| 950 5TH AVE PARKINGSTRUCTUREC | SUN0102 |

| | |
|---|---|
| 959-967 HAMILTON AVE | MPK 47 |
| 980 HAMILTON AVE | MPK 56 |
| 990-998 HAMILTON AVE | MPK 59 |
| BURLINGAME | BUR1846 |
| SAF 250 | SAF250 |

# Memo

**Date:** December 1, 2021
**Project:** Willow Village Mixed-Use Development
**Project Number:** 18-1489
**To:** Faye Brandin (Signature Development Group)
**From:** Ian Seagren, PE
Forest Tanier-Gesner, PE
**Subject:** Concept Level Energy Use and Production Summary
**Distribution:** Eric Harrison (SDG), PAE Team

The purpose of this memo is to summarize a preliminary estimate of energy consumption by programming and fuel type, to summarize a preliminary estimate of photovoltaic (PV) energy production and to summarize the key assumptions of the preliminary analysis for the Willow Village Mixed-Use Development.

**ENERGY CONSUMPTION SUMMARY BY PROGRAM AND FUEL**

The preliminary energy use estimates by land-use category and fuel type for the mixed-use portion of Willow Village are summarized below.

**Table 1| Concept Level Consumption Estimates**

| Land Use | Estimated Annual Electricity Usage (kWh/yr) | Estimated Annual Natural Gas Usage (Therms/yr) |
|---|---|---|
| Residential | 16,855,000 | 0 |
| Supermarket | 1,562,000 | 3,000 |
| Retail | 269,000 | 0 |
| Dining | 1,150,000 | 18,500 |
| Parking Infrastructure | 1,280,000 | 0 |
| Total | 21,116,000 | 21,500 |

**ENERGY PRODUCTION OPPORTUNITY SUMMARY BY BUILDING**

The preliminary production for the on-site solar photovoltaic (PV) has been estimated by building as summarized below. PV systems are sized to comply with the Solar PV requirements described under Title 24 and Menlo Park Municipal code ordinances.

**Table 2| Concept Level Production Estimates**

| BUILDING ID | SOLAR PV SYSTEM (kW) | ESTIMATED ENERGY PRODUCTION[i] (kWh/yr) |
|---|---|---|
| RS2 | 62 | 100,000 |
| RS3 | 57 | 92,000 |
| RS4 | 64 | 103,000 |
| RS5 | 34 | 55,000 |
| RS6 | 35 | 56,000 |
| RS7 | 13 | 21,000 |
| Total | | 427,000 |

## SUMMARY OF ANALYSIS AND KEY ASSUMPTIONS

### Land Use

Land use gross area estimates are based on the programming estimates provided on Jan 5, 2021, as summarized in Table 3 below.

**Table 3| Land Use Gross Area Estimates**

| Land Use | Proposed Area (GSF) | Note |
|---|---|---|
| Residential | 1,695,976 | 1730 Units Total |
| Supermarket | 40,000 | |
| Retail | 30,000 | 60,000 GSF Retail allocation assumed to be 50% Dining |
| Dining | 30,000 | |
| Parking Infrastructure | 617,715 | 1,883 residential spaces and 502 commercial spaces @ 259 SF/Space (308 EV Charging Stations) |

### Energy Data Sources

The estimates provided in Tables 1 utilize prototypical energy models for ASHRAE 90.1[ii] and Title 24[iii] along with supplemental existing building stock data[iv] and Title 24 exterior lighting power[v] allowances. Key characteristics of these data sources are:

- The prototype models utilize regional climate data (SFO or Oakland).
- Averaged estimates were taken from both ASHRAE 90.1-2016 prototypes and T-24 – 2016 prototypes when available. (Midrise Apartment; Restaurant; Retail)
- The Supermarket reference is an average of the DOE reference model and regional existing building stock data, due to a lack of cooking/baking energy in the reference model.
- The exterior lighting calculations only account for the General Hardscape allowance of 0.04 W/SF and does not include any "Special Security Lighting for Retail Parking and Pedestrian Hardscape" allowance.
- Electrification impacts are based on conservative heat pump space heating (2.5 COP) and electric tank water heating (0.93 EF). No efficiency credit estimated for conversion from gas cooking appliances to electric.
- Gas use in Supermarket and Dining is for commercial cooking equipment only. Smaller supermarkets may include minimal or no in-house food prep.
- Residential prototype includes in-unit air conditioning.

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[i] Energy production based on PV Watt calculations for the specified system capacity.
[ii] AHRAE 90.1-2016 Commercial Prototype Building Models and 90.1-2004 DOE reference Model (supermarket) https://www.energycodes.gov/development/commercial/prototype_models; https://www.energy.gov/eere/buildings/new-construction-commercial-reference-buildings
[iii] Title-24-2016 Prototype Models http://bees.archenergy.com/resources.html
[iv] Existing building data: Building Performance Database https://bpd.lbl.gov/#explore
[v] Title-24-2016 exterior lighting allowance https://energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1407requirementsforoutdoorlighting.htm

**End of memo.**

## Sarah Manzano

**From:** Jeff Bean <jtbean@fb.com>
**Sent:** Monday, November 8, 2021 1:07 PM
**To:** Sarah Manzano
**Cc:** Eric Harrison; Faye Brandin
**Subject:** Willow Village - Consolidated Data Request

Hi Sarah,

There have been a number of data requests related to Willow Village recently, and I wanted to consolidate a summary of our projected energy use and solar capabilities here in one place.

First, here are the estimates provided by our electrical engineering team. This is predominantly going off the 100% SD set – some of it based off modeled information, some off educated guesses and EV charging is still an evolving field:

| | **Estimated KWH/YR*** |
|---|---|
| Office Buildings (6) | 23,828,000 |
| North Garage | 397,120 |
| NG EV Charging | 17,100,000 |
| South Garage | 268,098 |
| SG EV Charging | 10,885,500 |
| Town Square Garage | 268,181 |
| TS EV Charging | 1,984,500 |
| Retail | 1,450,000 |
| Hotel (w/no garage) | 2,528,400 |
| Town Square Plaza | 38,000 |

**note that the office buildings, N&S garages and hotel will have solar PV installed. The hotel will also have solar hot water generation. This onsite renewable energy generation will have an impact on the KWH numbers listed above.*

EV – connected loads and consumption based on the following assumptions:

- North Garage: 30% of the parking stalls (had 20% in the SD set but increased to 30% in case more are desired)
- South Garage: 30% of the parking stalls (had 20% in the SD set but increased to 30% in case more are desired)
- TS Garage: 20% of the parking stalls (remains as per SD set)

Second, assuming usage of 21,500 therms/year for both the Mixed-Use (including the supermarket) and public-facing retail on the office campus (the owner-occupied campus will be all-electric), the question was asked if "all natural gas usage in the commercial cooking areas be offset by on-site solar capabilities to be in compliance with the Municipal Code?" The answer is below:

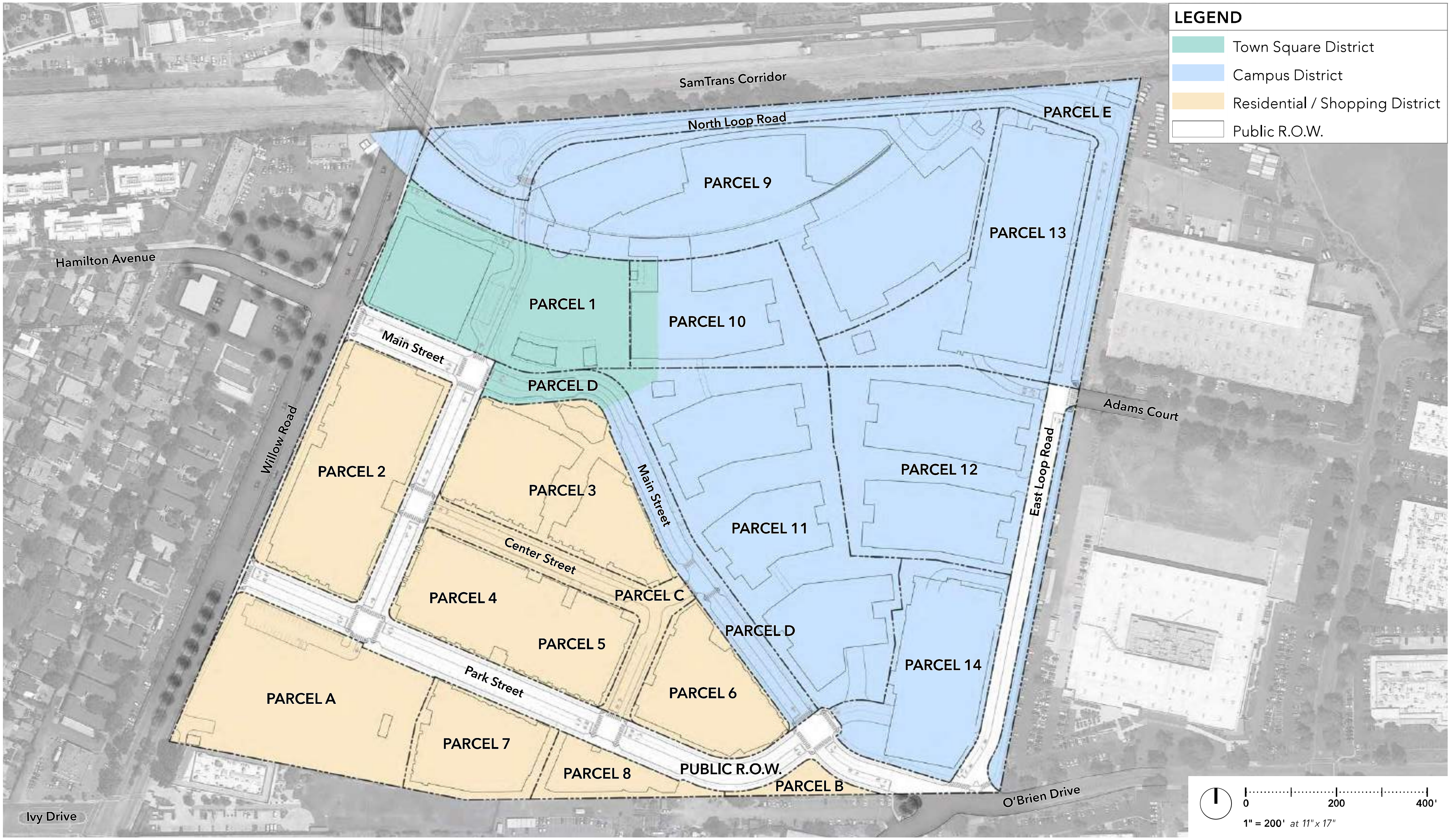
Yes, currently the office campus (6 offices + 2 garages) is on track to have enough solar PV to offset this gas usage. We are estimating producing approx. 3.5M kWh/year from solar PV.

Please let me know if there is anything else you need.

Regards,

Jeff

Jeff Bean
(308) 530-9538 | jtbean@fb.com




# Water Demand by Parcel | Plan

Peninsula Innovation Partners

**PARCEL BY PARCEL**

| Land Use | Parcel | Demand (MGY) | | | | |
|---|---|---|---|---|---|---|
| | | Indoor Water Use | | Irrigation | Cooling | Total |
| | | Potable | NP | | | |
| Retail | Parcel 1 | 5.77 | 1.13 | 3.00 | 0.00 | 9.90 |
| Park + Open Space | Parcel A | 0.00 | 0.00 | 4.86 | 0.00 | 4.86 |
| Park + Open Space | Parcel B | 0.00 | 0.00 | 0.40 | 0.00 | 0.40 |
| Roads | Parcel C | 0.00 | 0.00 | 0.14 | 0.00 | 0.14 |
| Retail + Residential | Parcel 2 | 11.50 | 2.24 | 1.54 | 0.00 | 15.27 |
| Retail + Residential | Parcel 3 | 16.28 | 3.77 | 1.38 | 0.00 | 21.43 |
| Residential | Parcel 4 | 5.70 | 0.97 | 0.64 | 0.00 | 7.31 |
| Residential | Parcel 5 | 5.54 | 0.94 | 0.64 | 0.00 | 7.12 |
| Retail + Residential | Parcel 6 | 7.93 | 1.48 | 0.78 | 0.00 | 10.19 |
| Residential | Parcel 7 | 4.55 | 0.78 | 0.72 | 0.00 | 6.04 |
| Residential | Parcel 8 | 2.74 | 0.47 | 0.36 | 0.00 | 3.57 |
| Roads | Public ROW | 0.00 | 0.00 | 0.23 | 0.00 | 0.23 |
| Meeting and Conference Facilities | Parcel 9 | 1.25 | 0.35 | 4.99 | 2.04 | 8.63 |
| Office Campus | Parcel 10 | 3.08 | 0.85 | 0.27 | 0.77 | 4.97 |
| Office Campus | Parcel 11 | 7.69 | 2.11 | 1.48 | 1.93 | 13.21 |
| Office Campus | Parcel 12 | 5.78 | 1.59 | 0.51 | 1.45 | 9.34 |
| Office Campus | Parcel 13 | 4.20 | 1.15 | 0.37 | 1.06 | 6.78 |
| Office Campus | Parcel 14 | 3.02 | 0.83 | 0.58 | 0.76 | 5.19 |
| Roads | Parcel D | 0.00 | 0.00 | 0.37 | 0.00 | 0.37 |
| Roads | Parcel E | 0.00 | 0.00 | 0.56 | 0.00 | 0.56 |
| **Sub-Total** | | 85.04 | 18.65 | 23.80 | 8.00 | 135.49 |
| Plus Leakage Factor | | 10% | 10% | 10% | 10% | 10% |
| **TOTAL** | | **93.54** | **20.52** | **26.18** | **8.80** | **149.03** |

# APPENDIX D
# CALEEMOD INPUTS FOR LANDSCAPING EMISSIONS ESTIMATION

# Facebook Willow Village - CEQA

**San Mateo County, Annual**

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| General Office Building | 251.53 | 1000sqft | 5.77 | 251,530.00 | 0 |
| Research & Development | 123.87 | 1000sqft | 2.84 | 123,870.00 | 0 |
| General Light Industry | 80.10 | 1000sqft | 1.84 | 80,100.00 | 0 |
| Manufacturing | 23.57 | 1000sqft | 0.54 | 23,570.00 | 0 |
| Unrefrigerated Warehouse-No Rail | 500.78 | 1000sqft | 11.50 | 500,780.00 | 0 |
| Enclosed Parking with Elevator | 2,300.00 | Space | 20.70 | 920,000.00 | 0 |
| Health Club | 24.06 | 1000sqft | 0.55 | 24,060.00 | 0 |

### 1.2 Other Project Characteristics

**Urbanization** Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 70

**Climate Zone** 5 **Operational Year** 2019

**Utility Company** Pacific Gas & Electric Company

**CO2 Intensity (lb/MWhr)** 243 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics - CO2 intensity factor changed to reflect Renewable Portfolio Standard (RPS) adjustments.

Land Use - Assumes 400 sqft/parking space, 2300 spaces total.

Energy Use -

Land Use Change -

Sequestration -

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblProjectCharacteristics | CO2IntensityFactor | 641.35 | 243 |
| tblSequestration | NumberOfNewTrees | 0.00 | 7.00 |

# FB Willow Village Full Buildout
## San Mateo County, Annual

## 1.0 Project Characteristics

### 1.1 Land Usage

| Land Uses | Size | Metric | Lot Acreage | Floor Surface Area | Population |
|---|---|---|---|---|---|
| Apartments Mid Rise | 1,730.00 | Dwelling Unit | 45.53 | 1,730,000.00 | 4948 |
| Regional Shopping Center | 200.00 | 1000sqft | 4.59 | 200,000.00 | 0 |
| Office Park | 1,600.00 | 1000sqft | 36.73 | 1,600,000.00 | 0 |
| Hotel | 119.00 | Room | 3.97 | 172,788.00 | 0 |
| Enclosed Parking with Elevator | 1,855.64 | 1000sqft | 42.60 | 1,855,640.00 | 0 |
| City Park | 11.59 | Acre | 11.59 | 504,702.00 | 0 |
| Parking Lot | 13.60 | 1000sqft | 0.31 | 13,600.00 | 0 |

### 1.2 Other Project Characteristics

| | | | | | |
|---|---|---|---|---|---|
| **Urbanization** | Urban | **Wind Speed (m/s)** | 2.2 | **Precipitation Freq (Days)** | 70 |
| **Climate Zone** | 5 | | | **Operational Year** | 2026 |
| **Utility Company** | Pacific Gas & Electric Company | | | | |
| **CO2 Intensity (lb/MWhr)** | 49 | **CH4 Intensity (lb/MWhr)** | 0.029 | **N2O Intensity (lb/MWhr)** | 0.006 |

### 1.3 User Entered Comments & Non-Default Data

Project Characteristics - PCE intensity factors used.

Land Use -

| Table Name | Column Name | Default Value | New Value |
|---|---|---|---|
| tblLandUse | LandUseSquareFeet | 504,703.58 | 504,702.00 |
| tblProjectCharacteristics | CO2IntensityFactor | 641.35 | 49 |

## 2.0 Emissions Summary

### 2.1 Overall Construction

**Unmitigated Construction**

# APPENDIX E
# REFINEMENT OF ONSITE HEALTH IMPACTS FOR THE WILLOW VILLAGE PROJECT

RAMBOLL

ENVIRONMENT
& HEALTH

# DRAFT MEMORANDUM

Date: May 17, 2022

To: Eric Harrison, Signature Development Group

From: Sarah Manzano
Michael Keinath

Subject: **Refinement of Onsite Health Impacts for the Willow Village Project**

## 1. PURPOSE OF MEMORANDUM

Ramboll refined the health risk assessment for onsite residents of the proposed mixed-use development at Willow Village in Menlo Park, California (referred to hereafter as "the Project"). The analysis presented in the Draft Environmental Impact Report (DEIR) for the Project overestimated health impacts for onsite residents for the Project, Variants and Alternatives in two ways:

1. The analysis in the DEIR conservatively assumed all residential buildings became operational at the time the first residential building became operational, meaning all receptors were exposed to all construction starting in 2025, including construction from parcels that would already been completed by the time a specific residential parcel became operational, which is very conservative hypothetical condition.
2. The analysis in the DEIR did not take into account the effects of the filtration required by California Building Code on the heating, ventilation and air conditioning system (HVAC).

Ramboll refined the analysis of the onsite resident to take these factors into account, as discussed below for the Proposed Project and the Increased Housing Density Variant (which was the only variant and alternative with a quantitative assessment of health impacts). These refinements would not affect the analysis or impact conclusions as related to the maximally impacted offsite resident. If offsite residents have filtration installed consistent with the most recent building code, the reductions associated with filtration could be applied to those offsite residents as well and health risks would be less than shown in the DEIR.

As discussed in detail below, cancer risks are greatly reduced with the refinements to the HRA methodology and the incorporation of filtration. A summary of impacts at the onsite maximally exposed individual receptor (MEIR) reported in the DEIR is compared to the refined cancer risk and thresholds of significance used in the DEIR in **Table A** below. Further details on the refinements are discussed below.


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**Table A Comparison of Refined Cancer Risks to Cancer Risks Reported in the DEIR**

| | Project Cancer Risk (in a million) | Variant Cancer Risk (in a million) |
|---|---|---|
| Onsite MEIR from DEIR | 9.8 | 10.6 |
| With HRA Refinement and Effects of Filtration | 5.1 | 5.5 |
| Threshold of Significance | 10 | |

## 2. REFINEMENT OF EXPOSURE

Onsite residents occupy six parcels of the Project, each of which becomes operational at different times throughout the proposed construction schedule. As a conservative measure, the analysis in the DEIR for the onsite residents evaluated a conservative hypothetical condition where all residents moved in when the first residential parcel was completed, as opposed to the expected condition where residents move in over the course of the construction as subsequent residential parcels are completed. The DEIR analysis assumed residents were exposed to construction starting in 2025 and were exposed to all construction in 2025, even if the construction of a certain building would have been completed before the residential building became operational. As such, the results presented in the DEIR conservatively overestimated impacts for onsite residents.

To refine the health risk assessment, phased operations were accounted for in the analysis. For each parcel with onsite residents, construction impacts from parcels whose construction had ended and had transitioned to operations were removed, consistent with the construction schedule shown in Figure 9 in Appendix 3.4-1 of the DEIR. For example, according to the construction schedule analyzed in the DEIR, construction of Parcel 7 is scheduled to be completed in month 48 of construction. Office Building 3 is scheduled to be completed in month 40. Because construction of Office Building 3 is complete before Parcel 7 becomes operational, Parcel 7 residents would not be exposed to construction of Office Building 3. Therefore, impacts from Office Building 3 were removed from the assessment of impacts to residents in buildings on Parcel 7. To be conservative, if a building was still under construction as another residential building becomes operational, all impacts from that building were included in the assessment. As a result, the refined estimates continue to be more conservative (i.e., higher) than expected.

This refinement results in construction impacts for many onsite residents being reduced and, in some cases, new MEIRs identified. **Table B** shows a summary of these impacts for the Project. After the refinements to the construction analysis were performed, the maximum cancer risk experienced from an onsite resident shifted from a combined construction and operational scenario, to an operational-only scenario, where the resident would be exposed to operations during the periods of highest exposure parameters. Therefore, **Table B** shows the impacts at this new MEIR and at the receptor with highest refined construction cancer risk (the impacts of both the construction plus operation and operational-only scenario are roughly equivalent at 7.11 and 7.14 in a million, respectively).

**Table C** shows a summary of these impacts for the Increased Housing Density Variant. Traffic impacts for the new Variant MEIRs were updated using the same methods as discussed in the Memorandum titled, “Air Quality, Greenhouse Gas, and Energy Analysis of the Willow Village Project Variants,” which is Appendix 5 of the DEIR. Note, the MEIR did not shift for the Variant and the construction plus operational scenario remained the scenario with the highest health risks.

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An explicit refinement of chronic hazard index and $PM_{2.5}$ concentration was not performed since impacts were well below thresholds in the DEIR.

**Table B: Updated Project Cancer Risk for Construction + Operations (in a million)**

| Source Category | On-Site MEIR from DEIR[1] | Maximum Construction plus Operational Impact On-Site Receptor, Refined[2] | | On-Site MEIR, Refined[2] |
|---|---|---|---|---|
| | Mitigated | Unmitigated[3] | Mitigated[4] | Mitigated[5] |
| Construction | 7.2 | 83 | 3.7 | 0 |
| Operational Generators | 1.4 | 1.7 | 1.3 | 6.9 |
| Operational Traffic | 1.1 | 1.1 | 2.1 | 0.19 |
| **Total Project Contribution** | **9.8** | **86** | **7.11** | **7.14** |
| Threshold of Significance | 10 | | | |

Notes:

1 The mitigated cancer risk for the on-site MEIR from the analysis in the DEIR was included for comparison. This MEIR is located at UTMx 575,245, UTMy 4,148,135, with a receptor height of 4.8, which is located on Parcel 4. Parcel 4 is the last building to come online, meaning no construction impacts would be expected, if phased operations were accounted for in the analysis

2 After the refinements to the construction analysis were performed, impacts from operational sources became drivers for the overall cancer risk at the MEIR. To show the maximum impacts from construction with the refinement, the receptor with the highest impact from construction is also shown.

3 Both the unmitigated maximum construction impact receptor and the MEIR are located at UTMx 575,215, UTMy 4,148,075, with a receptor height of 4.8 m

4 The mitigated maximum construction impact receptor is located at UTMx 575,255, UTMy 4,148,075, with a receptor height of 1.8 m

5 The mitigated MEIR is located at UTMx 575,275, UTMy 4,148,145, with a receptor height of 22.8 m

**Table C: Updated Variant Cancer Risk for Construction + Operations**

| Source Category | On-Site MEIR from DEIR Variants[1] | On-Site MEIR and Maximum Construction Impact Receptor, Refined | |
|---|---|---|---|
| | Mitigated | Unmitigated[2] | Mitigated[3] |
| Construction | 8.06 | 86 | 4.1 |
| Operational Generators | 1.40 | 1.7 | 1.3 |
| Operational Traffic | 1.16 | 1.9 | 2.2 |
| **Total Project Contribution** | **10.6** | **90** | **7.6** |
| Threshold of Significance | 10 | | |

Notes:

| |
|---|
| 1 The mitigated cancer risk for the on-site MEIR from the analysis in Appendix 5 of the DEIR was included for comparison. This MEIR is located at UTMx 575,245, UTMy 4,148,135, with a receptor height of 4.8. |
| 2 The unmitigated maximum construction impact receptor and the MEIR are located at UTMx 575,225, UTMy 4,148,095, with a receptor height of 1.8 m |
| 3 The mitigated maximum construction impact and the MEIR are located at UTMx 575,255, UTMy 4,148,085, with a receptor height of 1.8 m |

## 3. EFFECTS OF FILTRATION

Since January 1, 2020, California Title 24 has required all residential heating/cooling and ventilation systems to have Minimum Efficiency Reporting Value (MERV)-13 filters.[1,2] As Project construction would begin after January 1, 2020, residential units will have filtration installed. MERV-13 filters have a dust spot efficiency percent of 80-90%.[3] For this assessment, the lower end of that rating, 80%, was used to be conservative. These filters remove particulates from the air that are brought into the building for ventilation and remove particulates from the indoor air when the heating or cooling is recirculating air in the building.

In older buildings, air would enter the building through infiltration in cracks and crevices. The building code requires new buildings to be sealed from the outdoors to a point where not enough fresh outdoor air naturally enters the buildings with the windows closed. Therefore, the code requires the ventilation system to always bring in air from the outdoors, so residents have fresh air to breathe. The ventilation system is required to be equipped with MERV-13 filters; therefore, there is a constant supply of filtered air to the residences.

Furthermore, when the heating, cooling or fan modes are turned on, indoor air is pulled through a filter again and recirculated into the building, providing another reduction in particulates for air already in the building.

The health impacts reported in the DEIR are primarily from exposure to diesel particulate matter (DPM). The filters would remove DPM and thus reduce the health impacts experienced by residents who spend most of their time inside. However, health impacts would not be reduced proportionally to the rate the filters remove particulates because unfiltered air can also enter the residence through windows, doors and infiltration.

Therefore, to estimate the health impacts experienced by onsite residents that considers the effects of the filtration, a simple averaging calculation was performed that only considers the effects of the natural unfiltered air flow through windows and the filtered forced ventilation of outdoor air. As discussed above, the air would be further filtered through recirculation of indoor air when heating and cooling is on. However, this filtration mechanism is not considered in this analysis and would serve to increase the efficacy and reduce impacts. The amount of time recirculation is on is dependent on residents' preferences, which are not speculated in this

[1] California Energy Commission. 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. Title 24, Part 6, and Associated Administrative Regulations in Part 1. Available online at: https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf

[2] This requirement is carried forward in the adopted 2022 Building Energy Efficiency Standards that take effect January 1, 2023.

[3] USEPA. 2009. Residential Air Cleaners, A Summary of Available Information. EPA 402-F-09-002. August. Available online at: https://19january2017snapshot.epa.gov/indoor-air-quality-iaq/residential-air-cleaners-second-edition-summary-available-information_.html. Accessed May 11, 2022.

analysis. Excluding recirculation underestimates the reduction associated with the filtration system and provide a conservative estimate of indoor concentrations.

Flow rates into the building for the forced ventilation and the windows were estimated and combined with filtration percentages. The United States Environmental Protection Agency (USEPA) Exposure Factor Handbook provides a summary of air exchange rates by area for residential buildings by region of the United States. The 50$^{th}$ percentile air exchange rate for buildings in the western region of the United States is 0.43 air changes per hour (ACH).[4,5] ACH is defined as the ratio of the airflow to the volume. The mechanical engineer designing the residential buildings provided the air exchange rate for the forced air ventilation as a ratio of 0.41 to 0.47 air exchanges per hour.[6]

A percent reduction in exposure to DPM can be calculated through a simple weighted average of filtration percentage with air exchange rates. This simple average would assume windows are open all day, every day, which is conservative. It also does not include any additional reduction from recirculation.

The equation below shows the calculation for the average reduction of DPM indoors compared to outdoors based on the assumptions discussed above. **Table D** shows the parameters used to estimate this reduction.

$$R_{Avg} = \frac{ACH_W\ (1 - F_W) + ACH_V\ (1 - F_V)}{ACH_W + ACH_V}$$

Where:

| | |
|---|---|
| $R_{avg}$: | Ratio of indoor concentration of outdoor sources to outdoor concentration |
| $ACH_W$: | Air exchange rate through open windows |
| $ACH_V$: | Air exchange rate through forced ventilation of outdoor air |
| $F_W$: | Fraction of particulates removed through windows |
| $F_V$: | Fraction of particulates removed through forced ventilation of outdoor air |

**Table D. Building Parameters for Calculating Ratio of Indoor Concentration[1]**

| | **Air Exchange Rate (ACH)** | **Filtration Percentage** |
|---|---|---|
| **Windows** | 0.43 [$ACH_W$] | 0% [$F_W$] |
| **Forced Ventilation of Outdoor Air** | 0.41 [$ACH_V$] | 80% [$F_v$] |

Using the equation above and the parameters in **Table D**, the indoor concentration of DPM from outdoor sources is reduced to **61%** [$R_{avg}$]. As discussed above, this is a conservative estimate of the ratio of indoor concentration to outdoor concentration, which would result in a conservative

4 USEPA. 2018. Exposure Factors Handbook. Chapter 19: Building Characteristics. EPA/600/R-18/121F. July. Available at: https://www.epa.gov/expobox/exposure-factors-handbook-chapter-19. Accessed May 9, 2022.

5 This is the air exchange rate for air flows within the building, including natural ventilation (e.g., windows and doors), forced ventilation in the HVAC system, and infiltration. This study was conducted before modern code requirements for additional forced air ventilation. Assuming this air exchange rate applies only to windows would be a conservative estimate.

6 Communication between Greg Bucher, PAE, and Sarah Manzano, Ramboll, on April 19, 2022.

estimate of indoor concentrations, due to the exclusion of any reduction from recirculation and the assumption that windows would be open at all times.

**Tables E** and **F** show the cancer risk reported in the DEIR for the Project and Increased Housing Density Variant, respectively, and the reduction in risks taking into account filtration reduction. These risks do not incorporate the refinements to the risk assessment discussed in **Section 2**. Health impacts from traffic are based on DPM and other toxic air contaminants in the form of organic gases. The filters discussed in **Section 2** would filter the DPM from traffic and would likely filter some fraction of the organic gases. However, because the amount of filtration for organic gases is not known, filtration was not considered for traffic sources to be conservative.

**Table E. Cancer Risk Refined with Effects of Filtration (in a million)**

| Source Category | Onsite MEIR from DEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | Construction + Operations | Operations Only | Construction + Operations | Operations Only |
| Construction | 7.2 | -- | 4.4 | -- |
| Operational Generators | 1.4 | 1.4 | 0.9 | 0.9 |
| Operational Traffic | 1.1 | 2.0 | 1.1 | 2.0 |
| **Total Project Contribution** | **9.8** | **3.3** | **6.3** | **2.9** |
| Threshold of Significance | 10 | | | |

Notes:

1 Onsite MEIR from DEIR as reported in Table 59 of Appendix 3.4-1 of the DEIR.

2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

**Table F. Increased Housing Density Variant Cancer Risk Refined with Effects of Filtration (in a million)**

| Source Category | Onsite MEIR from DEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | Construction + Operations | Operations Only | Construction + Operations | Operations Only |
| Construction | 8.06 | -- | 4.9 | -- |
| Operational Generators | 1.4 | 1.4 | 0.9 | 0.9 |
| Operational Traffic | 1.16 | 2.0 | 1.2 | 2.0 |
| **Total Project Contribution** | **10.6** | **3.4** | **6.9** | **2.9** |
| Threshold of Significance | 10 | | | |

| |
|---|
| Notes:<br><br>1 Onsite MEIR from DEIR as reported in Table 59V of Appendix 5 of the DEIR.<br><br>2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative. |

## 4. COMBINED ANALYSIS

The ratio of indoor concentration of outdoor sources to outdoor concentration discussed in **Section 3** can be applied to the revised health impacts discussed in **Section 2**. **Table G** shows the mitigated cancer risk at the maximum onsite receptors for the Project and the Variant incorporating the refined health impacts from **Section 2** and the filtration discussed in **Section 3** and compares to the impacts reported in the DEIR.

As shown in the table, the revised health impacts are much lower than reported in the DEIR while still considering conservative assumptions discussed above.

**Table G. Onsite Mitigated Cancer Risk for Project and Variant considering HRA Refinements and Filtration**

| Source Category | Onsite MEIR from DEIR | | With HRA Refinement and Effects of Filtration | |
|---|---|---|---|---|
| | Project | Variant | Project | Variant |
| Construction | 7.2 | 8.06 | 2.3 | 2.5 |
| Operational Generators | 1.4 | 1.4 | 0.8 | 0.8 |
| Operational Traffic | 1.1 | 1.16 | 2.1 | 2.2 |
| **Total Project Contribution** | **9.8** | **10.6** | **5.1** | **5.5** |
| Threshold of Significance | 10 | | | |

Notes:

1 Onsite MEIR from DEIR as reported in Table 59 of Appendix 3.4-1 and Table 59V of Appendix 5 of the DEIR.

2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

# APPENDIX F
# ANALYSIS OF THE RELOCATION OF THE PUMP STATION GENERATOR FOR THE WILLOW VILLAGE PROJECT

RAMBOLL

ENVIRONMENT
& HEALTH

# DRAFT MEMORANDUM

Date: June 9, 2022

To: Eric Harrison, Signature Development Group

From: Sarah Manzano
Michael Keinath, P.E.

Subject: **Analysis of the Relocation of the Pump Station Generator for the Willow Village Project**


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## 1. PURPOSE OF MEMORANDUM

We understand the pump station associated with the Willow Village Project in Menlo Park will be relocated from the southwest corner of the site to one of two possible locations: 1) in the dog park (referred to as Location 1) or 2) in the parking lot of the park in the southwest portion of the site (referred to as Location 2). The pump station has an associated generator that was analyzed in our previous analyses discussed in our report titled "CEQA Air Quality, Greenhouse Gas and Health Risk Assessment Technical Report for Willow Village", which is Appendix 3.4-1 of the Draft Environmental Impact Report (DEIR) for Willow Village. This analysis was further refined in our memo "Refinement of Onsite Health Impacts for the Willow Village Project" dated May 17, 2022, herein referred to as the "Onsite Refinements Memo."

The relocation of the pump station would not affect the calculation of mass emissions as reported in the DEIR, since the same generator would be used and the total quantity of emissions would remain the same. The relocation also would not affect the analysis of odors or mitigation as discussed in the DEIR. However, the relocation would affect the health risk assessment because the location of the generator's emissions would change. Therefore, Ramboll refined the health risk assessment performed for Willow Village to assess the health risk impacts of the pump station generator at both proposed new locations. This memorandum discusses the methods used and the results of the health risk assessment at the two proposed new locations.

As discussed in detail below, impacts of the generators in the newly proposed locations are similar to those reported in the DEIR and the Onsite Refinements Memo. A summary of impacts at the onsite maximally exposed individual receptor (MEIR) for both proposed generator locations with and without filtration is shown in **Table A** below. Further details on the analysis are discussed below.

**Table A Summary of Refined Cancer Risks to Cancer Risks Reported in the DEIR**

| | | Cancer Risk at Location 1 (in a million) | Cancer Risk at Location 2 (in a million) |
|---|---|---|---|
| Project | Onsite MEIR | 7.5 | 7.2 |
| | With Effects of Filtration | 4.7 | 5.2 |
| Variant | Onsite MEIR | 7.6 | 7.7 |
| | With Effects of Filtration | 5.5 | 5.5 |
| Threshold of Significance | | 10 | |

## 2. ANALYSIS OF GENERATOR RELOCATION

As discussed above, the relocation of the pumping station will impact the health risk assessment by changing the location of the generator's emissions, thereby impacting the estimated air concentrations of the toxic air contaminants (TACs) analyzed in the health risk assessment. Consistent with the methodology used in the DEIR, the most recent version of the American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD Version 21112) was used to recalculate the air concentrations of DPM and $PM_{2.5}$ from the pumping station generator at both potential locations. For both locations, the generator was modeled using the same source parameters used in the DEIR, with the stack height at one foot above the height of the utility building at 3.78 meters. Consistent with the DEIR, the latest version of the Building Profile Input Program, PRIME (BPIP PRIME, version 04274) was used to estimate the building downwash caused by the utility building that houses the pumping station generator, as well as the surrounding buildings present at both potential locations.

As detailed in the DEIR, emissions were modeled using the x/Q ("chi over q") method. Since the generator specifications would not change as a result of the relocation, the same actual emission rates from the DEIR were multiplied by the updated dispersion factors for both proposed locations to obtain updated concentrations. Exposure assumptions and receptor details from the DEIR were used in the updated health risk assessment as well.

Results from the updated health risk assessments conducted for both proposed locations can be found in the attached tables. **Table 1**, **Table 2**, and **Table 3** show the excess lifetime cancer risk, chronic health impact, and $PM_{2.5}$ concentration from the Project construction and operation at the MEIR for Location 1 (located in the dog park). **Table 4**, **Table 5**, and **Table 6** show the excess lifetime cancer risk, chronic health impact, and $PM_{2.5}$ concentration from the Project construction and operation at the MEIR for Location 2 (located in the parking lot of the park located at the southwest portion of the site). The excess lifetime cancer risk results in Table 1 and Table 4 incorporate the onsite refinements to exposure discussed in Section 2 of our Onsite Refinements Memo. Similar to the Onsite Refinements Memo, the chronic health impact and $PM_{2.5}$ concentration were not refined because results were well below thresholds without refinements. Therefore, these metrics are overestimated.

As the tables show, all impacts are below thresholds.

As discussed in our Onsite Refinements Memo, the filtration required to be installed in new residential buildings by California Building Code would reduce concentrations of outdoor sources indoors to about 61%. Therefore, the health impacts to onsite residents were further refined to account for the reduction in concentration associated with filtration, as shown in **Table B** for Location 1 and **Table C** for Location 2. Chronic HI and $PM_{2.5}$ concentration would be similarly reduced. However, since impacts for these categories are well below thresholds, the analysis was not explicitly performed.

**Table B. Cancer Risk at Location 1, Refined with Effects of Filtration (in a million)**

| Source Category | Onsite MEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | **Construction + Operations** | **Operations Only** | **Construction + Operations** | **Operations Only** |
| Construction | 0 | -- | 0 | -- |
| Operational Generators | 7.3 | 7.3 | 4.5 | 4.5 |
| Operational Traffic | 0.19 | 0.19 | 0.19 | 0.19 |
| **Total Project Contribution** | **7.5** | **7.5** | **4.7** | **4.7** |
| Threshold of Significance | 10 | | | |

Notes:
1 Onsite MEIR as reported in Table 1.
2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

**Table C. Cancer Risk at Location 2, Refined with Effects of Filtration (in a million)**

| Source Category | Onsite MEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | **Construction + Operations** | **Operations Only** | **Construction + Operations** | **Operations Only** |
| Construction | 3.7 | -- | 2.2 | -- |
| Operational Generators | 1.4 | 7.0 | 0.85 | 4.2 |
| Operational Traffic | 2.1 | 0.19 | 2.1 | 0.19 |
| **Total Project Contribution** | **7.2** | **7.1** | **5.2** | **4.4** |
| Threshold of Significance | 10 | | | |

Notes:
1 Onsite MEIR as reported in Table 4.
2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

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## 3. ANALYSIS OF GENERATOR RELOCATION FOR THE INCREASED HOUSING DENSITY VARIANT

The same analysis discussed in Section 2 was performed for the Increased Housing Density Variant. **Table 7**, **Table 8**, and **Table 9** show the excess lifetime cancer risk, chronic health impact, and $PM_{2.5}$ concentration from the Project construction and operation at the MEIR for Location 1 (located in the dog park) for the Increased Housing Density Variant. **Table 10**, **Table 11**, and **Table 12** show the excess lifetime cancer risk, chronic health impact, and $PM_{2.5}$ concentration from the Project construction and operation at the MEIR for Location 2 (located in the parking lot of the park located at the southwest portion of the site) for the Increased Housing Density Variant.

As the tables show, all impacts are below thresholds.

Similar to the Project, the health impacts to onsite residents for the Variant were further refined to account for the reduction in concentration associated with filtration, as shown in **Table D** for Location 1 and **Table E** for Location 2.

**Table D. Cancer Risk at Location 1, Refined with Effects of Filtration for Variant (in a million)**

| Source Category | Onsite MEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | Construction + Operations | Operations Only | Construction + Operations | Operations Only |
| Construction | 4.1 | -- | 2.5 | -- |
| Operational Generators | 1.3 | 7.3 | 0.81 | 4.5 |
| Operational Traffic | 2.2 | 0.20 | 2.2 | 0.20 |
| **Total Variant Contribution** | **7.6** | **7.5** | **5.5** | **4.7** |
| Threshold of Significance | 10 | | | |

Notes:
1 Onsite MEIR as reported in Table 7.
2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

**Table E. Cancer Risk at Location 2, Refined with Effects of Filtration for Variant (in a million)**

| Source Category | Onsite MEIR[1] | | With Effects of Filtration[2] | |
|---|---|---|---|---|
| | Construction + Operations | Operations Only | Construction + Operations | Operations Only |
| Construction | 4.1 | -- | 2.5 | -- |
| Operational Generators | 1.4 | 7.0 | 0.85 | 4.2 |
| Operational Traffic | 2.2 | 0.20 | 2.2 | 0.20 |

| | | | | |
|---|---|---|---|---|
| **Total Variant Contribution** | **7.7** | **7.2** | **5.5** | **4.4** |
| Threshold of Significance | 10 | | | |

Notes:
1 Onsite MEIR as reported in Table 10.
2 Impacts at the MEIR are refined to incorporate the effects of filtration by assuming indoor concentrations of outdoor sources is 61% of the outdoor concentration for construction and generators. As discussed above, impacts from traffic were not refined to be conservative.

**TABLE**

## Table 1
## Project Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| **Source Category** | **Lifetime Excess Cancer Risk[1] (in a million)** | | | | | |
|---|---|---|---|---|---|---|
| | **Construction + Operations** | | | | **Operations Only** | |
| | **Unmitigated[2]** | | **Mitigated[2]** | | | |
| **Project Contribution** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** |
| | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 4** |
| Construction | 83 | 57 | 0 | 7.6 | -- | -- |
| Operational Generators | 1.6 | 0.99 | 7.3 | 0.99 | 7.3 | 1.8 |
| Operational Traffic | 1.1 | 0.89 | 0.19 | 0.89 | 0.19 | 1.6 |
| **Total Project Contribution** | **86** | **59** | **7.5** | **9.5** | **7.5** | **3.4** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (μg/m3)
   CF = Conversion Factor (mg/μg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 1
## Project Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,215 | 575,500 | 575,275 | 575,500 | 575,275 | 575,500 |
| UTMy (m) | 4,148,075 | 4,147,960 | 4,148,145 | 4,147,960 | 4,148,145 | 4,147,960 |
| Receptor Height (m) | 4.8 | 1.8 | 22.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 2**
**Project Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1**
**Willow Village**
**Menlo Park, California**

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| **Project Contribution** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** |
| | **Scenario 3** | **Scenario 1** | **Scenario 3** | **Scenario 1** | **Scenario 3** | **Scenario 1** |
| Construction | 0.23 | 0.11 | 8.8E-03 | 0.011 | -- | -- |
| Operational Generators | 4.0E-04 | 5.8E-04 | 3.9E-04 | 7.0E-04 | 8.8E-04 | 8.1E-04 |
| Operational Traffic | 2.1E-03 | 1.4E-03 | 2.3E-03 | 3.3E-03 | 6.0E-03 | 3.9E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.011** | **0.015** | **6.9E-03** | **4.7E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$

   Where:

   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)

   $C_i$ = Annual Average Air Concentration for Chemical "i" ($\mu g/m^3$)

   cREL = Chronic Reference Exposure Level ($\mu g/m^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

5. On-site and off-site MEIR locations are documented below:

## Table 2
## Project Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,245 | 575,400 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

## Table 3
## Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| Source Category | $PM_{2.5}$ Concentration[1] ($\mu g/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 1.1 | 0.52 | 0.038 | 0.063 | -- | -- |
| Operational Generators | 2.0E-03 | 2.9E-03 | 2.2E-03 | 4.1E-03 | 4.4E-03 | 4.1E-03 |
| Operational Traffic | 0.040 | 0.030 | 0.092 | 0.12 | 0.11 | 0.12 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.13** | **0.18** | **0.11** | **0.12** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

   The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

   $C_i = E \times D_i$

   Where:

   C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)

   $D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($\mu g/m^3$)/(g/s)

   E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 3
## Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 4**
**Project Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| Source Category | Lifetime Excess Cancer Risk[1] (in a million) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| Construction | 83 | 57 | 3.7 | 7.6 | -- | -- |
| Operational Generators | 1.8 | 0.66 | 1.4 | 0.66 | 7.0 | 0.17 |
| Operational Traffic | 1.1 | 0.89 | 2.1 | 0.89 | 0.19 | 3.2 |
| **Total Project Contribution** | **86** | **58** | **7.2** | **9.2** | **7.1** | **3.4** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (µg/m3)
   CF = Conversion Factor (mg/µg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 4
## Project Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,215 | 575,500 | 575,255 | 575,500 | 575,275 | 574,720 |
| UTMy (m) | 4,148,075 | 4,147,960 | 4,148,085 | 4,147,960 | 4,148,145 | 4,147,360 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 5**
**Project Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 |
| Construction | 0.23 | 0.11 | 8.9E-03 | 0.011 | -- | -- |
| Operational Generators | 4.2E-04 | 6.9E-04 | 4.2E-04 | 2.2E-04 | 4.6E-03 | 2.7E-04 |
| Operational Traffic | 2.1E-03 | 1.4E-03 | 2.1E-03 | 3.3E-03 | 2.3E-03 | 3.9E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.011** | **0.014** | **6.9E-03** | **4.1E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$

   Where:

   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)

   $C_i$ = Annual Average Air Concentration for Chemical "i" ($\mu g/m^3$)

   cREL = Chronic Reference Exposure Level ($\mu g/m^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

**Table 5**
**Project Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,235 | 575,400 | 575,015 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,175 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

## Table 6
## Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2
## Willow Village
## Menlo Park, California

| Source Category | $PM_{2.5}$ Concentration[1] ($\mu g/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 1.1 | 0.52 | 0.038 | 0.063 | -- | -- |
| Operational Generators | 2.1E-03 | 3.5E-03 | 1.8E-03 | 1.3E-03 | 1.7E-03 | 1.3E-03 |
| Operational Traffic | 0.040 | 0.030 | 0.092 | 0.12 | 0.11 | 0.12 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.13** | **0.18** | **0.11** | **0.12** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

   The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

   $C_i = E \times D_i$
   Where:
   C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)
   $D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($\mu g/m^3$)/(g/s)
   E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

5. On-site and off-site MEIR locations are documented below:

**Table 6**
**Project $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 7**
**Project Variant Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1**
**Willow Village**
**Menlo Park, California**

| Source Category | Lifetime Excess Cancer Risk[1] (in a million) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| **Project Contribution** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** |
| | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 2** | **Scenario 3** | **Scenario 4** |
| Construction | 86 | 57 | 4.1 | 7.6 | -- | -- |
| Operational Generators | 1.4 | 0.99 | 1.3 | 0.99 | 7.3 | 1.8 |
| Operational Traffic | 1.9 | 0.92 | 2.2 | 0.92 | 0.20 | 1.7 |
| **Total Project Contribution** | **90** | **59** | **7.6** | **9.5** | **7.5** | **3.5** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (μg/m3)
   CF = Conversion Factor (mg/μg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

**Table 7**
**Project Variant Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1**
**Willow Village**
**Menlo Park, California**

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,225 | 575,500 | 575,255 | 575,500 | 575,275 | 575,500 |
| UTMy (m) | 4,148,095 | 4,147,960 | 4,148,085 | 4,147,960 | 4,148,145 | 4,147,960 |
| Receptor Height (m) | 1.8 | 1.8 | 1.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 8**
**Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1**
**Willow Village**
**Menlo Park, California**

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 0.23 | 0.11 | 8.9E-03 | 0.011 | -- | -- |
| Operational Generators | 4.0E-04 | 5.8E-04 | 3.9E-04 | 7.0E-04 | 8.8E-04 | 8.1E-04 |
| Operational Traffic | 2.1E-03 | 1.4E-03 | 2.3E-03 | 3.3E-03 | 6.0E-03 | 3.9E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.012** | **0.015** | **6.9E-03** | **4.7E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$

   Where:

   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)

   $C_i$ = Annual Average Air Concentration for Chemical "i" (μg/m$^3$)

   cREL = Chronic Reference Exposure Level (μg/m$^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 8
## Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,245 | 575,400 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 9**
**Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1**
**Willow Village**
**Menlo Park, California**

| Source Category | $PM_{2.5}$ Concentration[1] ($\mu g/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 1.1 | 0.52 | 0.040 | 0.063 | -- | -- |
| Operational Generators | 2.0E-03 | 2.9E-03 | 2.2E-03 | 4.1E-03 | 4.4E-03 | 4.1E-03 |
| Operational Traffic | 0.040 | 0.030 | 0.092 | 0.12 | 0.11 | 0.12 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.13** | **0.18** | **0.11** | **0.12** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

$C_i = E \times D_i$
Where:
C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)
$D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($\mu g/m^3$)/(g/s)
E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

5. On-site and off-site MEIR locations are documented below:

## Table 9
## Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 1
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 10**
**Project Variant Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| Source Category | Lifetime Excess Cancer Risk[1] (in a million) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 2 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 2 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 4 |
| Construction | 86 | 57 | 4.1 | 7.6 | -- | -- |
| Operational Generators | 1.5 | 0.66 | 1.4 | 0.66 | 7.0 | 0.17 |
| Operational Traffic | 1.9 | 0.92 | 2.2 | 0.92 | 0.20 | 3.4 |
| **Total Project Contribution** | **90** | **58** | **7.7** | **9.2** | **7.2** | **3.6** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (μg/m3)
   CF = Conversion Factor (mg/μg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

## Table 10
## Project Variant Cancer Risk at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,225 | 575,500 | 575,255 | 575,500 | 575,275 | 574,720 |
| UTMy (m) | 4,148,095 | 4,147,960 | 4,148,085 | 4,147,960 | 4,148,145 | 4,147,360 |
| Receptor Height (m) | 1.8 | 1.8 | 1.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 11**
**Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 0.23 | 0.11 | 8.9E-03 | 0.011 | -- | -- |
| Operational Generators | 4.2E-04 | 6.9E-04 | 4.0E-04 | 2.2E-04 | 4.6E-03 | 2.7E-04 |
| Operational Traffic | 2.1E-03 | 1.4E-03 | 2.3E-03 | 3.3E-03 | 2.3E-03 | 3.9E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.012** | **0.014** | **6.9E-03** | **4.1E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$
   Where:
   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)
   $C_i$ = Annual Average Air Concentration for Chemical "i" (μg/m$^3$)
   cREL = Chronic Reference Exposure Level (μg/m$^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.
3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.
5. On-site and off-site MEIR locations are documented below:

**Table 11**
**Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,245 | 575,400 | 575,015 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,175 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 12**
**Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2**
**Willow Village**
**Menlo Park, California**

| Source Category | $PM_{2.5}$ Concentration[1] ($\mu g/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 | On-Site MEIR[3,5] Scenario 3 | Off-Site MEIR[4,5] Scenario 1 |
| Construction | 1.1 | 0.52 | 0.040 | 0.063 | -- | -- |
| Operational Generators | 2.1E-03 | 3.5E-03 | 1.8E-03 | 1.3E-03 | 1.7E-03 | 1.3E-03 |
| Operational Traffic | 0.040 | 0.030 | 0.092 | 0.12 | 0.11 | 0.12 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.13** | **0.18** | **0.11** | **0.12** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

$C_i = E \times D_i$
Where:
C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)
$D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($(\mu g/m^3)/(g/s)$)
E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project.

5. On-site and off-site MEIR locations are documented below:

## Table 12
## Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR for Pumping Station Relocation at Location 2
## Willow Village
## Menlo Park, California

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Appendix 5.2

# Additional Information Regarding Potential Health Effects or Criteria Air Pollutant Emission Impacts

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ENVIRONMENT
& HEALTH

# MEMORANDUM

Date: June 24, 2022

To: Eric Harrison, Signature Development Group

From: Michael Keinath, PE
Sarah Manzano

Subject: **Air Quality, Greenhouse Gas, and Energy Analysis of the Willow Village Project Variants**


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## 1. PURPOSE OF MEMORANDUM

As a supplemental analysis to the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report prepared for the construction and operation of the proposed mixed-use development at Willow Village in Menlo Park, California (referred to hereafter as "the Project"), Ramboll evaluated potential criteria air pollutant (CAP) emissions, greenhouse gas (GHG) emissions, and health impacts associated with the Project variants at the maximally exposed individual receptor (MEIR) as described below. Variants are elements that may or may not be proposed as part of the Project for particular reasons.

## 2. PROJECT VARIANTS

### 2.1 Increased Residential Density Variant

The Increased Residential Density Variant would increase the number of residential dwelling units by approximately 200 units, to a total of up to 1,930 residential units. These additional dwelling units would be included in Parcel 4, which is one of the last buildings to be built. No other changes to the Project would occur under this Variant. Updates to the land use summary can be found in **Table 1V**.

An analysis consistent with the Project analysis was performed to evaluate the potential impacts associated with the increase in dwelling units. Table references included herein correspond to the similar tables in the Technical Report that would be replaced by the changes associated with the Increased Residential Density Variant.

#### 2.1.1 *Construction Emissions and Health Risk Assessment*

This Variant results in additional construction activity to build the additional 200 dwelling units. The Project Applicant indicated that there would be no change to the foundations or excavation necessary to accommodate the additional dwelling units. However, the core and shell phase for Parcel 4 would be increased by one month and tenant improvements would increase by three months. Both phases would use the same equipment information for the extended construction period. This increased activity would result in additional emissions, which are shown in **Table 12V**[1] for construction architectural coating off-gassing emissions, **Table 13V** for unmitigated criteria air pollutant emissions, **Table 14V** for mitigated criteria air pollutant emissions and **Table 15V** for GHG emissions. As shown in these tables, emissions would increase slightly, but conclusions would not change.

The increase in emissions would also affect health impacts. A health risk assessment was performed using the same methodology as was used in the Technical Report with these additional emissions. Results are shown in **Tables 59V**, **60V** and **61V**. Additional discussion on findings is in **Section 2.1.3.**

### 2.1.2 *Operational Emissions and Health Risk Assessment*

Increasing the density of the residential area by 200 units, or roughly 12% compared to the original 1,730 units, would be expected to increase the residential emissions associated with consumer products, architectural coatings, water use, and energy use by approximately the same margin. Landscaping and generator emissions are not expected to change because the additional units would be installed by increasing the height of existing apartment buildings, leaving landscaping and generator requirements the same. The impacted building operational capacity can be found in **Table 16V**.

The Transportation Engineer provided increased traffic associated with this Variant, which increases the daily average residential trip rate and VMT from 7,359 trips and 69,910 miles to 8,210 trips and 77,992 miles, respectively.

The emissions due to increased traffic and operational emissions associated with this Variant can be found in **Tables 17V**, **18V**, **21aV**, **21bV**, **22V**, **23V**, **24aV**, **24bV**, **25aV**, **25bV**, **28V**, **30V-36V**, **38V**, and **39V**. A summary of increased emissions can be found in **Tables 40V**, **41V**, and **42V**.

The total construction and operations emissions increase from this Variant can be found in **Tables 43V** and **44V**. As shown in **Table 44V**, an additional 200 DU is not expected to change significance findings compared to the Project.

The increase in dwelling units would also increase the traffic volumes on certain roadways. Analysis comparing volumes by roadways at the MEIR from the Technical Report was performed to determine the impact of the additional traffic. **Table 47V** shows how traffic volumes scale by segment. As shown in **Table 59V**, operational emissions due to this Variant would increase the operational only lifetime excess cancer risk from 3.3 in a million to 3.4 in a million for the On-Site MEIR and from 3.4 to 3.6 in a million for the Off-Site MEIR. Based on these results, the increase in cancer risk associated with this Variant is minor and remains below the Bay Area Air Quality Management District cancer risk threshold of 10 in a million.

The potential for exposure to the increased traffic volumes to result in adverse chronic noncancer effects and excess $PM_{2.5}$ concentrations were evaluated by conservatively scaling the Project operations chronic noncancer hazard index and excess $PM_{2.5}$ concentrations by the maximum change in traffic volumes for any segment. The impact from the Increased Residential Density Variant remains below threshold.

[1] Table numbers referenced herein correspond to the similar table in the Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report.

### 2.1.3 *Combined Construction and Operational Health Impacts*

Similar to the analysis for the Project, health impacts from Increased Residential Variant construction and operations were added together to estimate the combined health impacts of construction activities and operation. A breakdown of excess lifetime cancer risk from construction, operational generators, and operational traffic at the Project MEIR is shown in **Table 59V**. The table also shows the Scenario for which the maximum was identified. Similar breakdowns for chronic HI and $PM_{2.5}$ concentration are shown in **Table 60V** and **Table 61V**, respectively. These tables also show the Scenario for which the maximums were identified, as well as the year for which the maximum occurred since chronic HI and $PM_{2.5}$ concentrations are annual impacts.

All health impacts remain below thresholds. Similar to the Project, the health impacts at onsite residents would be reduced due to the required filtration on the new residential units. However, these impacts were conservatively not taken into account. Appendix E and Appendix F of the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report contain more information on the effects of filtration for informational purposes.

### 2.1.4 *Other Air Impacts*

This Variant also would not change conclusions of the odor, carbon monoxide and cumulative assessments. This Variant would not substantially change emissions of odor and would not increase traffic volumes to above the screening levels discussed in the carbon monoxide assessment in the Technical Report. This Variant also would not change the MEIR, so the cumulative assessment would not change, and cumulative health impacts would remain below thresholds.

### 2.1.5 *Energy*

This Variant would increase energy use associated with construction and operations. However, increases in energy use would be minor, similar to the increase in emissions, and significance findings would not change.

## 2.2 No Hamilton Avenue Realignment Variant

The No Hamilton Avenue Realignment Variant assumes that no changes would occur to the existing land uses on the Hamilton Avenue Parcels and that the intersection of Willow Road and Hamilton Avenue would remain in the existing location. This would alter the circulation network east of Willow Road to accommodate retaining the Willow Road and Hamilton Avenue intersection in its current alignment. This Variant would result from forces outside of the Project's control, such as not receiving approval from Caltrans or affected property owners.

### 2.2.1 *Construction Emissions and Health Risk Assessment*

This Variant results in less construction activity due to the lack of construction of the Hamilton Avenue Realignment and lack of increase in retail and relocation of the service station at the Hamilton Avenue Parcels North and South. Therefore, construction emissions would be reduced. However, emissions would not be reduced to a level that would change significance findings of construction criteria air pollutant emissions since construction associated with these parcels were relatively minor.

As a result of the emissions reduction due to the reduction in equipment activity, health impacts would also be reduced. However, the reduction in emissions is far from the MEIR reported in our Technical Report. Therefore, the reduction in construction activity would not have a substantial change in health impacts reported in the Technical Report due to the dispersion of the emissions at the MEIR. The reduction also would not substantially reduce required mitigation of construction equipment.

### 2.2.2 *Operational Emissions and Health Risk Assessment*

Operational emissions would be reduced as a result of the reduction in additional retail associated with the Hamilton Avenue Parcels North and South. Emissions from architectural coatings, consumer products, landscaping, mobile, energy use, water, waste and emergency generators would be reduced as a result of the reduction in additional retail with this Variant. For context, the Hamilton Avenue Parcels North and South account for only 0.7% of daily trips and 0.4% of daily vehicle miles traveled of the Project at Full Buildout. This Variant would decrease Project traffic emissions by a similarly insubstantial margin. Therefore, the change in emissions associated with this Variant would be minimal and would not change significance findings.

The overall effect on the operational health impacts of the Project is expected to be negligible. Considering both the relatively small decrease in emissions and the Hamilton Avenue Parcels being approximately 0.25 miles to the onsite MEIR and 0.5 miles to offsite MEIR, it is unlikely that this Variant would produce a meaningful reduction to the health impacts associated with the Project.

### 2.2.3 *Other Air Impacts*

This Variant also would not change conclusions of the odor, carbon monoxide and cumulative assessments. This Variant would not substantially change emissions of odor and would not increase traffic volumes to above the screening levels discussed in the carbon monoxide assessment in the Technical Report. This Variant also would not change the MEIR, so the cumulative assessment would not change, and cumulative health impacts would remain below thresholds.

### 2.2.4 *Energy*

This Variant would not have an appreciable effect on energy use compared to the Project. As mentioned above, construction activity would be reduced with this Variant due to the reduction in activity at the Hamilton Avenue Parcels North and South. Therefore, construction fuel use would be minorly reduced. However, the reduction in fuel use would not change any significance findings due to the minor reduction.

Project building related energy use would also be minorly reduced due to the reduction in new retail space. The minor change in traffic patterns associated with this Variant would have a negligible impact on energy use associated with vehicle travel. These changes would not change any significance findings due to the minor changes.

## 2.3 No Willow Road Tunnel Variant

The No Willow Road Tunnel Variant assumes the tunnel from the northwest corner of the Project site to the southeast corner of the Bayfront campus would not be constructed, resulting from forces outside of the Project’s control. With this Variant, the trams would continue to operate, but would use Willow Road instead of the tunnel. Pedestrians and bicyclists would use the sidewalk and on-street bike lanes to move along the Willow Road corridor.

### 2.3.1 *Construction Emissions and Health Risk Assessment*

This Variant results in less construction activity due to the lack of construction of the Willow Road Tunnel. Therefore, construction emissions will be reduced. However, emissions would not be reduced to a level that would change significance findings of construction criteria air pollutant emissions.

As a result of the emissions reduction due to the reduction in equipment activity, health impacts would also be reduced. However, the reduction in emissions is far from the MEIR reported in our Technical Report. Therefore, the reduction in construction activity would not have a substantial change in health impacts reported in the Technical Report due to the dispersion of the emissions at the MEIR. The reduction also would not substantially reduce required mitigation of construction equipment.

### 2.3.2 *Operational Emissions and Health Risk Assessment*

Emissions from architectural coatings, consumer products, energy use, and emergency generators would not be affected by this Variant. Landscaping emissions may change slightly due to the change in landscape in this area. However, the parameters used to estimate emissions from landscaping, as prescribed in CalEEMod, would not change. Therefore, any change in landscaping emissions would be small.

This Variant would move trams, pedestrians and bicyclists from the tunnel to Willow Road. Pedestrians and bicyclists do not release emissions. The tram and shuttle schedule would not be affected by the lack of tunnel under Willow Road. The slight change in distance traveled by the trams and shuttles would be negligible and would not change emissions associated with their travel.

The change in travel patterns for the trams and shuttles also would not affect the health impacts from traffic reported in the Technical Report. The onsite and offsite MEIR is far from where this change in location of emissions would occur and the change in location of emissions is small. Therefore, this Variant would have a negligible change on reported health impacts. Furthermore, without the Project, the trams and shuttles would travel on this segment of Willow Road. Therefore, the change in health impacts to sensitive receptors near the tunnel with this Variant would be negligible.

### 2.3.3 *Other Air Impacts*

This Variant also would not change conclusions of the odor, carbon monoxide and cumulative assessments. This Variant would not substantially change emissions of odor and would not increase traffic volumes to above the screening levels discussed in the carbon monoxide assessment in the Technical Report. This Variant also would not change the MEIR, so the cumulative assessment would not change, and cumulative health impacts would remain below thresholds.

### 2.3.4 *Energy*

This Variant would not have an appreciable effect on energy use compared to the Project. As mentioned above, construction activity would be reduced with this Variant. Therefore, construction fuel use would be minorly reduced. However, the reduction in fuel use would not change any significance findings due to the minor reduction. Building related energy use would not be affected by this Variant. The minor change in traffic patterns associated with this Variant would have a negligible impact on energy use associated with vehicle travel.

## 2.4 On-site Recycled Water Variant

The On-Site Recycled Water Variant would provide recycled water to Willow Village through the on-site treatment of wastewater. The on-site treatment and production of recycled water would capture wastewater supplies, including blackwater, from all Willow Village buildings by providing four water reuse facilities. The recycled water would be utilized for irrigation, toilet flushing and cooling. This Variant would be included in the Project if the West Bay Sanitary District does not construct its proposed Bayfront Recycled Water Plant and associated improvements to convey recycled water to the Project Site.

### 2.4.1 *Construction Emissions and Health Risk Assessment*

This Variant results in very little change in construction activity. Any equipment to be used to install the water treatment facility would already be on-site for the other components of construction and any activity associated with the installation would be encompassed in the existing schedule. Therefore, construction emissions would not be expected to change as a result of the On-site Recycled Water Variant.

Since emissions are not expected to change, health impacts are also not expected to change as a result of the On-site Recycled Water Variant.

### 2.4.2 *Operational Emissions and Health Risk Assessment*

Emissions from architectural coatings, consumer products, landscaping, mobile, waste and emergency generators would not be affected by this Variant. Any increase in on-site energy use associated with the on-site treatment would be offset by the reduction in energy to pump the water to a central treatment facility and energy the central treatment facility would use to treat the water. As a result, this Variant would not alter emissions as compared to the Project.

Similarly, health impacts of operations would not change as a result of this Variant.

### 2.4.3 *Other Air Impacts*

This Variant also would not change conclusions of the odor, carbon monoxide and cumulative assessments. Recycled water systems that employ biological treatment are capable of removing odor causing organic compounds and sulfides. These odorous compounds are oxidized to carbon dioxide, sulfates and water by microorganisms in the biological reactor in the presence of dissolved oxygen. Any remaining compounds that might volatilize are quickly diluted by the surrounding air. Therefore, this Variant would not change odor impacts. This Variant would not change traffic volumes, so the carbon monoxide assessment would not change. This Variant also would not change the MEIR, so the cumulative assessment would not change, and cumulative health impacts would remain below thresholds.

### 2.4.4 *Energy*

This Variant would not have an appreciable effect on energy use compared to the Project. Any increase in on-site energy use due to the water treatment would be offset by the reduction in energy use at a central treatment plant and the energy to pump the water to the treatment plant.

# TABLES

**Table 1V**
**Land Use Summary**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Land Use[1] | CalEEMod® Land Use | Size | Units[2] | Square Footage |
|---|---|---|---|---|
| **Existing Conditions (2019)** | | | | |
| Office | General Office Building | 252 | ksf | 251,530 |
| R&D | Research and Development | 124 | ksf | 123,870 |
| Warehouse | Unrefrigerated Warehouse-No Rail | 501 | ksf | 500,780 |
| Lab & Manufacture | Manufacturing | 24 | ksf | 23,570 |
| Health Center | Health Club | 24 | ksf | 24,060 |
| Former Fire Department Building | General Light Industry | 80 | ksf | 80,100 |
| Parking | Enclosed Parking with Elevator | 2,300 | Spaces | 920,000 |
| **Partial Buildout by Year[3]** | | | | |
| **Land Use Type[4]** | | **Percent Operational by Year** | | |
| | | **Year 4** | **Year 5** | **Year 6** |
| Office | | 3.1% | 58% | 95% |
| Retail | | 10% | 59% | 98% |
| Residential | | 0% | 16% | 64% |
| Hotel | | 0% | 41% | 100% |
| Parking | | 53% | 75% | 96% |
| Park | | 89% | 95% | 100% |
| **Full Buildout** | | | | |
| **Land Use Type[4]** | | **Size** | **Units[2]** | **Square Footage** |
| Office | | 1,600 | ksf | 1,600,000 |
| Retail | | 208 | ksf | 207,690 |
| Residential | | 1,930 | DU | 1,892,043 |
| Hotel | | 193 | Rooms | 172,000 |
| Parking | | 1,869 | ksf | 1,869,240 |
| Park | | 404 | ksf | 403,837 |

**Notes:**

1. Land uses analyzed based on information provided by the Project Applicant, as found in the Project Description. "Office" land use mapped to General Office Building and Research and Development; "Office/Lab" mapped to General Office Building, Research and Development, Health Club, and Manufacturing; "Warehouse" mapped to Unrefrigerated Warehouse-No Rail and General Light Industry, and "Warehouse/Office" mapped to Unrefrigerated Warehouse-No Rail and Research and Development CalEEMod land use types on a building-by-building basis.
2. The Project Applicant provided Project land uses in units of square footage, hotel rooms, and dwelling units. For the existing parking land use, each parking space is assumed to be 400 sqft. This assumption is based on CalEEMod defaults.
3. Partial buildout for Year 4, Year 5, and Year 6 were calculated based on the portion of building area for each land use type that becomes operational each year, based on the construction schedule, as shown in Table 2.
4. For Hamilton Avenue Parcels North and South, only net new square footage was included in the analysis. This is under the conservative assumption that the existing retail area and the retail land use that will replace it have similar operational emissions.

**Abbreviations:**

DU - dwelling unit
sqft - square foot
ksf - 1,000 square feet
CalEEMod® - California Emissions Estimator Model

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

**Table 12V**
**Project Construction Architectural Coating Off-Gassing Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

| Coating Category | Unmitigated Interior | Mitigated Interior | Exterior |
|---|---|---|---|
| **VOC Content (g/L)[1,2]** | 100 | 10 | 150 |
| **Emission Factor (lb/ft$^2$)[3]** | 0.0046 | 0.00046 | 0.0070 |
| **Land Use** | **Fraction of Surface Area Painted[3] (%)** | | **Painted Area Multiplier[3]** |
| | **Interior** | **Exterior** | |
| Residential | 75% | 25% | 2.7 |
| Non-Residential | 75% | 25% | 2 |
| Parking | 0% | 6% | -- |

| Building or Parcel | Land Use[4] | Start Year | End Year | Building Square Footage[5] | | | Painted Surface Area | | Unmitigated ROG Emissions | Mitigated ROG Emissions |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential Area | Non-Residential Area | Parking Area | Interior | Exterior | | |
| | | | | ft$^2$ | ft$^2$ | ft$^2$ | ft$^2$ | ft$^2$ | tons | tons |
| Parcel 2 | Residential | Year 4 | Year 5 | 320,569 | -- | -- | 649,152 | 216,384 | 2.3 | 0.90 |
| | Non-Residential | | | -- | 40,000 | -- | 60,000 | 20,000 | 0.21 | 0.083 |
| | Parking | | | -- | -- | 216,862 | -- | 13,012 | 0.045 | 0.045 |
| Parcel 3 | Residential | Year 4 | Year 5 | 410,760 | -- | -- | 831,788 | 277,263 | 2.9 | 1.2 |
| | Non-Residential | | | -- | 55,000 | -- | 82,500 | 27,500 | 0.29 | 0.11 |
| | Parking | | | -- | -- | 233,000 | -- | 13,980 | 0.049 | 0.049 |
| North Garage | Parking | Year 2 | Year 3 | -- | -- | 840,056 | -- | 50,403 | 0.18 | 0.18 |
| Office Building 4 | Non-Residential | Year 4 | | -- | 269,934 | -- | 404,902 | 134,967 | 1.4 | 0.56 |
| Meeting, Collaboration, Park | Non-Residential | Year 5 | Year 6 | -- | 454,563 | -- | 681,844 | 227,281 | 2.4 | 0.95 |
| Hotel | Non-Residential | Year 5 | | -- | 172,000 | -- | 258,000 | 86,000 | 0.90 | 0.36 |
| Other | Non-Residential | Year 4 | | -- | 6,085 | -- | 9,127 | 3,042 | 0.032 | 0.013 |
| | Parking | | | -- | -- | 13,600 | -- | 816 | 2.8E-03 | 2.8E-03 |
| Parcel 7 | Residential | Year 4 | Year 5 | 117,640 | -- | -- | 238,221 | 79,407 | 0.83 | 0.33 |
| | Parking | | | -- | -- | 9,547 | -- | 573 | 2.0E-03 | 2.0E-03 |
| Parcel 6 | Residential | Year 5 | | 174,499 | -- | -- | 353,361 | 117,787 | 1.2 | 0.49 |
| | Parking | | | -- | -- | 26,809 | -- | 1,609 | 5.6E-03 | 5.6E-03 |
| South Garage | Parking | Year 3 | Year 4 | -- | -- | 446,830 | -- | 26,810 | 0.093 | 0.093 |
| Office Building 3 | Non-Residential | Year 4 | Year 5 | -- | 212,805 | -- | 319,207 | 106,402 | 1.1 | 0.44 |
| Office Building 1 | Non-Residential | Year 4 | | -- | 134,237 | -- | 201,355 | 67,118 | 0.70 | 0.28 |
| Office Building 2 | Non-Residential | Year 4 | Year 5 | -- | 164,078 | -- | 246,118 | 82,039 | 0.86 | 0.34 |
| Office Building 5 | Non-Residential | Year 4 | Year 5 | -- | 236,320 | -- | 354,481 | 118,160 | 1.2 | 0.49 |
| Office Building 6 | Non-Residential | Year 4 | Year 5 | -- | 221,978 | -- | 332,967 | 110,989 | 1.2 | 0.46 |
| Parcels 4 + 5 | Residential | Year 5 | Year 6 | 868,575 | -- | -- | 1,758,864 | 586,288 | 6.1 | 2.4 |
| | Non-Residential | | | -- | 5,000 | -- | 7,500 | 2,500 | 0.026 | 0.010 |
| | Parking | | | -- | -- | 82,536 | -- | 4,952 | 0.017 | 0.017 |
| Hamilton Avenues Parcels North and South | Non-Residential | Year 5 | | -- | 7,690 | -- | 11,535 | 3,845 | 0.040 | 0.016 |
| | | | | | | | | **Total Year 2[6]** | **0.025** | **0.025** |
| | | | | | | | | **Total Year 3[6]** | **0.20** | **0.20** |
| | | | | | | | | **Total Year 4[6]** | **7.5** | **3.1** |
| | | | | | | | | **Total Year 5[6]** | **9.9** | **4.0** |
| | | | | | | | | **Total Year 6[6]** | **6.4** | **2.6** |

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**Table 12V**
**Project Construction Architectural Coating Off-Gassing Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**Notes:**

1. VOC content of paint is assumed to be consistent with BAAQMD Regulation 8, Rule 3 for flat and nonflat coatings. VOC is assumed to be equivalent to ROG for these purposes.
2. Paint VOC content is consistent with or more stringent than BAAQMD Regulation 8 Rule 3 (Architectural Coatings). Emissions are estimated assuming that indoor painting will utilize "super-compliant" VOC architectural coatings that meet the more stringent limits in South Coast Air Quality Management District Rule 1113. For outdoor paint, assumes use of coatings with VOC content of 150 g/L, consistent with BAAQMD requirements. VOC is assumed to be equivalent to ROG for these purposes.
3. The emission factor is calculated using CalEEMod default architectural coating emissions parameters. The default assumptions account for the painting surface area relative to the floor square footage assuming 1 gallon of paint covers 180 sqft of surface area.
4. Consistent with CalEEMod Appendix A, recreational areas were excluded from the floor square footage in calculating VOC emissions due to architectural coatings.
5. Project square footage by land use was provided by the Project Applicant.
6. ROG emissions are allocated to each year based on the construction schedule for each building or parcel.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator MODel
CEQA - California Environmental Quality Act
$ft^2$ - square feet
g - gram
gal - gallons
L - liters
lb - pounds
ROG - reactive organic gas
sqft - square feet
VOC - volatile organic compound

**References:**

BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). 2016. Appendix A. Available at: http://www.caleemod.com

**Table 13V**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**Off-Road Emissions[1,2]**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 34 | 376 | 15 | 14 |
| | | Year 2 | 196 | 2,133 | 82 | 76 |
| | Grading and Utilities | Year 2 | 436 | 4,632 | 159 | 146 |
| Parcel 2 Foundations | | Year 3 | 285 | 2,758 | 163 | 150 |
| Parcel 2 Core and Shell | | Year 3 | 31 | 296 | 16 | 15 |
| | | Year 4 | 57 | 451 | 25 | 23 |
| Parcel 2 Tenant Improvements | | Year 4 | 52 | 371 | 24 | 22 |
| | | Year 5 | 32 | 302 | 18 | 16 |
| Parcel 2 Landscaping | | Year 5 | 134 | 896 | 70 | 65 |
| Parcel 3 Foundations | | Year 3 | 373 | 3,494 | 219 | 202 |
| | | Year 4 | 2.4 | 21 | 1.3 | 1.2 |
| Parcel 3 Core and Shell | | Year 4 | 128 | 938 | 54 | 50 |
| Parcel 3 Tenant Improvements | | Year 4 | 30 | 235 | 13 | 12.2 |
| | | Year 5 | 52 | 531 | 28 | 25 |
| Parcel 3 Landscaping | | Year 5 | 160 | 1,093 | 87 | 80 |
| North Garage | | Year 2 | 62 | 644 | 20 | 19 |
| | | Year 3 | 152 | 1,615 | 62 | 57 |
| Office Building 4 | | Year 3 | 132 | 1,355 | 54 | 50 |
| | | Year 4 | 17 | 227 | 7.3 | 6.8 |
| Meeting, Collaboration, Park | | Year 2 | 102 | 992 | 31 | 29 |
| | | Year 3 | 433 | 4,090 | 159 | 147 |
| | | Year 4 | 96 | 1,075 | 24 | 22 |
| | | Year 5 | 81 | 842 | 18 | 17 |
| | | Year 6 | 26 | 229 | 8.0 | 7.4 |
| Hotel Excavation | | Year 2 | 99 | 995 | 34 | 31 |
| | | Year 3 | 421 | 4,048 | 173 | 160 |
| Hotel Construction | | Year 4 | 94 | 1,011 | 27 | 25 |
| | | Year 5 | 71 | 845 | 18 | 16 |
| Town Square | | Year 3 | 608 | 5,208 | 301 | 277 |
| | | Year 4 | 256 | 2,207 | 120 | 111 |
| | | Year 5 | 26 | 218 | 3.7 | 3.4 |
| Area 2 | Demolition | Year 2 | 112 | 1,219 | 47 | 43 |
| | Grading and Utilities | Year 2 | 198 | 2,106 | 72 | 67 |
| | | Year 3 | 289 | 2,620 | 132 | 122 |
| Parcel 7 Foundations | | Year 4 | 200 | 1,666 | 113 | 104 |
| Parcel 7 Core and Shell | | Year 4 | 63 | 482 | 28 | 26 |
| Parcel 7 Tenant Improvements | | Year 4 | 6.0 | 41 | 2.7 | 2.5 |
| | | Year 5 | 48 | 438 | 26 | 24 |
| Parcel 7 Landscaping | | Year 5 | 110 | 704 | 55 | 51 |
| Parcel 6 Foundations | | Year 4 | 202 | 1,728 | 113 | 104 |
| Parcel 6 Core and Shell | | Year 4 | 58 | 410 | 24 | 22 |
| | | Year 5 | 27 | 256 | 14 | 13 |
| Parcel 6 Tenant Improvements | | Year 5 | 54 | 538 | 29 | 27 |
| Parcel 6 Landscaping | | Year 5 | 64 | 426 | 34 | 32 |
| | | Year 6 | 74 | 488 | 40 | 37 |
| South Garage | | Year 3 | 188 | 1,854 | 77 | 71 |
| | | Year 4 | 83 | 889 | 32 | 29 |
| Office Building 3 | | Year 3 | 168 | 1,611 | 72 | 66 |
| | | Year 4 | 35 | 442 | 13 | 12 |
| | | Year 5 | 3.9 | 58 | 1.6 | 1.5 |
| Office Building 1 | | Year 3 | 147 | 1,427 | 62 | 57 |
| | | Year 4 | 33 | 411 | 13 | 12 |
| Office Building 2 | | Year 3 | 142 | 1,366 | 60 | 56 |
| | | Year 4 | 36 | 448 | 14 | 13 |
| | | Year 5 | 0.44 | 6.4 | 0.18 | 0.17 |
| Office Building 5 | | Year 3 | 197 | 1,875 | 84 | 78 |
| | | Year 4 | 33 | 418 | 13 | 12 |
| | | Year 5 | 3.6 | 52 | 1.5 | 1.4 |

**Table 13V**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Office Building 6 | | Year 3 | 189 | 1,775 | 82 | 75 |
| | | Year 4 | 39 | 476 | 14 | 13 |
| | | Year 5 | 7.6 | 112 | 3.2 | 3.0 |
| Area 3 | Grading and Utilities | Year 3 | 49 | 443 | 22 | 21 |
| | Tunnel Construction | Year 3 | 145 | 1,476 | 68 | 63 |
| | | Year 4 | 71 | 710 | 33 | 31 |
| | Foundations | Year 4 | 86 | 725 | 47 | 43 |
| | | Year 5 | 333 | 2,939 | 190 | 174 |
| | Core and Shell | Year 5 | 174 | 1,563 | 82 | 75 |
| | Tenant Improvements | Year 5 | 17 | 157 | 7.5 | 6.9 |
| | | Year 6 | 113 | 1,065 | 50 | 46 |
| | Landscaping | Year 6 | 210 | 1,522 | 119 | 110 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 42 | 428 | 23 | 21 |
| | Grading and Utilities | Year 4 | 2.1 | 20 | 1.2 | 1.1 |
| | | Year 5 | 45 | 441 | 25 | 23 |
| | Foundations | Year 5 | 35 | 309 | 20 | 18 |
| | Core and Shell | Year 5 | 18 | 189 | 7.9 | 7.3 |
| | Tenant Improvements | Year 5 | 14 | 141 | 7.1 | 6.5 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 223 | 1,749 | 142 | 131 |
| Feeder Line | PG&E Offsite Work | Year 3 | 180 | 1,438 | 99 | 91 |
| | Surface Improvements | Year 3 | 20 | 186 | 11 | 10 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 8.4 | 66 | 5.3 | 4.9 |
| | Adams and O'Brien | Year 3 | 5.6 | 44 | 3.6 | 3.3 |
| | Willow Road and Ivy Drive | Year 3 | 5.6 | 44 | 3.6 | 3.3 |

**On-Road and Paving[1]**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 10 | 513 | 4.6 | 4.4 |
| | | Year 2 | 56 | 3,017 | 23 | 22 |
| | Grading and Utilities | Year 2 | 132 | 2,549 | 17 | 17 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 1.6 | 90 | 0.92 | 0.88 |
| | | Year 4 | 0.0064 | 0.38 | 3.8E-03 | 3.7E-03 |
| | Core and Shell | Year 3 | 0.45 | 26 | 0.26 | 0.25 |
| | | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Tenant Improvements | Year 4 | 0.95 | 56 | 0.56 | 0.54 |
| | | Year 5 | 1.0 | 64 | 0.63 | 0.61 |
| | Landscaping | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 300 | 219 | 3.9 | 3.6 |
| | | Year 4 | 328 | 230 | 4.4 | 4.1 |
| | | Year 5 | 210 | 142 | 2.9 | 2.6 |
| | Landscaping Worker Mobile Trips | Year 5 | 39 | 26 | 0.53 | 0.49 |
| Campus District | Foundations + Core and Shell | Year 2 | 2.3 | 111 | 1.1 | 1.0 |
| | | Year 3 | 10 | 576 | 5.9 | 5.6 |
| | | Year 4 | 9.3 | 548 | 5.5 | 5.3 |
| | | Year 5 | 8.4 | 515 | 5.1 | 4.9 |
| | Tenant Improvements | Year 4 | 3.8 | 223 | 2.2 | 2.1 |
| | | Year 5 | 4.6 | 281 | 2.8 | 2.7 |
| | | Year 6 | 0.74 | 47 | 0.46 | 0.44 |
| | O4 and NG Worker Mobile Trips | Year 2 | 53 | 41 | 0.69 | 0.64 |
| | | Year 3 | 309 | 226 | 4.1 | 3.7 |
| | | Year 4 | 230 | 162 | 3.1 | 2.8 |
| | MCS Worker Mobile Trips | Year 2 | 40 | 31 | 0.52 | 0.48 |
| | | Year 3 | 232 | 169 | 3.1 | 2.8 |
| | | Year 4 | 219 | 153 | 2.9 | 2.7 |
| | | Year 5 | 205 | 139 | 2.8 | 2.6 |
| | | Year 6 | 34 | 22 | 0.47 | 0.43 |
| Area 2 | Demolition | Year 2 | 58 | 3,480 | 27 | 25 |
| | Grading and Utilities | Year 2 | 48 | 1,273 | 8.7 | 8.3 |
| | | Year 3 | 43 | 1,129 | 8.3 | 7.9 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Core and Shell | Year 4 | 1.4 | 83 | 0.83 | 0.79 |
| | | Year 5 | 0.42 | 26 | 0.26 | 0.25 |

**Table 13V**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Unmitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 2 Town Square and Residential/Shopping District | Tenant Improvements | Year 4 | 0.16 | 10 | 0.10 | 0.093 |
| | | Year 5 | 2.1 | 126 | 1.3 | 1.2 |
| | Landscaping | Year 5 | 0.54 | 33 | 0.32 | 0.31 |
| | | Year 6 | 0.17 | 11 | 0.11 | 0.10 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 326 | 228 | 4.4 | 4.0 |
| | | Year 5 | 277 | 187 | 3.8 | 3.5 |
| | Landscaping Worker Mobile Trips | Year 5 | 29 | 19 | 0.39 | 0.36 |
| | | Year 6 | 10 | 6.2 | 0.13 | 0.12 |
| Campus District | Foundations + Core and Shell | Year 3 | 7.8 | 447 | 4.5 | 4.3 |
| | | Year 4 | 8.2 | 486 | 4.9 | 4.7 |
| | Tenant Improvements | Year 4 | 7.0 | 410 | 4.1 | 3.9 |
| | | Year 5 | 5.0 | 306 | 3.0 | 2.9 |
| | Worker Mobile Trips | Year 3 | 516 | 377 | 6.8 | 6.3 |
| | | Year 4 | 627 | 440 | 8.4 | 7.7 |
| | | Year 5 | 275 | 186 | 3.8 | 3.5 |
| Area 3 | Grading and Utilities | Year 3 | 45 | 196 | 1.7 | 1.6 |
| | Tunnel Construction | Year 3 | 686 | 779 | 12 | 11 |
| | | Year 4 | 319 | 355 | 5.6 | 5.2 |
| | Foundations | Year 4 | 88 | 107 | 1.6 | 1.5 |
| | | Year 5 | 343 | 407 | 6.4 | 6.0 |
| | Core and Shell | Year 5 | 556 | 716 | 11 | 10 |
| | Tenant Improvements | Year 5 | 115 | 148 | 2.3 | 2.1 |
| | | Year 6 | 758 | 960 | 15 | 14 |
| | Landscaping | Year 6 | 10 | 71 | 0.77 | 0.73 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 2.1 | 66.3 | 0.58 | 0.55 |
| | Grading and Utilities | Year 4 | 0.077 | 1.3 | 0.010 | 9.2E-03 |
| | | Year 5 | 5.0 | 27 | 0.21 | 0.20 |
| | Foundations | Year 5 | 0.80 | 49 | 0.49 | 0.47 |
| | Core and Shell | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Tenant Improvements | Year 5 | 0.90 | 55 | 0.55 | 0.52 |
| | Worker Mobile Trips | Year 5 | 72 | 48 | 1.0 | 0.90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 5.5 | 24 | 0.27 | 0.26 |
| Feeder Line | PG&E Offsite Work | Year 3 | 15 | 56 | 0.65 | 0.62 |
| | Surface Improvements | Year 3 | 4.3 | 5.4 | 0.063 | 0.059 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.0 | 10 | 0.11 | 0.10 |
| | Adams and O'Brien | Year 3 | 0.83 | 10 | 0.11 | 0.10 |
| | Willow Road and Ivy Drive | Year 3 | 0.83 | 10 | 0.11 | 0.10 |

**Summary of Project Construction Unmitigated Annual CAP Emissions by Year**

| Year | Emissions[4] | | | |
|---|---|---|---|---|
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | ton/year | | | |
| Year 1 | 0.022 | 0.44 | 0.010 | 9.0E-03 |
| Year 2 | 0.82 | 12 | 0.26 | 0.24 |
| Year 3 | 3.5 | 23 | 1.06 | 0.98 |
| Year 4 | 9.5 | 9.8 | 0.41 | 0.38 |
| Year 5 | 12 | 8.3 | 0.40 | 0.37 |
| Year 6 | 7.0 | 2.2 | 0.12 | 0.11 |
| **Total** | 33 | 55 | 2.3 | 2.1 |

**Summary of Project Construction Unmitigated Daily CAP Emissions by Year**

| Year | Emissions | | | |
|---|---|---|---|---|
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | lb/day | | | |
| Year 1 | 2.8 | **56** | 1.2 | 1.1 |
| Year 2 | 4.5 | **64** | 1.4 | 1.3 |
| Year 3 | 19 | **124** | 5.8 | 5.4 |
| Year 4 | 52 | 53 | 2.3 | 2.1 |
| Year 5 | **64** | 46 | 2.2 | 2.0 |
| Year 6 | 43 | 14 | 0.72 | 0.67 |
| **Threshold[5]** | 54 | 54 | 82 | 54 |

**Notes:**

1. Construction emissions were estimated with methodology equivalent to CalEEMod 2020.4.0. Emissions were estimated using on-road emissions factors from EMFAC2021 and off-road construction equipment emission factors from OFFROAD2017. Onroad trips and offroad construction equipment use were provided by the Project Applicant.

2. Unmitigated construction emissions from offroad equipment are calculated using fleet-average emission factors.

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**Table 13V**
**Summary of Unmitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

3. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.

4. The mass emissions shown above are converted from pound per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.

5. Thresholds are from BAAQMD California Environmental Quality Act (CEQA) Guidelines. Bolded values indicate threshold exceedances. Fugitive emissions sources are excluded from comparison to this threshold.

**Abbreviations:**

CAP - criteria air pollutant

CalEEMod - California Emissions Estimate Model

ROG - reactive organic gases

$NO_X$ - nitrous oxide

**Table 14V**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**Off-Road Emissions[1,2]**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 13 | 168 | 2.4 | 2.4 |
| | | Year 2 | 79 | 1,045 | 15 | 15 |
| | Grading and Utilities | Year 2 | 189 | 2,033 | 36 | 35 |
| Parcel 2 Foundations | | Year 3 | 48 | 933 | 8.4 | 8.4 |
| Parcel 2 Core and Shell | | Year 3 | 7.3 | 81 | 1.4 | 1.4 |
| | | Year 4 | 13 | 143 | 2.5 | 2.4 |
| Parcel 2 Tenant Improvements | | Year 4 | 9.3 | 133 | 1.8 | 1.7 |
| | | Year 5 | 6.8 | 95 | 1.1 | 1.0 |
| Parcel 2 Landscaping | | Year 5 | 10 | 165 | 1.3 | 1.3 |
| Parcel 3 Foundations | | Year 3 | 53 | 1,008 | 9.5 | 9.4 |
| | | Year 4 | 0.33 | 6.2 | 0.059 | 0.058 |
| Parcel 3 Core and Shell | | Year 4 | 24 | 333 | 4.3 | 4.2 |
| Parcel 3 Tenant Improvements | | Year 4 | 6.1 | 102 | 1.11 | 1.09 |
| | | Year 5 | 13 | 207 | 1.9 | 1.9 |
| Parcel 3 Landscaping | | Year 5 | 11 | 215 | 1.3 | 1.3 |
| North Garage | | Year 2 | 31 | 310 | 5.7 | 5.7 |
| | | Year 3 | 57 | 568 | 11 | 11.0 |
| Office Building 4 | | Year 3 | 46 | 562 | 8.4 | 8.4 |
| | | Year 4 | 7.0 | 138 | 1.2 | 1.2 |
| Meeting, Collaboration, Park | | Year 2 | 50 | 453 | 9.3 | 9.3 |
| | | Year 3 | 172 | 1,532 | 32 | 32 |
| | | Year 4 | 55 | 818 | 10 | 10 |
| | | Year 5 | 50 | 561 | 7.2 | 7.2 |
| | | Year 6 | 12 | 69 | 1.8 | 1.8 |
| Hotel Excavation | | Year 2 | 50 | 441 | 10 | 9 |
| | | Year 3 | 160 | 1,462 | 32 | 32 |
| Hotel Construction | | Year 4 | 63 | 814 | 13 | 13 |
| | | Year 5 | 42 | 643 | 6.1 | 6.1 |
| Town Square | | Year 3 | 141 | 1,493 | 27 | 27 |
| | | Year 4 | 67 | 676 | 13 | 13 |
| | | Year 5 | 21 | 147 | 3.4 | 3.4 |
| Area 2 | Demolition | Year 2 | 45 | 597 | 8.7 | 8.6 |
| | Grading and Utilities | Year 2 | 86 | 924 | 16 | 16 |
| | | Year 3 | 83 | 886 | 16 | 16 |
| Parcel 7 Foundations | | Year 4 | 25 | 412 | 4.4 | 4.4 |
| Parcel 7 Core and Shell | | Year 4 | 14 | 139 | 2.7 | 2.7 |
| Parcel 7 Tenant Improvements | | Year 4 | 1.1 | 14 | 0.21 | 0.20 |
| | | Year 5 | 10 | 126 | 1.6 | 1.6 |
| Parcel 7 Landscaping | | Year 5 | 8.6 | 153 | 1.1 | 1.1 |
| Parcel 6 Foundations | | Year 4 | 27 | 474 | 4.7 | 4.6 |
| Parcel 6 Core and Shell | | Year 4 | 11 | 138 | 1.9 | 1.9 |
| | | Year 5 | 6.1 | 75 | 0.91 | 0.89 |
| Parcel 6 Tenant Improvements | | Year 5 | 13 | 198 | 2.0 | 2.0 |
| Parcel 6 Landscaping | | Year 5 | 4.6 | 96 | 0.54 | 0.54 |
| | | Year 6 | 5.4 | 112 | 0.63 | 0.63 |
| South Garage | | Year 3 | 68 | 674 | 13 | 13 |
| | | Year 4 | 34 | 372 | 6.5 | 6.5 |
| Office Building 3 | | Year 3 | 55 | 532 | 10 | 10 |
| | | Year 4 | 14 | 289 | 2.4 | 2.4 |
| | | Year 5 | 1.8 | 35 | 0.25 | 0.25 |
| Office Building 1 | | Year 3 | 48 | 492 | 9.2 | 9.1 |
| | | Year 4 | 13 | 269 | 2.2 | 2.2 |
| Office Building 2 | | Year 3 | 46 | 454 | 8.8 | 8.8 |
| | | Year 4 | 14 | 293 | 2.5 | 2.4 |
| | | Year 5 | 0.20 | 3.8 | 0.029 | 0.028 |
| Office Building 5 | | Year 3 | 63 | 617 | 12 | 12 |
| | | Year 4 | 13 | 271 | 2.3 | 2.3 |
| | | Year 5 | 1.7 | 31 | 0.23 | 0.23 |

**Table 14V**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Office Building 6 | | Year 3 | 60 | 540 | 11 | 11 |
| | | Year 4 | 16 | 316 | 2.7 | 2.7 |
| | | Year 5 | 3.6 | 67 | 0.50 | 0.49 |
| Area 3 | Grading and Utilities | Year 3 | 14 | 150 | 2.7 | 2.7 |
| | Tunnel Construction | Year 3 | 43 | 557 | 7.6 | 7.5 |
| | | Year 4 | 21 | 275 | 3.7 | 3.7 |
| | Foundations | Year 4 | 12 | 208 | 2.2 | 2.1 |
| | | Year 5 | 49 | 796 | 6.5 | 6.5 |
| | Core and Shell | Year 5 | 47 | 512 | 6.8 | 6.7 |
| | Tenant Improvements | Year 5 | 5.6 | 70 | 0.81 | 0.79 |
| | | Year 6 | 38 | 479 | 5.5 | 5.4 |
| | Landscaping | Year 6 | 18 | 336 | 2.2 | 2.2 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 9.0 | 200 | 1.5 | 1.5 |
| | Grading and Utilities | Year 4 | 0.34 | 6.8 | 0.062 | 0.061 |
| | | Year 5 | 7.2 | 138 | 1.1 | 1.1 |
| | Foundations | Year 5 | 5.4 | 97 | 0.78 | 0.78 |
| | Core and Shell | Year 5 | 8.1 | 117 | 1.4 | 1.4 |
| | Tenant Improvements | Year 5 | 3.6 | 54 | 0.51 | 0.50 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 10 | 68 | 2.4 | 2.4 |
| Feeder Line | PG&E Offsite Work | Year 3 | 30 | 207 | 6.5 | 6.5 |
| | Surface Improvements | Year 3 | 3.3 | 22 | 0.66 | 0.65 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 0.36 | 2.6 | 0.091 | 0.091 |
| | Adams and O'Brien | Year 3 | 0.24 | 1.7 | 0.061 | 0.061 |
| | Willow Road and Ivy Drive | Year 3 | 0.24 | 1.7 | 0.061 | 0.061 |

**On-Road and Paving[1]**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 1 | Demolition | Year 1 | 10 | 513 | 4.6 | 4.4 |
| | | Year 2 | 56 | 3,017 | 23 | 22 |
| | Grading and Utilities | Year 2 | 132 | 2,549 | 17 | 17 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 1.6 | 90 | 0.92 | 0.88 |
| | | Year 4 | 6.4E-03 | 0.38 | 3.8E-03 | 3.7E-03 |
| | Core and Shell | Year 3 | 0.45 | 26 | 0.26 | 0.25 |
| | | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Tenant Improvements | Year 4 | 0.95 | 56 | 0.56 | 0.54 |
| | | Year 5 | 1.0 | 64 | 0.63 | 0.61 |
| | Landscaping | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 300 | 219 | 3.9 | 3.6 |
| | | Year 4 | 328 | 230 | 4.4 | 4.1 |
| | | Year 5 | 210 | 142 | 2.9 | 2.6 |
| | Landscaping Worker Mobile Trips | Year 5 | 39 | 26 | 0.53 | 0.49 |
| Area 1 Campus District | Foundations + Core and Shell | Year 2 | 2.3 | 111 | 1.1 | 1.0 |
| | | Year 3 | 10 | 576 | 5.9 | 5.6 |
| | | Year 4 | 9.3 | 548 | 5.5 | 5.3 |
| | | Year 5 | 8.4 | 515 | 5.1 | 4.9 |
| | Tenant Improvements | Year 4 | 3.8 | 223 | 2.2 | 2.1 |
| | | Year 5 | 4.6 | 281 | 2.8 | 2.7 |
| | | Year 6 | 0.74 | 47 | 0.46 | 0.44 |
| | O4 and NG Worker Mobile Trips | Year 2 | 53 | 41 | 0.69 | 0.64 |
| | | Year 3 | 309 | 226 | 4.1 | 3.7 |
| | | Year 4 | 230 | 162 | 3.1 | 2.8 |
| | MCS Worker Mobile Trips | Year 2 | 40 | 31 | 0.52 | 0.48 |
| | | Year 3 | 232 | 169 | 3.1 | 2.8 |
| | | Year 4 | 219 | 153 | 2.9 | 2.7 |
| | | Year 5 | 205 | 139 | 2.8 | 2.6 |
| | | Year 6 | 34 | 22 | 0.47 | 0.43 |
| Area 2 | Demolition | Year 2 | 58 | 3,480 | 27 | 25 |
| | Grading and Utilities | Year 2 | 48 | 1,273 | 8.7 | 8.3 |
| | | Year 3 | 43 | 1,129 | 8.3 | 7.9 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 1.2 | 68 | 0.69 | 0.66 |
| | Core and Shell | Year 4 | 1.4 | 83 | 0.83 | 0.79 |
| | | Year 5 | 0.42 | 26 | 0.26 | 0.25 |

**Table 14V**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

| Construction Area[3] | Construction Subphase | Year | Mitigated Construction CAP Emissions | | | |
|---|---|---|---|---|---|---|
| | | | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | | | lb/year | | | |
| Area 2 Town Square and Residential/Shopping District | Tenant Improvements | Year 4 | 0.16 | 10 | 0.10 | 0.093 |
| | | Year 5 | 2.1 | 126 | 1.3 | 1.2 |
| | Landscaping | Year 5 | 0.54 | 33 | 0.3 | 0.31 |
| | | Year 6 | 0.17 | 11 | 0.11 | 0.10 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 326 | 228 | 4.4 | 4.0 |
| | | Year 5 | 277 | 187 | 3.8 | 3.5 |
| | Landscaping Worker Mobile Trips | Year 5 | 29 | 19 | 0.39 | 0.36 |
| | | Year 6 | 10 | 6.2 | 0.13 | 0.12 |
| Campus District | Foundations + Core and Shell | Year 3 | 7.8 | 447 | 4.5 | 4.3 |
| | | Year 4 | 8.2 | 486 | 4.9 | 4.7 |
| | Tenant Improvements | Year 4 | 7.0 | 410 | 4.1 | 3.9 |
| | | Year 5 | 5.0 | 306 | 3.0 | 2.9 |
| | Worker Mobile Trips | Year 3 | 516 | 377 | 6.8 | 6.3 |
| | | Year 4 | 627 | 440 | 8.4 | 7.7 |
| | | Year 5 | 275 | 186 | 3.8 | 3.5 |
| Area 3 | Grading and Utilities | Year 3 | 45 | 196 | 1.7 | 1.6 |
| | Tunnel Construction | Year 3 | 686 | 779 | 12 | 11 |
| | | Year 4 | 319 | 355 | 5.6 | 5.2 |
| | Foundations | Year 4 | 88 | 107 | 1.6 | 1.5 |
| | | Year 5 | 343 | 407 | 6.4 | 6.0 |
| | Core and Shell | Year 5 | 556 | 716 | 11 | 10 |
| | Tenant Improvements | Year 5 | 115 | 148 | 2.3 | 2.1 |
| | | Year 6 | 758 | 960 | 15 | 14 |
| | Landscaping | Year 6 | 10 | 71 | 0.77 | 0.73 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 2.1 | 66.3 | 0.58 | 0.55 |
| | Grading and Utilities | Year 4 | 0.077 | 1.3 | 0.010 | 9.2E-03 |
| | | Year 5 | 5.0 | 27 | 0.21 | 0.20 |
| | Foundations | Year 5 | 0.80 | 49 | 0.49 | 0.47 |
| | Core and Shell | Year 5 | 0.72 | 44 | 0.44 | 0.42 |
| | Tenant Improvements | Year 5 | 0.90 | 55 | 0.55 | 0.52 |
| | Worker Mobile Trips | Year 5 | 72 | 48 | 0.98 | 0.90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 5.5 | 24 | 0.27 | 0.26 |
| Feeder Line | PG&E Offsite Work | Year 3 | 15 | 56 | 0.65 | 0.62 |
| | Surface Improvements | Year 3 | 4.3 | 5.4 | 0.063 | 0.059 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.0 | 10 | 0.11 | 0.10 |
| | Adams and O'Brien | Year 3 | 0.83 | 10 | 0.11 | 0.10 |
| | Willow Road and Ivy Drive | Year 3 | 0.83 | 10 | 0.11 | 0.10 |

| Summary of Project Construction Mitigated Annual CAP Emissions by Year | | | | |
|---|---|---|---|---|
| Year | Emissions[4] | | | |
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | ton/year | | | |
| Year 1 | 0.012 | 0.34 | 3.5E-03 | 3.4E-03 |
| Year 2 | 0.48 | 8.2 | 0.089 | 0.087 |
| Year 3 | 1.9 | 8.6 | 0.142 | 0.140 |
| Year 4 | 4.4 | 5.3 | 0.069 | 0.067 |
| Year 5 | 5.2 | 4.1 | 0.049 | 0.047 |
| Year 6 | 3.0 | 1.06 | 0.014 | 0.013 |
| **Total** | 15 | 28 | 0.37 | 0.36 |

| Summary of Project Construction Mitigated Daily CAP Emissions by Year | | | | |
|---|---|---|---|---|
| Year | Emissions | | | |
| | ROG | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
| | lb/day | | | |
| Year 1 | 1.5 | 43 | 0.44 | 0.42 |
| Year 2 | 2.7 | 45 | 0.49 | 0.48 |
| Year 3 | 10 | 47 | 0.78 | 0.77 |
| Year 4 | 24 | 29 | 0.38 | 0.37 |
| Year 5 | 29 | 22 | 0.27 | 0.26 |
| Year 6 | 19 | 6.5 | 0.084 | 0.080 |
| **Threshold[5]** | 54 | 54 | 82 | 54 |

**Notes:**

1. Construction emissions were estimated with methodology equivalent to CalEEMod® 2020.4.0. Emissions were estimated using on-road emissions factors from EMFAC2021 and off-road construction equipment emission factors from OFFROAD. Onroad trips and offroad construction equipment use were provided by the Project Applicant.
2. Mitigated construction emissions from offroad equipment are calculated using Tier 4 Final emission factors for 95 percent of the equipment before residents move on-site in Year 5 and 98 percent of the equipment after residents move on-site in Year 5. The other 5 percent and 2 percent (before and after on-site residents, repspectively) of non-Tier 4 equipment are assumed to be Tier 2.
3. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
4. The mass emissions shown above are converted from pound per year to gram per second for the health risk assessment. The conversion is based on 365 days per year and 11 hours per day, consistent with the modeled hours from 7 AM - 6 PM.
5. Thresholds are from BAAQMD California Environmental Quality Act (CEQA) Guidelines. Fugitive emissions sources are excluded from comparison to this threshold.

**Abbreviations:**

RAMBOLL

**Table 14V**
**Summary of Mitigated Project Construction Criteria Air Pollutant Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

CAP - criteria air pollutant
CalEEMod® - California Emissions Estimate Model

ROG - reactive organic gases
$NO_X$ - nitrous oxide

**Table 15V**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**Off-Road Emissions[1]**

| Construction Area[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 1 | Demolition | Year 1 | 45 | 8.0E-03 | 2.3E-03 | 46 |
| | | Year 2 | 287 | 5.2E-02 | 1.5E-02 | 292 |
| | Grading and Utilities | Year 2 | 705 | 1.5E-01 | 2.5E-02 | 716 |
| Parcel 2 Foundations | | Year 3 | 179 | 2.3E-02 | 1.3E-02 | 184 |
| Parcel 2 Core and Shell | | Year 3 | 24 | 4.7E-03 | 1.0E-03 | 24 |
| | | Year 4 | 43 | 8.5E-03 | 1.8E-03 | 44 |
| Parcel 2 Tenant Improvements | | Year 4 | 29 | 4.5E-03 | 1.9E-03 | 30 |
| | | Year 5 | 22 | 3.5E-03 | 1.5E-03 | 23 |
| Parcel 2 Landscaping | | Year 5 | 32 | 6.0E-03 | 1.6E-03 | 32 |
| Parcel 3 Foundations | | Year 3 | 200 | 2.7E-02 | 1.4E-02 | 205 |
| | | Year 4 | 1.2 | 1.7E-04 | 8.5E-05 | 1.3 |
| Parcel 3 Core and Shell | | Year 4 | 83 | 1.5E-02 | 4.2E-03 | 84 |
| Parcel 3 Tenant Improvements | | Year 4 | 21 | 2.6E-03 | 1.8E-03 | 22 |
| | | Year 5 | 45 | 5.5E-03 | 3.7E-03 | 46 |
| Parcel 3 Landscaping | | Year 5 | 32 | 6.1E-03 | 1.6E-03 | 32 |
| North Garage | | Year 2 | 118 | 2.9E-02 | 2.6E-03 | 119 |
| | | Year 3 | 206 | 4.9E-02 | 3.9E-03 | 208 |
| Office Building 4 | | Year 3 | 162 | 3.8E-02 | 4.0E-03 | 164 |
| | | Year 4 | 29 | 3.7E-03 | 2.3E-03 | 29.7 |
| Meeting, Collaboration, Park | | Year 2 | 192 | 4.9E-02 | 2.9E-03 | 194 |
| | | Year 3 | 640 | 1.7E-01 | 8.6E-03 | 647 |
| | | Year 4 | 190 | 4.3E-02 | 5.8E-03 | 193 |
| | | Year 5 | 185 | 4.3E-02 | 5.0E-03 | 187 |
| | | Year 6 | 45 | 1.2E-02 | 3.4E-04 | 45 |
| Hotel Excavation | | Year 2 | 185 | 4.8E-02 | 2.6E-03 | 187 |
| | | Year 3 | 529 | 1.2E-01 | 8.1E-03 | 535 |
| Hotel Construction | | Year 4 | 193 | 3.5E-02 | 4.2E-03 | 195 |
| | | Year 5 | 156 | 2.9E-02 | 6.4E-03 | 158 |
| Town Square | | Year 3 | 545 | 1.3E-01 | 1.4E-02 | 553 |
| | | Year 4 | 261 | 6.3E-02 | 6.0E-03 | 264 |
| | | Year 5 | 83 | 2.2E-02 | 1.2E-03 | 84 |
| Area 2 | Demolition | Year 2 | 164 | 3.0E-02 | 8.4E-03 | 167 |
| | Grading and Utilities | Year 2 | 320 | 7.0E-02 | 1.1E-02 | 326 |
| | | Year 3 | 319 | 7.0E-02 | 1.1E-02 | 324 |
| Parcel 7 Foundations | | Year 4 | 87 | 1.6E-02 | 4.4E-03 | 88 |
| Parcel 7 Core and Shell | | Year 4 | 48 | 9.5E-03 | 2.0E-03 | 48 |
| Parcel 7 Tenant Improvements | | Year 4 | 3.3 | 5.2E-04 | 2.2E-04 | 3.4 |
| | | Year 5 | 33 | 5.3E-03 | 2.2E-03 | 34 |
| Parcel 7 Landscaping | | Year 5 | 28 | 5.0E-03 | 1.6E-03 | 28 |
| Parcel 6 Foundations | | Year 4 | 97 | 1.6E-02 | 5.7E-03 | 99 |
| Parcel 6 Core and Shell | | Year 4 | 36 | 6.5E-03 | 1.9E-03 | 37 |
| | | Year 5 | 21 | 3.9E-03 | 1.1E-03 | 22 |
| Parcel 6 Tenant Improvements | | Year 5 | 47 | 5.8E-03 | 3.9E-03 | 48 |
| Parcel 6 Landscaping | | Year 5 | 13 | 2.4E-03 | 7.2E-04 | 13 |
| | | Year 6 | 15 | 2.8E-03 | 8.4E-04 | 16 |
| South Garage | | Year 3 | 255 | 6.2E-02 | 5.3E-03 | 258 |
| | | Year 4 | 120 | 2.7E-02 | 2.5E-03 | 122 |
| Office Building 3 | | Year 3 | 201 | 5.1E-02 | 3.5E-03 | 204 |
| | | Year 4 | 49 | 7.7E-03 | 3.0E-03 | 50 |
| | | Year 5 | 8.4 | 9.4E-04 | 7.4E-04 | 8.6 |
| Office Building 1 | | Year 3 | 178 | 4.4E-02 | 3.4E-03 | 180 |
| | | Year 4 | 45 | 7.2E-03 | 2.8E-03 | 46 |
| Office Building 2 | | Year 3 | 171 | 4.3E-02 | 3.1E-03 | 173 |
| | | Year 4 | 49 | 8.0E-03 | 3.0E-03 | 50 |
| | | Year 5 | 0.94 | 1.1E-04 | 8.3E-05 | 0.97 |
| Office Building 5 | | Year 3 | 234 | 5.9E-02 | 4.0E-03 | 237 |
| | | Year 4 | 47 | 7.4E-03 | 3.0E-03 | 48 |
| | | Year 5 | 7.7 | 8.6E-04 | 6.8E-04 | 7.9 |

**Table 15V**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**Off-Road Emissions[1]**

| Phase | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Office Building 6 | | Year 3 | 224 | 5.8E-02 | 3.2E-03 | 226 |
| | | Year 4 | 52 | 8.5E-03 | 2.9E-03 | 53 |
| | | Year 5 | 16 | 1.8E-03 | 1.5E-03 | 17 |
| Area 3 | Grading and Utilities | Year 3 | 56 | 1.2E-02 | 2.1E-03 | 57 |
| | Tunnel Construction | Year 3 | 156 | 2.6E-02 | 9.4E-03 | 159 |
| | | Year 4 | 77 | 1.3E-02 | 4.6E-03 | 79 |
| | Foundations | Year 4 | 40 | 7.0E-03 | 2.1E-03 | 41 |
| | | Year 5 | 163 | 2.9E-02 | 8.4E-03 | 167 |
| | Core and Shell | Year 5 | 139 | 2.7E-02 | 6.1E-03 | 142 |
| | Tenant Improvements | Year 5 | 16 | 2.2E-03 | 1.1E-03 | 16 |
| | | Year 6 | 107 | 1.5E-02 | 7.6E-03 | 110 |
| | Landscaping | Year 6 | 54 | 9.6E-03 | 3.1E-03 | 55 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 35 | 3.8E-03 | 2.9E-03 | 36 |
| | Grading and Utilities | Year 4 | 1.6 | 2.0E-04 | 1.3E-04 | 1.7 |
| | | Year 5 | 35 | 4.4E-03 | 2.9E-03 | 36 |
| | Foundations | Year 5 | 17 | 2.1E-03 | 1.1E-03 | 18 |
| | Core and Shell | Year 5 | 24 | 2.2E-03 | 1.4E-03 | 24 |
| | Tenant Improvements | Year 5 | 12 | 2.0E-03 | 6.6E-04 | 12 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 34 | 9.8E-03 | 0 | 34 |
| Feeder Line | PG&E Offsite Work | Year 3 | 108 | 3.1E-02 | 0 | 109 |
| | Surface Improvements | Year 3 | 12 | 2.3E-03 | 0 | 12 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 1.3 | 3.7E-04 | 0 | 1.3 |
| | Adams and O'Brien | Year 3 | 0.85 | 2.5E-04 | 0 | 0.85 |
| | Willow Road and Ivy Drive | Year 3 | 0.85 | 2.5E-04 | 0 | 0.85 |

**On-Road Emissions[1]**

| Phase[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 1 | Demolition | Year 1 | 112 | 2.5E-04 | 1.7E-02 | 117 |
| | | Year 2 | 717 | 1.4E-03 | 1.1E-01 | 750 |
| | Grading and Utilities | Year 2 | 585 | 3.1E-03 | 8.5E-02 | 610 |
| Area 1 Town Square and Residential/Shopping District | Foundations | Year 3 | 27 | 3.3E-05 | 4.3E-03 | 28 |
| | | Year 4 | 0.12 | 1.4E-07 | 1.9E-05 | 0.13 |
| | Core and Shell | Year 3 | 7.7 | 9.5E-06 | 1.2E-03 | 8.1 |
| | | Year 4 | 22 | 2.4E-05 | 3.4E-03 | 23 |
| | Tenant Improvements | Year 4 | 18 | 2.0E-05 | 2.8E-03 | 18 |
| | | Year 5 | 21 | 2.2E-05 | 3.3E-03 | 22 |
| | Landscaping | Year 5 | 15 | 1.5E-05 | 2.3E-03 | 15 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 3 | 340 | 1.1E-02 | 9.6E-03 | 344 |
| | | Year 4 | 391 | 1.2E-02 | 1.0E-02 | 395 |
| | | Year 5 | 261 | 7.7E-03 | 6.7E-03 | 263 |
| | Landscaping Worker Mobile Trips | Year 5 | 48 | 1.4E-03 | 1.2E-03 | 49 |
| Campus District | Foundations + Core and Shell | Year 2 | 28 | 4.8E-05 | 4.5E-03 | 30 |
| | | Year 3 | 173 | 2.1E-04 | 2.7E-02 | 181 |
| | | Year 4 | 172 | 2.0E-04 | 2.7E-02 | 180 |
| | | Year 5 | 170 | 1.8E-04 | 2.7E-02 | 177 |
| | Tenant Improvements | Year 4 | 70 | 7.9E-05 | 1.1E-02 | 73 |
| | | Year 5 | 92 | 9.7E-05 | 1.5E-02 | 97 |
| | | Year 6 | 16 | 1.6E-05 | 2.5E-03 | 17 |
| | O4 and NG Worker Mobile Trips | Year 2 | 58 | 2.1E-03 | 1.7E-03 | 58 |
| | | Year 3 | 351 | 1.2E-02 | 9.9E-03 | 355 |
| | | Year 4 | 275 | 8.6E-03 | 7.3E-03 | 277 |
| | MCS Worker Mobile Trips | Year 2 | 43 | 1.6E-03 | 1.3E-03 | 44 |
| | | Year 3 | 263 | 8.9E-03 | 7.4E-03 | 266 |
| | | Year 4 | 261 | 8.2E-03 | 7.0E-03 | 263 |
| | | Year 5 | 255 | 7.5E-03 | 6.5E-03 | 257 |
| | | Year 6 | 44 | 1.2E-03 | 1.1E-03 | 45 |

**Table 15V**
**Summary of Project Construction Greenhouse Gas Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**On-Road Emissions[1]**

| Phase[2] | Construction Subphase | Year | Construction GHG Emissions[3] | | | |
|---|---|---|---|---|---|---|
| | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | MT/year | | | |
| Area 2 | Demolition | Year 2 | 821 | 1.3E-03 | 1.3E-01 | 859 |
| | Grading and Utilities | Year 2 | 290 | 1.5E-03 | 4.2E-02 | 302 |
| | | Year 3 | 286 | 1.3E-03 | 4.2E-02 | 298 |
| Area 2 Town Square and Residential/Shopping District | Foundations | Year 4 | 22 | 2.4E-05 | 3.4E-03 | 23 |
| | Core and Shell | Year 4 | 26 | 3.0E-05 | 4.1E-03 | 27 |
| | | Year 5 | 8.5 | 8.9E-06 | 1.3E-03 | 8.9 |
| | Tenant Improvements | Year 4 | 3.1 | 3.5E-06 | 4.8E-04 | 3.2 |
| | | Year 5 | 42 | 4.4E-05 | 6.6E-03 | 44 |
| | Landscaping | Year 5 | 11 | 1.1E-05 | 1.7E-03 | 11 |
| | | Year 6 | 3.7 | 3.6E-06 | 5.9E-04 | 3.9 |
| | Town Square and Residential/Shopping District Worker Mobile Trips | Year 4 | 388 | 1.2E-02 | 1.0E-02 | 392 |
| | | Year 5 | 345 | 1.0E-02 | 8.8E-03 | 348 |
| | Landscaping Worker Mobile Trips | Year 5 | 36 | 1.0E-03 | 9.1E-04 | 36 |
| | | Year 6 | 12 | 3.4E-04 | 3.0E-04 | 12 |
| Campus District | Foundations + Core and Shell | Year 3 | 134 | 1.7E-04 | 2.1E-02 | 141 |
| | | Year 4 | 153 | 1.7E-04 | 2.4E-02 | 160 |
| | Tenant Improvements | Year 4 | 129 | 1.5E-04 | 2.0E-02 | 135 |
| | | Year 5 | 101 | 1.1E-04 | 1.6E-02 | 106 |
| | Worker Mobile Trips | Year 3 | 587 | 2.0E-02 | 1.6E-02 | 592 |
| | | Year 4 | 748 | 2.4E-02 | 2.0E-02 | 754 |
| | | Year 5 | 342 | 1.0E-02 | 8.8E-03 | 345 |
| Area 3 | Grading and Utilities | Year 3 | 83 | 1.5E-03 | 7.4E-03 | 85 |
| | Tunnel Construction | Year 3 | 859 | 2.6E-02 | 3.5E-02 | 870 |
| | | Year 4 | 420 | 1.2E-02 | 1.7E-02 | 425 |
| | Foundations | Year 4 | 119 | 3.3E-03 | 5.1E-03 | 120 |
| | | Year 5 | 481 | 1.3E-02 | 2.0E-02 | 487 |
| | Core and Shell | Year 5 | 797 | 2.0E-02 | 3.5E-02 | 808 |
| | Tenant Improvements | Year 5 | 165 | 4.2E-03 | 7.3E-03 | 167 |
| | | Year 6 | 1130 | 2.7E-02 | 4.9E-02 | 1145 |
| | Landscaping | Year 6 | 34 | 3.4E-04 | 3.8E-03 | 35 |
| Hamilton Avenue Parcels North and South | Demolition | Year 4 | 19 | 6.4E-05 | 2.9E-03 | 20 |
| | Grading and Utilities | Year 4 | 0.36 | 2.5E-06 | 4.7E-05 | 0.37 |
| | | Year 5 | 7.7 | 5.2E-05 | 1.0E-03 | 8.0 |
| | Foundations | Year 5 | 16 | 1.7E-05 | 2.5E-03 | 17 |
| | Core and Shell | Year 5 | 14 | 1.5E-05 | 2.3E-03 | 15 |
| | Tenant Improvements | Year 5 | 18 | 1.9E-05 | 2.8E-03 | 19 |
| | Worker Mobile Trips | Year 5 | 89 | 2.6E-03 | 2.3E-03 | 90 |
| Substation Upgrade | PG&E Substation Work | Year 3 | 12 | 2.1E-04 | 1.1E-03 | 12 |
| Feeder Line | PG&E Offsite Work | Year 3 | 30 | 5.6E-04 | 2.6E-03 | 31 |
| | Surface Improvements | Year 3 | 2.9 | 5.4E-05 | 2.5E-04 | 3.0 |
| Intersection Improvements | O'Brien and Kavanaugh | Year 3 | 3.6 | 2.4E-05 | 4.9E-04 | 3.8 |
| | Adams and O'Brien | Year 3 | 3.4 | 1.7E-05 | 4.9E-04 | 3.6 |
| | Willow Road and Ivy Drive | Year 3 | 3.4 | 1.7E-05 | 4.9E-04 | 3.6 |

**Summary of Project Construction Annual GHG Emissions by Year**

| Year | Emissions[4,5] | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | MT/year | | | |
| Year 1 | 157 | 0.0083 | 0.020 | 163 |
| Year 2 | 4,514 | 0.44 | 0.44 | 4,657 |
| Year 3 | 7,605 | 1.1 | 0.30 | 7,722 |
| Year 4 | 4,871 | 0.40 | 0.25 | 4,954 |
| Year 5 | 4,471 | 0.29 | 0.23 | 4,548 |
| Year 6 | 1,462 | 0.069 | 0.070 | 1,484 |
| | | | **Total** | **23,528** |

**Notes:**

1. Emissions were estimated using onroad emissions factors from EMFAC2021 and offroad construction equipment emission factors from OFFROAD. Onroad trips and offroad construction equipment use were provided by the Project Applicant.
2. Area 1 includes Parcel 2, Parcel 3, North Garage, Office Building 4, Hotel, Town Square, and Meeting, Collaboration, Park. Area 2 includes Parcel 6, Parcel 7, South Garage, Office Building 1, Office Building 2, Office Building 3, Office Building 5, and Office Building 6. Area 3 includes Parcel 4 and Parcel 5, along with the Tunnel Construction.
3. Carbon dioxide equivalent emissions were determined using IPCC 5th Assessment Report Global Warming Potentials for $CH_4$ and $N_2O$.
4. The Summary of Project Construction Annual GHG Emissions by Year is the sum of the values represented above as well as Construction Water Use Emissions, shown in Table 10.
5. The BAAQMD does not have an adopted Threshold of Significance for construction-related GHG emissions.

**Abbreviations:**

CalEEMod® - California Emissions Estimate Model
GHG - greenhouse gases
$CH_4$ - methane
$CO_2$ - carbon dioxide
$N_2O$ - nitrous oxide
$CO_2e$ - carbon dioxide equivalent
MT - metric ton
IPCC - Intergovernmental Panel on Climate Change

**Table 16V**
**Building Operational Capacity For Emissions Scaling**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Building or Parcel[1] | | Percent Breakdown of Land Use Type by Building | | | | | | Percent of Year Building is Operational[2] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Office | Retail | Residential | Hotel | Parking | Park | Year 4 | Year 5 | Year 6 |
| North Garage | | -- | -- | -- | -- | 45% | -- | 100% | 100% | 100% |
| Office Building 4 | | 11% | 48% | -- | -- | -- | -- | 21% | 100% | 100% |
| Meeting, Collaboration, Park | | 28% | -- | -- | -- | -- | -- | 0% | 0% | 82% |
| Hotel Construction | | -- | -- | -- | 100% | -- | -- | 0% | 41% | 100% |
| Town Square | | -- | -- | -- | -- | -- | 14% | 0% | 58% | 100% |
| Parcel 2 | | -- | 19% | 17% | -- | 12% | -- | 0% | 34% | 100% |
| Parcel 3 | | -- | 26% | 22% | -- | 12% | -- | 0% | 10% | 100% |
| Other | | 0.38% | -- | -- | -- | 0.73% | 86% | 100% | 100% | 100% |
| South Garage | | -- | -- | -- | -- | 23.9% | -- | 29% | 100% | 100% |
| Office Building 3 | | 13% | -- | -- | -- | -- | -- | 0% | 76% | 100% |
| Office Building 1 | | 8.4% | -- | -- | -- | -- | -- | 5% | 100% | 100% |
| Office Building 2 | | 10% | -- | -- | -- | -- | -- | 0% | 98% | 100% |
| Office Building 5 | | 15% | -- | -- | -- | -- | -- | 0% | 78% | 100% |
| Office Building 6 | | 14% | -- | -- | -- | -- | -- | 0% | 53% | 100% |
| Parcel 6 | | -- | -- | 9% | -- | 1.4% | -- | 0% | 0% | 88% |
| Parcel 7 | | -- | -- | 6.2% | -- | 0.5% | -- | 0% | 99% | 100% |
| Parcels 4 + 5 | | -- | 2.4% | 46% | -- | 4.4% | -- | 0% | 0% | 11% |
| Hamilton Avenue Parcels North and South | | -- | 3.7% | -- | -- | -- | -- | 0% | 54% | 100% |
| **Partial Buildout by Year and Land Use Type[3]** | **Year 4** | 3.1% | 10% | 0% | 0% | 53% | 86% | | | |
| | **Year 5** | 58% | 59% | 14% | 41% | 75% | 94% | | | |
| | **Year 6** | 95% | 98% | 58% | 100% | 96% | 100% | | | |

**Notes:**

1. Construction area/subphasing information and full buildout square footage by building provided by Project Applicant.
2. The percentage of year that each building is operational is calculated using the last day of construction for each building. For each partial year of construction, the building is assumed to be operational during the fraction of the year between the last day of construction and the end of that year. The building is assumed to be 0% operational for each full year of construction and 100% operational for each year full year after the end of construction.
3. Partial buildout for Year 4, Year 5, and Year 6 were calculated based on the portion of building area that becomes operational each year over the total building area for each land use type.

**Abbreviations:**

% - percent

**Table 17V**
**Traffic Data Provided by the Transportation Engineer**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Daily Trips Rates and VMT**

| Land Use | Fleet Type / Land Use | Trip Rate Units[1] | Weekday Trips per Day per Unit[1] | Weekday daily VMT[2] |
|---|---|---|---|---|
| | | | TOTAL | TOTAL |
| Main Project Site - Existing Conditions | Cars | per 1,000 s.f. | 9.19 | 110,860 |
| | Trucks | per 1,000 s.f. | 0.22 | 2,640 |
| | Shuttles | per 1,000 s.f. | 0.66 | 21,088 |
| | On-Demand | per 1,000 s.f. | 0.66 | 7,919 |
| Campus District - Full Buildout | Cars | per 1,000 s.f. | 10.05 | 178,766 |
| | Trucks | per 1,000 s.f. | 0.23 | 4,056 |
| | Shuttles | per 1,000 s.f. | 0.44 | 21,088 |
| | On-Demand | per 1,000 s.f. | 0.68 | 12,168 |
| Town Square and the Residential/Shopping District - Full Buildout | Residential | per d.u. | 4.35 | 79,792 |
| | Retail[3] | per 1,000 s.f. | 25.07 | 33,594 |
| | Hamilton Avenue Parcels North and South[3] | per 1,000 s.f. | 28.31 | 1,461 |
| | Park | per acre | 42.80 | 1,147 |
| | Hotel | per room | 6.69 | 14,814 |

**Notes:**

1. Daily project trip rates were provided by the Transportation Engineer in terms of trip rates per land use amount.
2. Daily Project VMT provided by the Transportation Engineer include reductions for pass-by and diverted trips. Daily VMT is given in VMT per day. For the increased residential variant, the residential trips and VMT are based on an increasing the residential dwelling units by 200, to a total of 1930 residential dwelling units.
3. The trip rates and VMT for Hamilton Avenue Parcels North and South were provided separately and added to retail totals in calculations.

**Abbreviations:**

VMT - Vehicle miles traveled
s.f. - Square feet
d.u. - Dwelling unit

**Table 18V**
**Trip Rates and VMT for Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Project Area[1] | Land Use | Fleet Type[2] | Total Weekday Daily VMT[3] | Total Weekday Daily Trips[3] | Total Average Daily VMT[4] | Total Average Daily Trips[4] | Total Annual VMT[5] | Total Annual Trips[5] |
|---|---|---|---|---|---|---|---|---|
| | | | VMT/day | trips/day | VMT/day | trips/day | VMT/year | trips/year |
| Existing Conditions | Campus District | Cars | 110,860 | 9,221 | 84,225 | 7,006 | 30,742,244 | 2,557,040 |
| | | Trucks | 2,640 | 220 | 2,005 | 167 | 731,958 | 60,882 |
| | | Shuttles | 21,088 | 659 | 15,063 | 470 | 3,916,358 | 122,319 |
| | | On-Demand | 7,919 | 659 | 5,656 | 470 | 1,470,590 | 122,319 |
| Year 4 | Campus District | Cars | 5,480 | 493 | 4,079 | 367 | 1,488,677 | 133,874 |
| | | Trucks | 124 | 11 | 93 | 8.3 | 33,776 | 3,037 |
| | | Shuttles | 646 | 22 | 462 | 15 | 120,048 | 3,996 |
| | | On-Demand | 373 | 34 | 266 | 24 | 69,267 | 6,229 |
| | Residential | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 |
| | Retail | San Mateo | 3,563 | 510 | 3,442 | 492 | 1,256,238 | 179,684 |
| | Park | San Mateo | 987 | 147 | 3,652 | 545 | 1,332,917 | 198,943 |
| | Hotel | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 5 | Campus District | Cars | 104,523 | 9,400 | 77,797 | 6,996 | 28,395,923 | 2,553,590 |
| | | Trucks | 2,371 | 213 | 1,765 | 159 | 644,259 | 57,937 |
| | | Shuttles | 12,330 | 410 | 8,807 | 293 | 2,289,859 | 76,227 |
| | | On-Demand | 7,114 | 640 | 5,082 | 457 | 1,321,238 | 118,816 |
| | Residential | San Mateo | 11,209 | 1,180 | 10,956 | 1,153 | 3,999,096 | 420,957 |
| | Retail | San Mateo | 20,794 | 2,974 | 20,085 | 2,873 | 7,331,178 | 1,048,602 |
| | Park | San Mateo | 1,080 | 161 | 3,993 | 596 | 1,457,557 | 217,546 |
| | Hotel | San Mateo | 6,049 | 527 | 5,816 | 507 | 2,122,939 | 184,925 |
| Year 6 | Campus District | Cars | 169,737 | 15,264 | 126,336 | 11,361 | 46,112,784 | 4,146,833 |
| | | Trucks | 3,851 | 346 | 2,866 | 258 | 1,046,226 | 94,085 |
| | | Shuttles | 20,023 | 667 | 14,302 | 476 | 3,718,554 | 123,787 |
| | | On-Demand | 11,553 | 1,039 | 8,252 | 742 | 2,145,589 | 192,949 |
| | Residential | San Mateo | 46,475 | 4,892 | 45,427 | 4,782 | 16,580,889 | 1,745,357 |
| | Retail | San Mateo | 34,307 | 4,907 | 33,137 | 4,740 | 12,095,154 | 1,730,009 |
| | Park | San Mateo | 1,147 | 171 | 4,243 | 633 | 1,548,641 | 231,140 |
| | Hotel | San Mateo | 14,814 | 1,290 | 14,244 | 1,241 | 5,199,035 | 452,878 |
| Full Buildout | Campus District | Cars | 178,766 | 16,076 | 133,057 | 11,966 | 48,565,689 | 4,367,418 |
| | | Trucks | 4,056 | 365 | 3,019 | 271 | 1,101,879 | 99,090 |
| | | Shuttles | 21,088 | 702 | 15,063 | 501 | 3,916,358 | 130,371 |
| | | On-Demand | 12,168 | 1,094 | 8,691 | 782 | 2,259,721 | 203,212 |
| | Residential | San Mateo | 79,792 | 8,399 | 77,992 | 8,210 | 28,467,226 | 2,996,550 |
| | Retail | San Mateo | 35,055 | 5,014 | 33,860 | 4,843 | 12,358,799 | 1,767,718 |
| | Park | San Mateo | 1,147 | 171 | 4,243 | 633 | 1,548,641 | 231,140 |
| | Hotel | San Mateo | 14,814 | 1,290 | 14,244 | 1,241 | 5,199,035 | 452,878 |

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**Table 18V**

**Trip Rates and VMT for Existing Conditions and Project Operations**

**Willow Village - Increased Residential Variant Analysis**

**Menlo Park, California**

**Notes:**

1. Partial years are scaled from the full buildout based on the portion of each land use that becomes operational for each year of construction. See VariantTable 16 for more details.
2. The fleet type for each land use was provided by the Transportation Engineer. The Campus District will have various fleets for specific uses. Town Square and the Residential/Shopping District land uses (Residential, Retail, Park, and Hotel) are analyzed assuming a default San Mateo fleet. Hamilton Avenue Parcels North and South are combined with retail land uses. See AQTR Table 19 for more information.
3. Daily VMT and trip rates were provided by the Transportation Engineer on October 5, 2021. Total trip rates are calculated using land uses in AQTR Table 1.
4. Weekday VMT and trip rates provided by the Transportation Engineer were scaled to average trip rates using the ratio between CalEEMod® weekday and weekend one-way trip rates.
5. Annual trips and VMT are calculated by multiplying daily values by 365 for all fleets with the exception of shuttles and on-demand, which are multiplied by 260 days/year.

**Abbreviations:**

VMT - vehicle miles traveled

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

**Table 21aV**
**Mobile CAP Emissions Before EV Reductions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Year | Land Use[1] | Fleet Type | Annual Trips[2] | Annual VMT[2] | CAP Emissions[3,4] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ROG | NOX | $PM_{10}$ | $PM_{2.5}$ | ROG | NOX | $PM_{10}$ | $PM_{2.5}$ |
| | | | trips/year | VMT/year | tons/year | | | | lb/day | | | |
| **Existing Conditions** | Campus District | Cars | 2,557,040 | 30,742,244 | 4.9 | 4.1 | 3.1 | 0.59 | 27 | 22 | 17 | 3.3 |
| | | Trucks | 60,882 | 731,958 | 0.18 | 2.0 | 0.17 | 0.068 | 1.0 | 11 | 0.92 | 0.37 |
| | | Shuttles | 122,319 | 3,916,358 | 0.027 | 1.8 | 0.59 | 0.15 | 0.15 | 10 | 3.3 | 0.80 |
| | | On-Demand | 122,319 | 1,470,590 | 0.19 | 0.15 | 0.15 | 0.028 | 1.1 | 0.85 | 0.81 | 0.15 |
| | | | **2,862,559** | **36,861,150** | **5.3** | **8.0** | **4.0** | **0.84** | **29** | **44** | **22** | **4.6** |
| **Partial Buildout - Year 4** | Campus District | Cars | 133,874 | 1,488,677 | 0.19 | 0.12 | 0.15 | 0.028 | 1.1 | 0.65 | 0.82 | 0.15 |
| | | Trucks | 3,037 | 33,776 | 0.0041 | 0.035 | 0.0065 | 0.0020 | 0.023 | 0.19 | 0.036 | 0.011 |
| | | Shuttles | 3,996 | 120,048 | 0.0011 | 0.071 | 0.018 | 0.0046 | 0.0058 | 0.39 | 0.10 | 0.025 |
| | | On-Demand | 6,229 | 69,267 | 0.0077 | 0.0046 | 0.0069 | 0.0013 | 0.042 | 0.025 | 0.038 | 0.0071 |
| | Residential | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Retail | San Mateo | 179,684 | 1,256,238 | 0.19 | 0.21 | 0.13 | 0.027 | 1.1 | 1.2 | 0.74 | 0.15 |
| | Park | San Mateo | 198,943 | 1,332,917 | 0.21 | 0.23 | 0.14 | 0.029 | 1.2 | 1.2 | 0.78 | 0.16 |
| | Hotel | San Mateo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | **525,763** | **4,300,922** | **0.61** | **0.67** | **0.46** | **0.092** | **3.4** | **3.7** | **2.5** | **0.50** |
| **Partial Buildout - Year 5** | Campus District | Cars | 2,553,590 | 28,395,923 | 3.6 | 2.1 | 2.9 | 0.53 | 20 | 11 | 16 | 2.9 |
| | | Trucks | 57,937 | 644,259 | 0.073 | 0.60 | 0.12 | 0.037 | 0.40 | 3.3 | 0.68 | 0.20 |
| | | Shuttles | 76,227 | 2,289,859 | 0.021 | 1.4 | 0.35 | 0.089 | 0.11 | 7.4 | 1.9 | 0.49 |
| | | On-Demand | 118,816 | 1,321,238 | 0.14 | 0.081 | 0.13 | 0.025 | 0.78 | 0.45 | 0.72 | 0.13 |
| | Residential | San Mateo | 420,957 | 3,999,096 | 0.49 | 0.57 | 0.43 | 0.085 | 2.7 | 3.1 | 2.3 | 0.47 |
| | Retail | San Mateo | 1,048,602 | 7,331,178 | 1.1 | 1.1 | 0.78 | 0.16 | 5.9 | 6.3 | 4.3 | 0.86 |
| | Park | San Mateo | 217,546 | 1,457,557 | 0.22 | 0.23 | 0.16 | 0.031 | 1.2 | 1.3 | 0.85 | 0.17 |
| | Hotel | San Mateo | 184,925 | 2,122,939 | 0.23 | 0.29 | 0.23 | 0.045 | 1.3 | 1.6 | 1.2 | 0.25 |
| | | | **4,678,601** | **47,562,050** | **5.8** | **6.3** | **5.1** | **1.0** | **32** | **35** | **28** | **5.5** |
| **Partial Buildout - Year 6** | Campus District | Cars | 4,146,833 | 46,112,784 | 5.6 | 3.1 | 4.6 | 0.86 | 31 | 17 | 25 | 4.7 |
| | | Trucks | 94,085 | 1,046,226 | 0.11 | 0.89 | 0.20 | 0.059 | 0.62 | 4.9 | 1.1 | 0.33 |
| | | Shuttles | 123,787 | 3,718,554 | 0.034 | 2.2 | 0.57 | 0.15 | 0.19 | 12 | 3.1 | 0.80 |
| | | On-Demand | 192,949 | 2,145,589 | 0.22 | 0.12 | 0.21 | 0.040 | 1.2 | 0.68 | 1.2 | 0.22 |
| | Residential | San Mateo | 1,745,357 | 16,580,889 | 1.9 | 2.2 | 1.8 | 0.35 | 11 | 12 | 9.7 | 1.9 |
| | Retail | San Mateo | 1,730,009 | 12,095,154 | 1.7 | 1.8 | 1.3 | 0.26 | 9.3 | 10 | 7.1 | 1.4 |
| | Park | San Mateo | 231,140 | 1,548,641 | 0.22 | 0.23 | 0.17 | 0.033 | 1.2 | 1.3 | 0.91 | 0.18 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 0.55 | 0.65 | 0.55 | 0.11 | 3.0 | 3.6 | 3.0 | 0.60 |
| | | | **8,717,037** | **88,446,872** | **10** | **11** | **9.4** | **1.9** | **57** | **61** | **52** | **10** |
| **Full Buildout** | Campus District | Cars | 4,367,418 | 48,565,689 | 5.9 | 3.3 | 4.9 | 0.91 | 32 | 18 | 27 | 5.0 |
| | | Trucks | 99,090 | 1,101,879 | 0.12 | 0.94 | 0.21 | 0.062 | 0.65 | 5.2 | 1.2 | 0.34 |
| | | Shuttles | 130,371 | 3,916,358 | 0.036 | 2.3 | 0.61 | 0.15 | 0.20 | 13 | 3.3 | 0.84 |
| | | On-Demand | 203,212 | 2,259,721 | 0.23 | 0.13 | 0.23 | 0.042 | 1.3 | 0.71 | 1.2 | 0.23 |
| | Residential | San Mateo | 2,996,550 | 28,467,226 | 3.3 | 3.7 | 3.0 | 0.60 | 18 | 21 | 17 | 3.3 |
| | Retail | San Mateo | 1,767,718 | 12,358,799 | 1.7 | 1.8 | 1.3 | 0.26 | 9.5 | 10 | 7.2 | 1.4 |
| | Park | San Mateo | 231,140 | 1,548,641 | 0.22 | 0.23 | 0.17 | 0.033 | 1.2 | 1.3 | 0.91 | 0.18 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 0.55 | 0.65 | 0.55 | 0.11 | 3.0 | 3.6 | 3.0 | 0.60 |
| | | | **10,248,378** | **103,417,346** | **12** | **13** | **11** | **2.2** | **66** | **72** | **60** | **12** |

**Table 21aV**
**Mobile CAP Emissions Before EV Reductions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Notes:**

1. Hamilton Avenue Parcels North and South were provided separately and added to the retail land use totals.
2. Trip counts and VMTs by land use type were broken out by year using a scaling factor representing the percent of each fleet that is operational in a given year leading up to full buildout. This percent was determined based on the square footage of the land use associated with each fleet that is operational in a given year relative to that land use's full buildout square footage. See Table 16 for more details on scaling. See Table 18 for Project Trip Rates and VMT.
3. Criteria air pollutants are calculated by year using emission factors for the associated year and fleet from EMFAC2021. Electric vehicles are not included in the emission factors for Campus District fleets (all fleet types except San Mateo Fleet), as reductions associated with EVs are considered separately. Project emission factors are shown in AQTR Table 20a.
4. Full buildout emissions are conservatively calculated using 2026 emission factors.

**Abbreviations:**

| | |
|---|---|
| EV - electric vehicle | $PM_{10}$ - particulate matter less than 10 microns in diameter |
| lb - pound | $PM_{2.5}$ - particulate matter less than 2.5 microns in diameter |
| $NO_x$ - nitrogen oxides | ROG - reactive organic gases |
| VMT- vehicle miles traveled | |

**References:**

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 21bV**
**Summary of Mobile GHG Emissions Before EV Reductions**
**Willow Village**
**Menlo Park, California - Increased Residential Variant Analysis**

| Year | Land Use[1] | Fleet Type | Annual Trips[2] | Annual VMT[2] | GHGs Emissions[3,4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| | | | trips/year | VMT/year | MT/year | | | |
| **Existing Conditions** | Campus District | Cars | 2,557,040 | 30,742,244 | 9,997 | 0.41 | 0.32 | 10,104 |
| | | Trucks | 60,882 | 731,958 | 834 | 0.043 | 0.082 | 859 |
| | | Shuttles | 122,319 | 3,916,358 | 4,965 | 0.019 | 0.78 | 5,199 |
| | | On-Demand | 122,319 | 1,470,590 | 444 | 0.017 | 0.014 | 448 |
| | | | **2,862,559** | **36,861,150** | **16,240** | **0.48** | **1.2** | **16,610** |
| **Full Buildout** | Campus District | Cars | 4,367,418 | 48,565,689 | 14,353 | 0.41 | 0.34 | 14,465 |
| | | Trucks | 99,090 | 1,101,879 | 1,086 | 0.040 | 0.11 | 1,119 |
| | | Shuttles | 130,371 | 3,916,358 | 4,772 | 0.0037 | 0.75 | 4,996 |
| | | On-Demand | 203,212 | 2,259,721 | 611 | 0.016 | 0.015 | 616 |
| | Residential | San Mateo | 2,996,550 | 28,467,226 | 9,942 | 0.33 | 0.40 | 10,069 |
| | Retail | San Mateo | 1,767,718 | 12,358,799 | 4,351 | 0.17 | 0.19 | 4,411 |
| | Park | San Mateo | 231,140 | 1,548,641 | 546 | 0.022 | 0.024 | 554 |
| | Hotel | San Mateo | 452,878 | 5,199,035 | 1,809 | 0.055 | 0.070 | 1,831 |
| | | | **10,248,378** | **103,417,346** | **37,469** | **1.0** | **1.9** | **38,060** |

**Notes:**
1. Hamilton Avenue Parcels North and South were provided separately and added to the retail land use totals.
2. VMT and trip rates for the increased residential variant were provided by the Transportation Engineer on February 9, 2022, and are summarized in Table 1
3. Greenhouse Gases are calculated by year using emission factors for the associated year and fleet from EMFAC2021. Electric vehicles are not included in the emission factors for Campus District fleets (all fleet types except San Mateo Fleet), as reductions associated with EVs are considered separately. Project emission factors are shown in AQTR Table 20b.
4. Full buildout emissions are conservatively calculated using 2026 emission factors.

**Abbreviations:**
GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
EV - electric vehicle
MT - Metric Ton
VMT- vehicle miles traveled

**References:**
California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 22V**
**EV Assumptions for Campus District**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Campus District EV Parameters**

| Description | Units | Value |
|---|---|---|
| Electricity required per mile charged[1] | kWh/mi | 0.30 |
| Total Charging Energy of Meta Campuses[2] | kWh/year | 3,791,856 |
| Total Area of Meta Campuses[2] | sqf | 4,753,594 |
| Total Meta Campus Energy per Area[2] | kWh/sqf | 0.80 |
| Existing Conditions Fleet eVMT per Total VMT[3] | Percent | 5.5% |
| Full Buildout Fleet MSS eVMT per Total VMT[4] | Percent | 14% |
| Electricity Loss Factor[5] | Percent | 10% |
| Existing Conditions Charging Energy Usage[6] | kWh/year | 534,955 |
| Full Buildout Charging Energy Usage[7] | kWh/year | 2,925,608 |

**eVMTs from Project Chargers at the proposed Campus District**

| Year | Land Use Category[8] | Project Increase in Annual eVMTs[9] |
|---|---|---|
| | | eVMT/year |
| **Existing Conditions** | Campus District | 1,783,182 |
| **Partial Buildout - Year 4** | | 298,927 |
| **Partial Buildout - Year 5** | | 5,701,922 |
| **Partial Buildout - Year 6** | | 9,259,481 |
| **Full Buildout** | | 9,752,026 |

**Notes:**

1. An average EV fuel economy of 0.30 kWh per mile was used. The fuel economy is based on electric fleet data from fueleconomy.gov. Available at: https://www.fueleconomy.gov/.
2. Meta provided energy usage and areas for EV charging at their existing campuses: Classic, Bayfront, Chilco, Willow, Gateway. The provided data was used to evaluate an average ratio of EV charging energy usage per campus area.
3. The percent eVMT for existing conditions is calculated by dividing the eVMT in existing conditions by the annual VMT from the 'Car' and 'On-Demand' vehicle types in existing conditions. For existing conditions VMT, see Variant Table 18.
4. ARB is currently preparing its 2020 Mobile Source Strategy (MSS) update to the ARB VISION Model (version 2.1) estimating future fleet characteristics. The Mobile Source Strategy projects eVMTs reflecting the aspirational target identified in EO N-79-20, assuming 100% of passenger vehicle sales in California are ZEV or PHEV, and GHG emissions assumed to have reduced by 2.0% per year from 2026 to 2035. The increase in annual eVMTs charged by the Campus District is scaled from the increase in fleet eVMT from existing conditions to full buildout.
5. A 10% Loss Factor was applied to the annual project energy uses to account for expected losses. Source available at: https://www.fueleconomy.gov/
6. The EV charging energy consumption for existing conditions was based on existing charger energy usage data for Willow Village for 2019 provided by the Project applicant. The total energy usage was reduced assuming a 10% loss factor.

**Table 22V**

**EV Assumptions for Campus District**

**Willow Village - Increased Residential Variant Analysis**

**Menlo Park, California**

7. The EV charging energy consumption for the Project at full buildout was determined using an average ratio of existing charging sites kWh/sqf and multiplying it by the Campus District land use area at full buildout (1.6 million sqf). This number was scaled by the increase in fleet eVMT from existing conditions to full buildout based on the MSS scenario of the VISION model. A 10% loss factor was applied to the total energy usage per year. All relevant data sources were provided by the Project applicant.

8. Meta offers an EV charging program to its workers. Charging on campus is free and valets move cars into chargers to maximize charging time. Therefore, the EV charging annual electricity for the Campus District was provided based on studies from Meta's existing campuses in the area. The electricity for EV charging at the Project would be supplied with 100% renewable energy.

9. For years where the Campus District is only operational a proportion of the year, the annual kWh is multiplied by a scaling fraction for the Campus District land use, found in Table 16.

**Abbreviations:**

EV - Electric vehicle (includes battery electric or plug-in hybrid technology)
eVMT- Electric vehicle miles traveled
kWh - Kilowatt hour
sqf- Square foot
MSS - Mobile Source Strategy

**References:**

City of Menlo Park Nonresidential EV Charging Requirements. Published July 17, 2019. Available at: https://www.menlopark.org/DocumentCenter/View/22382/Nonresidential-EV-Charging-Requirements

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

CalEEMod Appendix D. Available at: http://www.aqmd.gov/docs/default-source/caleemod/user-guide-2021/appendix-d2020-4-0-full-merge.pdf?sfvrsn=12

**Table 23V**
**EV Assumptions for Town Square and the Residential/Shopping District**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, CA**

**EV Assumptions**

| Description | Units | Input |
|---|---|---|
| Miles Charged per Hour Charged[1] | (miles/hr) | 21 |
| Scenario1[2] | - | Reference |
| Scenario 2[2] | - | MSS |
| Number of Chargers[3] | Total # | 249 |
| Average Daily Hours for Charging per Charger[4] | hr | 10 |
| Annual Days of Charger Activity[4] | days/yr | 365 |

**eVMTs from Project Chargers - Reference Scenario**

| Year | Total Annual Project Trips[5,6] | Total Annual Project VMT[5,6] | % of total Fleet using Electric Fuel[2] | Annual Project EV Trips[6] | Annual Project Electric VMT[6] | Number of Project EV Chargers Available[7] | Total Annual EV Charge Hours Available from Project Chargers[8] | Number of EV Annual VMT Available from Project Chargers[8] | Project Chargers at Capacity Relative to Project Electric VMT[9] | Total Annual eVMTs Charged by Project[9] |
|---|---|---|---|---|---|---|---|---|---|---|
| | trips/year | VMT/year | | trips/year | eVMT/year | | hours/year | eVMT/year | | |
| **Partial Buildout - Year 4** | 378,626 | 2,589,154 | **4.7%** | 17,714 | 121,137 | 131 | 477,218 | 10,021,583 | Under Capacity | **121,137** |
| **Partial Buildout - Year 5** | 1,872,030 | 14,910,770 | **5.2%** | 97,457 | 776,244 | 187 | 683,944 | 14,362,828 | Under Capacity | **776,244** |
| **Partial Buildout - Year 6** | 4,159,383 | 35,423,719 | **5.6%** | 231,865 | 1,974,696 | 239 | 871,770 | 18,307,160 | Under Capacity | **1,974,696** |
| **Full Buildout** | 5,448,287 | 47,573,700 | **5.9%** | 322,805 | 2,818,688 | 249 | 908,850 | 19,085,850 | Under Capacity | **2,818,688** |

**eVMTs from Project Chargers - Mobile Source Strategy (MSS) Scenario**

| Year | Total Annual Project Trips[5,6] | Total Annual Project VMT[5,6] | % of total Fleet using Electric Fuel[2] | Annual Project EV Trips[6] | Annual Project Electric VMT[6] | Number of Project EV Chargers Available[7] | Total Annual EV Charge Hours Available from Project Chargers[8] | Number of EV Annual VMT Available from Project Chargers[8] | Project Chargers at Capacity Relative to Project Electric VMT[9] | Total Annual eVMTs Charged by Project[9] |
|---|---|---|---|---|---|---|---|---|---|---|
| | trips/year | VMT/year | | trips/year | eVMT/year | | hours/year | eVMT/year | | |
| **Partial Buildout - Year 4** | 378,626 | 2,589,154 | **8.3%** | 31,482 | 215,280 | 131 | 477,218 | 10,021,583 | Under Capacity | **215,280** |
| **Partial Buildout - Year 5** | 1,872,030 | 14,910,770 | **10.6%** | 198,125 | 1,578,074 | 187 | 683,944 | 14,362,828 | Under Capacity | **1,578,074** |
| **Partial Buildout - Year 6** | 4,159,383 | 35,423,719 | **13.1%** | 543,454 | 4,628,372 | 239 | 871,770 | 18,307,160 | Under Capacity | **4,628,372** |
| **Full Buildout** | 5,448,287 | 47,573,700 | **15.8%** | 860,576 | 7,514,434 | 249 | 908850 | 19,085,850 | Under Capacity | **7,514,434** |

**Notes:**

1. The miles charged per hour charged is representative of a typical charge rate for an EV of 6.25 kWh per hour and a fuel economy of 0.30 kWh per mile. The charge rate is based on capability of existing battery-electric vehicles and Level 2 charging stations. Reference: Chargepoint. 2017. Level Up Your EV Charging Knowledge. Available at: https://www.chargepoint.com/blog/level-your-ev-charging-knowledge/. The fuel economy is based on electric fleet data from fueleconomy.gov. Available at: https://www.fueleconomy.gov/.
2. The two scenarios analyzed are the Reference and the Mobile Source Strategy scenarios. ARB is currently preparing its 2020 Mobile Source Strategy (MSS) update to the ARB VISION Model (version 2.1). The 2020 MSS uses "scenario planning to take an integrated approach to identifying the technology trajectories and programmatic concepts" to model projected years of electric vehicle miles for assessed scenarios. The Mobile Source Strategy projects eVMTs reflecting the aspirational target identified in EO N-79-20, assuming 100% of passenger vehicle sales in California are ZEV or PHEV, and GHG emissions assumed to have reduced by 2.0% per year from 2026 to 2035. The 2020 update only considers passenger vehicles (LDA, LDT1, LDT2, and MDV). To determine the eVMT percent of the passenger vehicle fleets, the 2020 MSS update was downloaded in July 13, 2021. The increase in annual eVMTs charged by the Project from the Reference Scenario to the MSS Scenario is used to determine the eVMTs the Project can take credit for based on providing additional charging infrastructure for the state to reach aspirational EV fleet penetration.
3. The number of chargers in the Town Square and the Residential/Shopping District was provided by the Project Applicant in the Willow Village Mixed Use Development Concept Level Energy Use Summary, dated June 14, 2021, detailing chargers available for all mixed-use traffic. 249 EV Charging Stations are available to serve the 1,694 residential spaces and 500 commercial spaces.
4. Meta offers a valet service to charge EVs from 7am to 7pm, average daily hours of availability for charging per charger is conservatively assumed to be 10 hours per day. When demand is met, the full 10 hours will be used for charging, with each vehicle cycling out of the charging spot before or as the car reaches full charge. The number of chargers are available for all Town Square and the Residential/Shopping District land uses, and it is expected that there will be 10 hours a day of active charging taking place due to the frequency of turnover associated with retail, restaurant, hotel, and park land uses. Town Square and the Residential/Shopping District land uses are assumed to operate 365 days per year. Any charging inefficiencies associated with cars remaining plugged in after reaching full charge is assumed to balance out due the likelihood of more than 10 hours of activity a day associated with Town Square and the Residential/Shopping District activity.
5. Town Square and the Residential/Shopping District Total VMT and trips includes all proposed Project residential, retail, park, and hotel land uses, consistent with Table 18. Retail land uses include Hamilton Parcels North and South and are added to total VMT and trips.
6. EV Annual Trips and EV Annual VMT are determined based on Project trips and VMTs and the VISION Reference Scenario percent of Electric Fleet. These eVMTs (electric vehicle miles traveled) represents the number of project VMTs that are driven by electric vehicles.
7. 249 EV Charging Stations are proposed for the full buildout. To reflect the EV charging stations that will come online during construction in the partial years leading up to full buildout, a scaling factor was applied based on the ratio of square feet of the parking land use that is built out in a given year to the total square feet that will be built. The scaling factor for a given year was applied to the 249 chargers at full buildout. To see scaling factors used, refer to the parking land use from Table 16.
8. Total annual charge hours available from the project are determined by multiplying the average daily hours of charging per charger (10 hours) by the annual days of charger activity (365 days). The annual charge hours available from the project are then multiplied by 25 miles charged per charge hour to determine the number of eVMT available from the project.
9. The Project EV chargers for Town Square and the Residential/Shopping District land uses are determined to be at capacity, meaning used fully for all available charge hours per day, when the electric vehicle miles associated with the Project are in excess of the maximum electric vehicle miles the Project chargers can charge. If there is a surplus of chargers relative to EVs coming to the site, then the Project chargers are under-capacity, and only a fraction of chargers will be used as the number of EVs coming to the site are fewer than the total number of charger capacity. If there is a surplus of EVs coming to the site relative to the chargers at the site, all chargers will be used and the site will be at capacity. In the scenario when the chargers are at capacity, the full capacity of VMTs the site can charge are assumed to be charged.

**Abbreviations:**

EV - electric vehicle (includes battery electric or plug-in hybrid technology)
Hr - hour
TDM - Transportation Demand Management
VMT - vehicle miles travelled
eVMT - electric vehicle mile traveled

**References:**

U.S. Census. 2019. Factfinder. Available at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2016.3.2. Available online at http://www.caleemod.com/
California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/
California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

**Table 24aV**
**EV CAP Emissions Reductions Summary**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Town Square and the Residential/Shopping District**

| Year | Scenario | Miles Charged by Project Chargers[1] | EV Trips Charged by Project Chargers[1] | eVMT from Additional Project Chargers[2] | Trip Counts from additional Project Chargers[2] | Electric VMT CAP Emissions Reduction (lb/year)[3,4] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | eVMT/year | trips/year | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | Reference | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MSS | 0 | 0 | | | | | | |
| Year 4 | Reference | 121,137 | 17,714 | 94,143 | 13,767 | -33 | -18 | -0.34 | -0.31 |
| | MSS | 215,280 | 31,482 | | | | | | |
| Year 5 | Reference | 776,244 | 97,457 | 801,830 | 100,669 | -246 | -133 | -2.7 | -2.5 |
| | MSS | 1,578,074 | 198,125 | | | | | | |
| Year 6 | Reference | 1,974,696 | 231,865 | 2,653,676 | 311,589 | -752 | -400 | -8.4 | -7.7 |
| | MSS | 4,628,372 | 543,454 | | | | | | |
| Full Buildout | Reference | 2,818,688 | 322,805 | 4,695,746 | 537,771 | -1,311 | -700 | -15 | -14 |
| | MSS | 7,514,434 | 860,576 | | | | | | |

**Campus District**

| Year | eVMT from Additional Project Chargers[5] | Trip Counts from additional Project Chargers[5,6] | Electric VMT CAP Emissions Reduction (lb/year)[3,4] | | | |
|---|---|---|---|---|---|---|
| | eVMT/year | trips/year | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | 1,783,182 | 148,319 | -564 | -472 | -7.6 | -7.0 |
| Year 4 | 298,927 | 26,882 | -78 | -47 | -1.0 | -0.91 |
| Year 5 | 5,701,922 | 512,763 | -1,432 | -833 | -18 | -17 |
| Year 6 | 9,259,481 | 832,687 | -2,249 | -1,262 | -28 | -26 |
| Full Buildout | 9,752,026 | 876,981 | -2,369 | -1,329 | -30 | -27 |

| Year | Electric VMT CAP Emissions Reduction (lb/year) | | | |
|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ |
| Existing Conditions | -564 | -472 | -7.6 | -7.0 |
| Partial Buildout- Year 4 | -111 | -65 | -1.3 | -1.2 |
| Partial Buildout- Year 5 | -1,677 | -966 | -21 | -19 |
| Partial Buildout- Year 6 | -3,002 | -1,662 | -37 | -34 |
| Full Buildout | -3,680 | -2,030 | -45 | -41 |

**Notes:**

1. Expected eVMT and trips charged by the Project chargers in Town Square and the Residential/Shopping District land uses are calculated based on the San Mateo Fleet, charger usage assumptions, ARB's Vision Model, and traffic data provided by the Transportation Engineer. For calculation details, see Table 23.
2. Emissions reductions from EV charging represent the decrease in emissions from increases in electric vehicle use due to the installation of EV chargers throughout the site. For Town Square and the Residential/Shopping District land uses, the eVMT and trips from additional Project chargers is calculated based on the difference between the MSS scenario and the baseline scenario, representing the additional eVMT due to the installation of additional chargers.
3. Emissions reductions use emission factors developed in EMFAC2021 that represent passenger vehicles (LDA, LDT1, LDT2, MCY). The eVMTs determined for Town Square and the Residential/Shopping District are based on ARB's VISION Model, which includes expected electric vehicle fleet % for passenger vehicles only (LDA, LDT1, LDT2, MCY).
4. EVs emit particulate matter brake wear and tire wear, therefore those emissions are not considered in the reductions.
5. Expected eVMT charged by additional Project chargers is measured based on anticipated charging energy usage provided by the Project Applicant. For calculation details see Variant Table 22.
6. Trip counts from Project chargers were calculated by dividing the increased eVMTs from project chargers by the average VMTs per trip for the passenger vehicles (Cars) in a given year, based on traffic data provided by the Transportation Engineer.

**Abbreviations:**

eVMT - electric vehicle miles traveled
lb - pound
EV - electric vehicle
ROG - reactive organic gases
NOx - nitrogen oxides
$PM_{10}$ - particulate matter less than 10 microns in diameter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter

**References:**

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

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**Table 24bV**
**EV GHG Emissions Reductions Summary**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Town Square and the Residential/Shopping District**

| Year | Scenario | Miles Charged by Project Chargers[1] | EV Trips Charged by Project Chargers[1] | eVMT from Additional Project Chargers[2] | Trip Counts from additional Project Chargers[2] | Electric VMT GHG Emissions Reduction (MT/year)[3,4] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | eVMT/year | trips/year | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Full Buildout | Reference | 2,818,688 | 322,805 | 4,695,746 | 537,771 | -1,396 | -0.047 | -0.037 | -1,408 |
| | MSS | 7,514,434 | 860,576 | | | | | | |

**Campus District**

| Year | eVMT from Additional Project Chargers[4] | Trip Counts from additional Project Chargers[4,5] | Electric VMT GHG Emissions Reduction (MT/year)[3] | | | |
|---|---|---|---|---|---|---|
| | eVMT/year | trips/year | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Existing Conditions | 1,783,182 | 148,319 | -580 | -0.024 | -0.019 | -586 |
| Full Buildout | 9,752,026 | 876,981 | -2,882 | -0.082 | -0.069 | -2,905 |

| Year | Electric VMT GHG Emissions Reduction (MT/year) | | | |
|---|---|---|---|---|
| | $CO_2$ | $CH_4$ | $N_2O$ | $CO_2e$ |
| Existing Conditions | -580 | -0.024 | -0.019 | -586 |
| Full Buildout | -4,278 | -0.13 | -0.11 | -4,313 |

**Notes:**

1. Expected eVMT and trips charged by the Project chargers in Town Square and the Residential/Shopping District land uses are calculated based on the San Mateo Fleet, charger usage assumptions, ARB's Vision Model, and traffic data provided by the Transportation Engineer. For calculation details, see Table 23.

2. Emissions reductions from EV charging represent the decrease in emissions from increases in electric vehicle use due to the installation of EV chargers throughout the site. For Town Square and the Residential/Shopping District land uses, the eVMT and trips from additional Project chargers is calculated based on the difference between the MSS scenario and the baseline scenario, representing the additional eVMT due to the installation of additional chargers.
3. Emissions reductions use emission factors developed in EMFAC2021 that represent passenger vehicles (LDA, LDT1, LDT2, MCY). The eVMTs determined for Town Square and the Residential/Shopping District are based on ARB's VISION Model, which includes expected electric vehicle fleet % for passenger vehicles only (LDA, LDT1, LDT2, MCY).
4. Expected eVMT charged by additional Project chargers is measured based on anticipated charging energy usage provided by the Project Applicant. For calculation details see Table 22.
5. Trip counts from Project chargers were calculated by dividing the increased eVMTs from project chargers by the average VMTs per trip for the passenger vehicles (Cars) in a given year, based on traffic data provided by the Transportation Engineer.

**Abbreviations:**

GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
eVMT - electric vehicle miles traveled
MT - metric ton
EV - electric vehicle

**References:**

California Air Resources Board. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

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**Table 25aV**
**Summary of Mobile CAP Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Total Emissions Before Reductions:[1]**

| **Year** | **CAP Emissions without Reductions (ton/year)** | | | |
|---|---|---|---|---|
| | **ROG** | **$NO_x$** | **$PM_{10}$[2]** | **$PM_{2.5}$[2]** |
| **Total Emissions by Year** | | | | |
| Existing Conditions[3] | 5.0 | 8.0 | 4.0 | 0.84 |
| Year 4 | 0.61 | 0.67 | 0.46 | 0.092 |
| Year 5 | 5.8 | 6.3 | 5.1 | 1.0 |
| Year 6 | 10 | 11 | 9.4 | 1.9 |
| **Full Buildout** | 12 | 13 | 11 | 2.2 |
| **Net Emissions by Year** | | | | |
| **Full Buildout** | **7.1** | **5.1** | **7.0** | **1.3** |

**Total Emissions with Reductions:[4]**

| **Year** | **CAP Emissions with Reductions (ton/year)** | | | |
|---|---|---|---|---|
| | **ROG** | **$NO_x$** | **$PM_{10}$[2]** | **$PM_{2.5}$[2]** |
| **Total Emissions by Year** | | | | |
| Existing Conditions[3] | 5.0 | 8.0 | 4.0 | 0.84 |
| Year 4 | 0.56 | 0.64 | 0.46 | 0.091 |
| Year 5 | 5.0 | 5.9 | 5.1 | 1.0 |
| Year 6 | 8.9 | 10 | 9.4 | 1.8 |
| **Full Buildout** | **10** | **12** | **11** | **2.2** |
| **Net Emissions by Year** | | | | |
| **Full Buildout** | **5.3** | **4.1** | **7.0** | **1.3** |

**Notes:**

1. Calculations of CAP emissions before reductions are shown in detail in Table 21a. Net emissions subtract the emissions from the existing conditions in 2019.
2. PM10 and PM2.5 emissions include exhaust, tire wear, brake wear, and fugitive dust. Fugitive dust emissions factors are calculated in AQTR Table 8.
3. The Existing Conditions includes EV reductions associated with existing Project Site chargers.
4. CAP Emissions after reductions account for the reductions associated with EVs as shown in Table 24a. The emissions reductions are subtracted from the total Project emissions.

**Abbreviations:**

lb - pound
MT - metric ton
EV - electric vehicle
ROG - reactive organic gases
NOx - nitrogen oxides
$PM_{10}$ - particulate matter less than 10 microns in diameter
$PM_{2.5}$ - particulate matter less than 2.5 microns in diameter

**References:**

California ARB. 2021. Miscellaneous Processes Methodologies - Paved Entrained Road Dust. Available online at: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

**Table 25bV**
**Summary of Mobile GHG Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Total Emissions Before Reductions:**[1]

| Year | GHG Emissions without Reductions (MT/year) | | | |
|---|---|---|---|---|
| | **$CO_2$** | **$CH_4$** | **$N_2O$** | **$CO_2e$** |
| **Total Emissions by Year** | | | | |
| Existing Conditions[2] | 15,660 | 0.46 | 1.2 | 16,024 |
| **Full Buildout** | 37,469 | 1.0 | 1.9 | 38,060 |
| **Net Emissions** | | | | |
| **Full Buildout** | **21,809** | **0.58** | **0.71** | **22,035** |

**Total Emissions with Reductions:**[3]

| Year | GHG Emissions with Reductions (MT/year) | | | |
|---|---|---|---|---|
| | **$CO_2$** | **$CH_4$** | **$N_2O$** | **$CO_2e$** |
| **Total Emissions by Year** | | | | |
| Existing Conditions[2] | 15,660 | 0.46 | 1.2 | 16,024 |
| **Full Buildout** | 33,191 | 0.92 | 1.8 | 33,747 |
| **Net Emissions** | | | | |
| **Full Buildout** | **17,531** | **0.45** | **0.61** | **17,723** |

**Notes:**

1. Calculations of GHG emissions before reductions are shown in detail in AQTR Table 21b. Net emissions subtract the emissions from the existing conditions in 2019.
2. The Existing Conditions includes EV reductions associated with existing Project Site chargers.
3. GHG Emissions after reductions account for the reductions associated with EVs as shown in Table 24b. The emissions reductions are subtracted from the total Project emissions.

**Abbreviations:**

GHG - Greenhouse Gas
$CO_2$ - carbon dioxide
$CH_4$ - methane
$N_2O$ - Nitrous Oxide
$CO_2e$ - Carbon dioxide equivalent
MT - metric ton
EV - electric vehicle

**References:**

California ARB. 2021. Miscellaneous Processes Methodologies - Paved Entrained Road Dust. Available online at: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf

California Air Resources Board. EMFAC2021. Available at: https://arb.ca.gov/emfac/

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**Table 28V**
**Energy Usage for Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Land Use | Floor Area | Annual Electricity Use | Annual Natural Gas Use |
|---|---|---|---|
| | (sqft) (DU - Residential) | (MWh/yr) | (MMBtu/yr) |
| **Existing Conditions (2019)[1]** | | | |
| All | 1,923,910 | 12,050 | 30,039 |
| | **Total Existing Energy Usage** | **12,050** | **30,039** |
| **Full Buildout[2,3]** | | | |
| Office | 1,600,000 | 23,828 | 0 |
| Retail | 207,690 | 4,517 | 2,195 |
| Residential | 1,930 | 18,804 | 0 |
| Hotel | 172,000 | 2,528 | 0 |
| Parking | 1,869,240 | 32,183 | 0 |
| Park | 403,837 | 38 | 0 |
| | **Total Full Buildout Energy Usage** | **81,898** | **2,195** |

**Notes:**

1. Energy use rates for existing conditions were provided for 2019 by the Project Applicant via email on August 10, 2021.
2. Electricity and natural gas usage rates for the retail, residential, and parking land uses were provided by PAE in the June 14, 2021 memorandum. Electricity usage rates for Office, Hotel, and Park were provided by Hines on June 21, 2021. The hotel and office do not use natural gas. The electricity usage includes 27,986 MWh/year of electricity use associated with the Campus District EV charging stations, which is summarized in the parking land use category. Electricity and energy use rates for the Willow Road Retail were calculated based on the CalEEMod defaults the retail land use type in Climate Zone 5.
3. Natural gas for the project is only used for Hamilton Avenue Parcels North and South and the supermarket and restaurant land uses, which are summarized in the retail category.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
DU - dwelling unit
kBTU - thousand British Thermal Units
kWh - kilowatt-hour
MMBTU - million British Thermal Units
MWh - Megawatt-hour
sqft - square feet
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2020.4.0. Available online at http://www.caleemod.com

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**Table 30V**
**Energy Usage Emissions from Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Location | Natural Gas Emissions[1,2] | | | | | Electricity Emissions[1,2] |
|---|---|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ | |
| | (tons/yr) | | | | (MT/yr) | |
| **Existing Conditions (2019)** | | | | | | |
| All | 0.16 | 1.5 | 0.11 | 0.11 | 1,613 | 0 |
| **Total Existing Emissions** | **0.16** | **1.5** | **0.11** | **0.11** | **1,613** | **0** |
| **Full Buildout** | | | | | | |
| Retail | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 118 | 0 |
| **Total Full Buildout Emissions** | **0.012** | **0.11** | **8.2E-03** | **8.2E-03** | **118** | **0** |
| **Partial Buildout[3]** | | | | | | |
| Total Year 4 Emissions | 0.0012 | 0.011 | 8.3E-04 | 8.3E-04 | 12 | 0 |
| Total Year 5 Emissions | 0.0070 | 0.064 | 4.9E-03 | 4.9E-03 | 70 | 0 |
| Total Year 6 Emissions | 0.012 | 0.11 | 8.0E-03 | 8.0E-03 | 115 | 0 |

**Notes:**

1. CAP emissions result from the combustion of natural gas. As a result, CAP emissions were only calculated for natural gas usage. In compliance with the City of Menlo Park Municipal Code, natural gas usage for the Project will be offset; however, since the carbon intensity of the offset production is not known at this time, GHG emissions from natural gas were conservatively included alongside electricity GHG emissions.
2. Emissions were calculated based on energy use, shown in Table 28, and energy emission factors, shown in AQTR Table 29. Existing electricity is sourced from PCE. Project electricity will be sourced from 100% renewable sources; as such, emissions from Project electricity use are expected to be zero. Project natural gas will only be used in retail land uses for commercial cooking equipment.
3. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

CAP - Criteria Air Pollutants
$CO_2e$ - carbon dioxide equivalents
GHG - Greenhouse Gas
MT - metric ton(s)
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 31V**
**Water Usage for Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Water Usage**

| Land Use | CalEEMod® Land Use Subtype | Size | Size Metric | Indoor Water (million gal/year) | Outdoor Water (million gal/year) |
|---|---|---|---|---|---|
| **Existing Conditions (2019)[1]** | | | | | |
| Office | General Office Building | 251,530 | sqft | 45 | 27 |
| Commercial | Research and Development | 123,870 | sqft | 61 | 0 |
| Industrial - Warehouse | Unrefrigerated Warehouse-No Rail | 500,780 | sqft | 116 | 0 |
| Industrial - Manufacturing | Manufacturing | 23,570 | sqft | 5.5 | 0 |
| Recreational | Health Club | 24,060 | sqft | 1.4 | 0.87 |
| Light Industrial | General Light Industry | 80,100 | sqft | 19 | 0 |
| Parking | Enclosed Parking with Elevator | 920,000 | sqft | 0 | 0 |
| **Full Buildout[2]** | | | | | |
| Office | | 1,600,000 | sqft | 35 | 10 |
| Retail | | 207,690 | sqft | 4.2 | 0.36 |
| Residential | | 1,892,043 | sqft | 75 | 7.0 |
| Hotel | | 172,000 | sqft | 7.6 | 2.5 |
| Parking | | 1,869,240 | sqft | 0 | 1.4 |
| Park | | 403,837 | sqft | 0 | 14 |
| **Partial Buildout[3]** | | | | | |
| | | | Total Year 4 Usage[3] | 1.5 | 13 |
| | | | Total Year 5 Usage[3] | 37 | 23 |
| | | | Total Year 6 Usage[3] | 89 | 32 |

**Notes:**

1. Existing water use was calculated using the CalEEMod default water consumption profile for each land use.
2. Project indoor water use rates and outdoor water use for all parcels except Willow Road Retail were provided by the Project Applicant on June 14, 2021. Indoor and outdoor water use rates for Willow Road Retail were calculated using the CalEEMod default water consumption profile for the retail land use type.
3. Partial buildout usage rates were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
gal - gallon
kWh - kilowatt-hours
ksf - thousand square feet
sqft - square feet

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 32V**
**Water Usage and Wastewater Emissions from Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Land Use | Electricity Indirect Emissions[1,2] | Septic Tank Direct Emissions[1,2] | Aerobic Direct Emissions[1,2] | Facultative Lagoon Direct Emissions[1,2] | Total Emissions |
|---|---|---|---|---|---|
| | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT $CO_2$e/yr) | (MT CO2e/yr) |
| **Existing Conditions (2019)** | | | | | |
| Office | 37 | 27 | 24 | 10 | 98 |
| Commercial | 36 | 37 | 33 | 13.1 | 119 |
| Industrial - Warehouse | 68 | 71 | 62 | 25 | 226 |
| Industrial - Manufacturing | 3.2 | 3.3 | 2.9 | 1.2 | 10.6 |
| Recreational | 1.2 | 0.87 | 0.76 | 0.30 | 3.1 |
| Light Industrial | 11 | 11.3 | 9.9 | 4.0 | 36 |
| Parking | 0 | 0 | 0 | 0 | 0 |
| **Total Existing Emissions** | **156** | **151** | **132** | **53** | **492** |
| **Full Buildout** | | | | | |
| Office | 19 | 21 | 19 | 7.5 | 67 |
| Retail | 2.0 | 2.6 | 2.3 | 0.91 | 7.8 |
| Residential | 36 | 46 | 40 | 16 | 138 |
| Hotel | 4.1 | 4.6 | 4.1 | 1.6 | 14 |
| Parking | 0.42 | 0 | 0 | 0 | 0.42 |
| Park | 4.2 | 0 | 0 | 0 | 4.2 |
| **Total Full Buildout Emissions** | **65** | **74** | **65** | **26** | **231** |
| **Partial Buildout[3]** | | | | | |
| Total Year 4 Emissions[3] | 5.0 | 0.92 | 0.81 | 0.32 | 7.1 |
| Total Year 5 Emissions[3] | 24 | 22 | 20 | 7.9 | 74 |
| Total Year 6 Emissions[3] | 49 | 54 | 48 | 19 | 170 |

**Notes:**

1. Emissions shown in this table were calculated using default values and methods from CalEEMod Version 2020.4.0. The Water Electricity Intensity, Water Treatment Types, and Wastewater Treatment Direct Emission Factors used in the calculation can be found in Tables 9.2, 9.3 and 9.4 of Appendix D of the CalEEMod user guide, respectively. These calculations were performed using water use rates, shown in Table 31, and energy emission factors, shown in AQTR Table 29.
2. Consistent with CalEEMod, indoor water use was assumed to be processed as wastewater and outdoor water use was assumed to not be processed as wastewater.
3. Partial buildout direct emissions from Septic Tank, Aerobic, and Facultative Lagoon wastewater treatment were calculated from full buildout using scaling factors by land use type and year, as shown in Table 1. For partial buildout indirect electricity emissions from water usage and wastewater treatment, usage rates rather than emission were scaled to account for year specific energy emission factors from PG&E, as shown in AQTR Table 29

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CO_2$e - carbon dioxide equivalents
MT - metric ton
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 33V**
**Solid Waste Generation for Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Solid Waste Generation[1]**

| Land Use | Size | Units | Solid Waste Disposal Rate (ton/year) |
|---|---|---|---|
| **Existing Conditions (2019)** | | | |
| Office | 251,530 | sqft | 42 |
| Commercial | 123,870 | sqft | 10 |
| Industrial - Warehouse | 500,780 | sqft | 471 |
| Industrial - Manufacturing | 23,570 | sqft | 29 |
| Recreational | 24,060 | sqft | 137 |
| Light Industrial | 80,100 | sqft | 99 |
| Parking | 920,000 | sqft | 0 |
| **Full Buildout Conditions** | | | |
| Office | 1,600,000 | sqft | 268 |
| Retail | 207,690 | sqft | 218 |
| Residential | 1,930 | DU | 888 |
| Hotel | 193 | Rooms | 106 |
| Parking | 1,869,240 | sqft | 0 |
| Park | 403,837 | sqft | 0.83 |

**Notes:**

1. Solid Waste Generation Rates are from Table 10.1 of Appendix D of the CalEEMod User's Guide. An 82% diversion rate, provided by the Project Applicant via email communication dated August 2, 2021, is applied to default solid waste generation rates for the existing and project office land use to account for recycling and composting. The diversion rate is generated using data from Recology with the assumption that all bins are at 100% capacity and 0% contamination.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
DU - dwelling unit
sqft - square feet

**References**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 34V**
**Solid Waste Emissions from Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

**Solid Waste Emissions[1]**

| Location | CalEEMod® Land Use Subtype | $CO_2$ (MT/year) | $CH_4$ (MT/year) | $CO_2e$ (MT/year) |
|---|---|---|---|---|
| **Existing Conditions (2019)** | | | | |
| Office | General Office Building | 8.5 | 0.51 | 21 |
| Commercial | Research and Development | 2.0 | 0.12 | 5.0 |
| Industrial - Warehouse | Unrefrigerated Warehouse-No Rail | 96 | 5.6 | 237 |
| Industrial - Manufacturing | Manufacturing | 5.9 | 0.35 | 15 |
| Recreational | Health Club | 28 | 1.6 | 69 |
| Light Industrial | General Light Industry | 20 | 1.2 | 50 |
| Parking | Enclosed Parking with Elevator | 0 | 0 | 0 |
| **Total Existing Emissions** | | **160** | **9.5** | **397** |
| **Full Buildout Conditions** | | | | |
| Office | | 54 | 3.2 | 135 |
| Retail | | 44 | 2.6 | 110 |
| Residential | | 180 | 10.7 | 446 |
| Hotel | | 22 | 1.3 | 53 |
| Parking | | 0 | 0 | 0 |
| Park | | 0.17 | 0.010 | 0.42 |
| **Total Full Buildout Emissions** | | **301** | **18** | **745** |
| **Partial Buildout[2]** | | | | |
| Total Year 4 Emissions[2] | | 6.3 | 0.37 | 16 |
| Total Year 5 Emissions[2] | | 92 | 5.5 | 229 |
| Total Year 6 Emissions[2] | | 222 | 13 | 549 |

**Notes:**

1. Emissions shown in this table were calculated using default values and methods from CalEEMod Version 2020.4.0. These calculations were performed using default waste use rates by land use type and an 82% diversion rate for office land use types provided by the Project Applicant, shown in Table 33, and default solid waste landfill gas emission factors from Table 10.2 of CalEEMod User's Guide Appendix D.
2. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CH_4$ - methane
$CO_2$ - carbon dioxide
$CO_2e$ - carbon dioxide equivalents
LFG - Landfill Gas
MT - metric ton

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

**Table 35V**
**Unmitigated Architectural Coating Emissions from Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Land Use | Floor Area | Building Surface Area[1] | Application Rate[2] | Indoor Paint VOC EF[3] | Outdoor Paint VOC EF[3] | Architectural Coating VOC Emissions[4] |
|---|---|---|---|---|---|---|
| | (sqft) | (sqft) | | (g/L) | (g/L) | (lb/yr) |
| **Existing Conditions (2019)** | | | | | | |
| Office | 251,530 | 503,060 | 10% | 100 | 150 | 262 |
| Commercial | 123,870 | 247,740 | 10% | 100 | 150 | 129 |
| Industrial - Warehouse | 500,780 | 1,001,560 | 10% | 100 | 150 | 522 |
| Industrial - Manufacturing | 23,570 | 47,140 | 10% | 100 | 150 | 25 |
| Recreational | 24,060 | 48,120 | 10% | 100 | 150 | 25 |
| Light Industrial | 80,100 | 160,200 | 10% | 100 | 150 | 84 |
| Parking | 920,000 | 55,200 | 10% | 0 | 150 | 9.6 |
| | | | | | **Total Existing Conditions Emissions** | **1,057** |
| **Full Buildout** | | | | | | |
| Office | 1,600,000 | 3,200,000 | 10% | 100 | 150 | 1,669 |
| Retail | 207,690 | 415,380 | 10% | 100 | 150 | 217 |
| Residential | 1,892,043 | 5,108,515 | 10% | 100 | 150 | 2,664 |
| Hotel | 172,000 | 344,000 | 10% | 100 | 150 | 179 |
| Parking | 1,869,240 | 112,154 | 10% | 0 | 150 | 19 |
| Park | 403,837 | 0 | 10% | 0 | 0 | 0 |
| | | | | | **Total Full Buildout Emissions** | **4,749** |
| **Partial Buildout[5]** | | | | | | |
| | | | | | Total Year 4 Emissions[5] | 83 |
| | | | | | Total Year 5 Emissions[5] | 1,567 |
| | | | | | Total Year 6 Emissions[5] | 3,547 |

**Notes:**

1. Consistent with CalEEMod Appendix A, residential building surface area was assumed to be 2.7 times the floor area, and non-residential 2 times the floor area. Also consistent with CalEEMod Appendix E, the parking painted area was assumed to be 6% of the total surface area for surface lots.
2. Consistent with CalEEMod Appendix A, 10% of all surfaces were assumed to be coated each year.
3. Consistent with CalEEMod Appendix D Table 6.1, which is based on BAAQMD Regulation 8 Rule 3 paint VOC regulations, use VOC EF of 100 g/L for flat paints, generally used indoors, and 150 g/L for all other architectural coatings.
4. Uses CalEEMod Appendix A assumption that 1 gallon of paint covers 180 square feet. Building surface area is assumed to be 75% indoors and 25% outdoors, consistent with CalEEMod Appendix A. Parking garages are assumed to have no indoor surfaces.
5. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
EF - emission factor
g - grams
L - liters
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**


BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/


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**Table 36V**
**Mitigated Architectural Coating Emissions from Existing Conditions and Project Operations**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Land Use | Floor Area | Building Surface Area[1] | Application Rate[2] | Indoor Paint VOC EF[3] | Outdoor Paint VOC EF[3] | Architectural Coating VOC Emissions[4] |
|---|---|---|---|---|---|---|
| | (sqft) | (sqft) | | (g/L) | (g/L) | (lb/yr) |
| **Full Buildout** | | | | | | |
| Office | 1,600,000 | 3,200,000 | 10% | 10 | 150 | 668 |
| Retail | 207,690 | 415,380 | 10% | 10 | 150 | 87 |
| Residential | 1,892,043 | 5,108,515 | 10% | 10 | 150 | 1,066 |
| Hotel | 172,000 | 344,000 | 10% | 10 | 150 | 72 |
| Parking | 1,869,240 | 112,154 | 10% | 0 | 150 | 19 |
| Park | 403,837 | 0 | 10% | 0 | 0 | 0 |
| **Total Full Buildout Emissions** | | | | | | **1,911** |
| **Partial Buildout[5]** | | | | | | |
| Total Year 4 Emissions[5] | | | | | | 40 |
| Total Year 5 Emissions[5] | | | | | | 635 |
| Total Year 6 Emissions[5] | | | | | | 1,430 |

**Notes:**

1. Consistent with CalEEMod Appendix A, residential building surface area was assumed to be 2.7 times the floor area, and non-residential 2 times the floor area. Also consistent with CalEEMod Appendix E, the parking painted area was assumed to be 6% of the total surface area for surface lots.
2. Consistent with CalEEMod Appendix A, 10% of all surfaces were assumed to be coated each year.
3. Paint VOC content is consistent with or more stringent than BAAQMD Regulation 8 Rule 3 (Architectural Coatings). Emissions were estimated assuming that indoor painting will utilize "super-compliant" VOC architectural coatings that meet the more stringent limits in South Coast Air Quality Management District Rule 1113. For outdoor paint, assumed use of coatings with VOC content of 150 g/L, consistent with BAAQMD requirements. VOC was assumed to be equivalent to ROG for these purposes.
4. Uses CalEEMod Appendix A assumption that 1 gallon of paint covers 180 square feet. Building surface area is assumed to be 75% indoors and 25% outdoors, consistent with CalEEMod Appendix A. Parking garages are assumed to have no indoor surfaces.
5. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
EF - emission factor
g - grams
L - liters
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**


BAAQMD. 2009. Regulation 8 Rule 3 Architectural Coatings. Accessed November 2020. Available at: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-8-rule-3-architectural-coatings/documents/rg0803_0709.pdf?la=en.

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

South Coast Air Quality Management District. Super Compliant Architectural Coatings per Rule 1113. Accessed July 2021. Available at: http://www.aqmd.gov/home/programs/business/business-detail?title=super-compliant-coatings&parent=other-low-voc-products.

**Table 38V**
**Consumer Product Emissions from Existing Conditions and Project Operations**
**Willow Village**
**Menlo Park, California**

| Land Use | Building Area | Consumer Products VOC EF[1,2] | Days per Year | Consumer Products VOC emissions |
|---|---|---|---|---|
| | (sqft) | (lb/sqft/day) | | (lb/yr) |
| **Existing Conditions (2019)** | | | | |
| Office | 251,530 | 1.8E-05 | 365 | 1,670 |
| Commercial | 123,870 | 1.8E-05 | 365 | 822 |
| Industrial - Warehouse | 500,780 | 1.8E-05 | 365 | 3,324 |
| Industrial - Manufacturing | 23,570 | 1.8E-05 | 365 | 156 |
| Recreational | 24,060 | 1.8E-05 | 365 | 160 |
| Light Industrial | 80,100 | 1.8E-05 | 365 | 532 |
| Parking | 920,000 | 3.5E-07 | 365 | 119 |
| | | | **Existing Conditions Emissions** | **6,783** |
| **Full Buildout** | | | | |
| Office | 1,600,000 | 1.8E-05 | 365 | 10,621 |
| Retail | 207,690 | 1.8E-05 | 365 | 1,379 |
| Residential | 1,892,043 | 1.8E-05 | 365 | 12,560 |
| Hotel | 172,000 | 1.8E-05 | 365 | 1,142 |
| Parking | 1,869,240 | 3.5E-07 | 365 | 242 |
| Park | 403,837 | 5.2E-08 | 365 | 7.6 |
| | | | **Total Full Buildout Emissions** | **25,950** |
| **Partial Buildout[3]** | | | | |
| | | | Total Year 4 Emissions[3] | 599 |
| | | | Total Year 5 Emissions[3] | 9,447 |
| | | | Total Year 6 Emissions[3] | 20,130 |

**Notes:**

1. The consumer products VOC EF for office, retail, and residential land uses was derived using methodology consistent with CalEEMod with adjusted parameters for San Mateo County, as described in AQTR Table 37. The default emissions factor assumes 2020 consumer products VOC inventory for San Mateo County. The default building square footage used is from 2010, which was updated to 2020 using population growth of San Mateo County, as shown in AQTR Table 37.
2. Consumer product VOC EFs for parking and open space were taken from CalEEMod 2020.4.0. These defaults take into account pesticide and fertilizer use in city parks and degreaser use in parking areas.
3. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.

**Abbreviations:**

ARB - Air Resources Board
CalEEMod - California Emissions Estimator Model
EF - emission factor
lb - pound
sqft - square feet
VOC - volatile organic compound
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com/

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## Table 39V
## Landscaping Emissions from Existing Conditions and Project Operations
## Willow Village - Increased Residential Variant Analysis
## Menlo Park, California

| Year[2] | Emissions from Landscaping Equipment[1] | | | | |
|---|---|---|---|---|---|
| | ROG | NOx | $PM_{10}$ | $PM_{2.5}$ | $CO_2e$ |
| | (tons/yr) | | | | (MT/yr) |
| Existing Conditions | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.063 |
| Year 4 | 0.37 | 0.14 | 0.068 | 0.068 | 21 |
| Year 5 | 0.41 | 0.16 | 0.075 | 0.075 | 23 |
| Year 6 | 0.43 | 0.17 | 0.079 | 0.079 | 24 |
| Full Buildout | **0.43** | **0.17** | **0.079** | **0.079** | **24** |

**Notes:**

1. Landscape emissions calculated using CalEEMod 2020.4.0 based on information regarding building square footage and acreage, shown in Appendix D.
2. Emissions in partial years were calculated by scaling full buildout emissions by the maximum percentage of land uses operational during that year.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
$CO_2e$ - carbon dioxide equivalents
MT - metric ton(s)
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model (CalEEMod®), Version 2020.4.0. Available online at http://www.caleemod.com

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**Table 40V**
**Summary of Unmitigated Operational CAP Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Emissions Source | CAP Emissions[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (ton/year) | | | | (lb/day)[2] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| **Existing Conditions (2019)[3]** | | | | | | | | |
| Architectural Coating | 0.53 | -- | -- | -- | 2.9 | -- | -- | -- |
| Consumer Products | 3.4 | -- | -- | -- | 19 | -- | -- | -- |
| Landscaping | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.016 | 1.5E-03 | 6.0E-04 | 6.0E-04 |
| Natural Gas Use | 0.16 | 1.5 | 0.11 | 0.11 | 0.89 | 8.1 | 0.61 | 0.61 |
| Mobile | 5.0 | 8.0 | 4.0 | 0.84 | 27 | 44 | 22 | 4.6 |
| Emergency Generators | 2.9E-03 | 0.051 | 2.7E-03 | 2.7E-03 | 0.016 | 0.28 | 0.015 | 0.015 |
| **Total Emissions** | **9.1** | **10** | **4.1** | **0.95** | **50** | **52** | **23** | **5.2** |
| **Full Buildout Conditions[4]** | | | | | | | | |
| Architectural Coating | 2.4 | -- | -- | -- | 13 | -- | -- | -- |
| Consumer Products | 13 | -- | -- | -- | 71 | -- | -- | -- |
| Landscaping | 0.43 | 0.17 | 0.079 | 0.079 | 2.4 | 0.90 | 0.44 | 0.44 |
| Natural Gas Use[5] | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 0.065 | 0.59 | 0.045 | 0.045 |
| Mobile | 10 | 12 | 11 | 2.2 | 56 | 66 | 60 | 12 |
| Emergency Generators | 0.15 | 1.3 | 0.047 | 0.047 | 0.79 | 7.0 | 0.26 | 0.26 |
| **Total Emissions** | **26** | **14** | **11** | **2.3** | **144** | **75** | **61** | **13** |
| **Partial Buildout Emissions[6]** | | | | | | | | |
| Total Year 4 Emissions | 1.3 | 1.1 | 0.54 | 0.17 | 7.2 | 6.0 | 2.9 | 0.94 |
| Total Year 5 Emissions | 11 | 6.7 | 5.2 | 1.1 | 60 | 37 | 28 | 6.0 |
| Total Year 6 Emissions | 21 | 12 | 9.5 | 2.0 | 117 | 63 | 52 | 11 |
| **Net Emissions[7]** | | | | | | | | |
| Net Year 4 Emissions | -7.8 | -8.4 | -3.6 | -0.78 | -43 | -46 | -20 | -4.3 |
| Net Year 5 Emissions | 1.9 | -2.8 | 1.0 | 0.15 | 11 | -15 | 5.6 | 0.81 |
| Net Year 6 Emissions | 12 | 2.0 | 5.4 | 1.0 | 67 | 11 | 29 | 5.6 |
| **Net Full Buildout Emissions** | **17** | **4.1** | **7.0** | **1.3** | **94** | **23** | **38** | **7.4** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Operational emissions shown represent activity and emissions across 365 days per year.
3. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
4. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions. Net emissions were calculated as the difference between full buildout emissions and existing condition emissions.
5. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
6. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.
7. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - Criteria Air Pollutant
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
lb - pounds
MT - metric ton
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
PM - particulate matter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod® Version 2020.4.0 Available Online at: http://www.caleemod.com

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**Table 41V**
**Summary of Mitigated Operational CAP Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Emissions Source | CAP Emissions[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (ton/year) | | | | (lb/day)[2] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| **Existing Conditions (2019)[3]** | | | | | | | | |
| Architectural Coating | 0.53 | -- | -- | -- | 2.9 | -- | -- | -- |
| Consumer Products | 3.4 | -- | -- | -- | 19 | -- | -- | -- |
| Landscaping | 2.9E-03 | 2.8E-04 | 1.1E-04 | 1.1E-04 | 0.016 | 1.5E-03 | 6.0E-04 | 6.0E-04 |
| Natural Gas Use | 0.16 | 1.5 | 0.11 | 0.11 | 0.89 | 8.1 | 0.61 | 0.61 |
| Mobile | 5.0 | 8.0 | 4.0 | 0.84 | 27 | 44 | 22 | 4.6 |
| Emergency Generators | 2.9E-03 | 0.051 | 2.7E-03 | 2.7E-03 | 0.016 | 0.28 | 0.015 | 0.015 |
| **Total Emissions** | **9.1** | **9.5** | **4.1** | **0.95** | **50** | **52** | **23** | **5.2** |
| **Full Buildout Conditions[4]** | | | | | | | | |
| Architectural Coating | 0.96 | -- | -- | -- | 5.2 | -- | -- | -- |
| Consumer Products | 13 | -- | -- | -- | 71 | -- | -- | -- |
| Landscaping | 0.43 | 0.17 | 0.079 | 0.079 | 2.4 | 0.90 | 0.44 | 0.44 |
| Natural Gas Use[5] | 0.012 | 0.11 | 8.2E-03 | 8.2E-03 | 0.065 | 0.59 | 0.045 | 0.045 |
| Mobile | 10 | 12 | 11 | 2.2 | 56 | 66 | 60 | 12 |
| Emergency Generators | 0.15 | 1.3 | 0.047 | 0.047 | 0.79 | 7.0 | 0.26 | 0.26 |
| **Total Emissions** | **25** | **14** | **11** | **2.3** | **136** | **75** | **61** | **13** |
| **Partial Buildout Emissions[6]** | | | | | | | | |
| Total Year 4 Emissions | 1.3 | 1.1 | 0.54 | 0.17 | 7.1 | 6.0 | 2.9 | 0.94 |
| Total Year 5 Emissions | 10.5 | 6.7 | 5.2 | 1.1 | 58 | 37 | 28 | 6.0 |
| Total Year 6 Emissions | 20 | 11.6 | 9.5 | 2.0 | 111 | 63 | 52 | 11 |
| **Net Emissions[7]** | | | | | | | | |
| Net Year 4 Emissions | -7.8 | -8.4 | -3.6 | -0.78 | -43 | -46 | -20 | -4.3 |
| Net Year 5 Emissions | 1.5 | -2.8 | 1.0 | 0.15 | 8.0 | -15 | 5.6 | 0.81 |
| Net Year 6 Emissions | 11.1 | 2.0 | 5.4 | 1.0 | 61 | 11.1 | 29 | 5.6 |
| **Net Full Buildout Emissions** | **16** | **4.1** | **7.0** | **1.3** | **86** | **23** | **38** | **7.4** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0. The mitigated scenario for the Project is equivalent to the unmitigated scenario for all sources except Architectural Coating, as shown in Table 36.
2. Operational emissions shown represent activity and emissions across 365 days per year.
3. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
4. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions.
5. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
6. Partial buildout emissions were calculated from full buildout using scaling factors by land use type and year, as shown in Table 16.
7. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - Criteria Air Pollutant
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
lb - pounds
MT - metric ton
NOx - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
PM - particulate matter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

**Table 42V**
**Summary of Operational GHG Emissions**
**Willow Village - Increased Residential Variant Analysis**
**Menlo Park, California**

| Emissions Source | GHG Emissions[1] (MT/yr) $CO_2e$ | |
|---|---|---|
| | Existing Conditions (2019)[2] | Full Buildout Conditions[3] |
| Landscaping | 0.063 | 24 |
| Electricity Use | 0 | 0 |
| Natural Gas Use[4] | 1,613 | 118 |
| Water Use | 492 | 231 |
| Waste Disposed | 397 | 745 |
| Emergency Generators | 8.5 | 399 |
| **Total Emissions** | **2,509** | **1,516** |
| | **Net Emissions[5]** | **-993** |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Operational emissions from existing conditions were calculated using CalEEMod® default data and emission factors based on the existing land use type and energy use rates provided by the Project Applicant.
3. Full buildout operational emissions are based on electricity, natural gas, and water usage rates provided by the Project Applicant alongside CalEEMod® defaults for architectural coating, consumer product, landscaping, and waste emissions.
4. Natural gas usage for the project would be used exclusively for supermarket and commercial cooking.
5. Net emissions were calculated as the difference between partial buildout emissions for each year and existing condition emissions.

**Abbreviations:**

CalEEMod® - California Emissions Estimator Model
$CO_2e$ - carbon dioxide equivalent
GHG - greenhouse gas
MT - metric ton
yr - year

**References:**

CalEEMod® Version 2020.4.0 Available Online at: http://www.caleemod.com

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## Table 43V
## Unmitigated Construction and Net New Operational CAP Emissions by Year
## Willow Village - Increased Residential Variant Analysis
## Menlo Park, California

| Year | Average Daily CAP Emissions[1,2] (lb/day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction Emissions Only | | | | Net Operational Emissions[3] | | | | Construction and Net Operational Emissions[3] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| Year 1 | 0.12 | 2.4 | 0.053 | 0.050 | -50 | -52 | -23 | -5.2 | -50 | -50 | -23 | -5.2 |
| Year 2 | 4.5 | 64 | 1.4 | 1.3 | -50 | -52 | -23 | -5.2 | -45 | 11 | -21 | -3.9 |
| Year 3 | 19 | 124 | 5.8 | 5.4 | -50 | -52 | -23 | -5.2 | -31 | 72 | -17 | 0.15 |
| Year 4 | 52 | 53 | 2.3 | 2.1 | -43 | -46 | -20 | -4.3 | 9.5 | 7.2 | -17 | -2.2 |
| Year 5 | 64 | 46 | 2.2 | 2.0 | 11 | -15 | 5.6 | 0.81 | 75 | 30 | 7.8 | 2.8 |
| Year 6 | 43 | 14 | 0.72 | 0.67 | 67 | 11 | 29 | 5.6 | 110 | 25 | 30 | 6.3 |
| Full Buildout | -- | -- | -- | -- | 94 | 23 | 38 | 7.4 | 94 | 23 | 38 | 7.4 |
| BAAQMD Significance Threshold | | | | | | | | | 54 | 54 | 82 | 54 |

**Notes:**

1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Net new operational emissions are scaled for partial years of phased operations by the percent that each parcel is operational for each year relative to full buildout, as shown in Table 16.
3. Unmitigated construction emissions can be found in Table 13. Net unmitigated operational emissions were calculated by subtracting the emissions from the existing conditions from the project emissions, as reported in Table 42.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
CAP - Criteria Air Pollutant
lb - pounds
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**

CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

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## Table 44V
## Mitigated Construction and Net New Operational CAP Emissions by Year
## Willow Village - Increased Residential Variant Analysis
## Menlo Park, California

| Year | Average Daily CAP Emissions[1,2] (lb/day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction Emissions Only[3] | | | | Net Operational Emissions Only[3] | | | | Construction and Net Operational Emissions[3] | | | |
| | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | ROG | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ |
| Year 1 | 0.064 | 1.9 | 0.019 | 0.019 | -50 | -52 | -23 | -5.2 | -50 | -50 | -23 | -5.2 |
| Year 2 | 2.7 | 45 | 0.49 | 0.48 | -50 | -52 | -23 | -5.2 | -47 | -7.6 | -22 | -4.7 |
| Year 3 | 10 | 47 | 0.78 | 0.77 | -50 | -52 | -23 | -5.2 | -40 | -5.1 | -22 | -4.4 |
| Year 4 | 24 | 29 | 0.38 | 0.37 | -43 | -46 | -20 | -4.3 | -19 | -17 | -19 | -3.9 |
| Year 5 | 29 | 22 | 0.27 | 0.26 | 8 | -15 | 5.6 | 0.81 | 37 | 7.0 | 5.8 | 1.1 |
| Year 6 | 19 | 6.5 | 0.084 | 0.080 | 61 | 11.1 | 29 | 5.6 | 80 | 18 | 30 | 5.7 |
| Full Buildout | -- | -- | -- | -- | 86 | 22.6 | 38 | 7.4 | 86 | 23 | 38 | 7.4 |
| BAAQMD Significance Threshold | | | | | | | | | 54 | 54 | 82 | 54 |

**Notes:**
1. Emissions estimated using methods consistent with CalEEMod® version 2020.4.0.
2. Net new operational emissions are scaled for partial years of phased operations by the percent that each parcel is operational for each year relative to full buildout, as shown in Table 16.
3. Mitigated construction emissions can be found in Table 14. Net mitigated operational emissions were calculated by subtracting the emissions from the existing conditions from the project emissions, as reported in Table 43.

**Abbreviations:**

CalEEMod - California Emissions Estimator Model
CAP - Criteria Air Pollutant
lb - pounds
$NO_x$ - nitrogen oxides
PM - particulate matter
$PM_{2.5}$ - PM less than 2.5 microns in diameter
$PM_{10}$ - PM less than 10 microns in diameter
ROG - reactive organic gases
yr - year

**References:**
CalEEMod Version 2020.4.0 Available Online at: http://www.caleemod.com

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**Table 47V**
**Summary of Full Buildout Traffic Volumes by Roadway Segment**
**Willow Village**
**Menlo Park, CA**

**Offsite Roadways[1]**

| Source Group Name | Distance (m) | Facebook Campus District | | | | | | Project + Variant Town Square and Residential/Shopping District[2] | | Total Project + Variant Volume and VMT[2] | | Total Project Volume and VMT[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cars | | On-Demand | | Trucks | | San Mateo Default Fleet | | San Mateo Default Fleet | | San Mateo Default Fleet | |
| | | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) | Volume (vehicles/day) | VMT (mi/day) |
| ADAMS_CT | 223 | 62 | 8.6 | 4.2 | 0.58 | 1.4 | 0.19 | 88 | 12 | 156 | 22 | 155 | 21 |
| ADAMSD01 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 2.9 | 81 | 2.9 | 80 | 2.9 |
| ADAMSD02 | 160 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 8.1 | 81 | 8.1 | 80 | 8.0 |
| ADAMSD03 | 76 | 66 | 3.1 | 4.5 | 0.21 | 1.5 | 0.071 | 7.9 | 0.37 | 80 | 3.8 | 80 | 3.8 |
| ADAMSD04 | 83 | 66 | 3.4 | 4.5 | 0.23 | 1.5 | 0.077 | 7.9 | 0.40 | 80 | 4.1 | 80 | 4.1 |
| ADAMSD05 | 147 | 66 | 6.0 | 4.5 | 0.41 | 1.5 | 0.14 | 7.9 | 0.71 | 80 | 7.3 | 80 | 7.3 |
| ADAMSD06 | 81 | 66 | 3.3 | 4.5 | 0.23 | 1.5 | 0.076 | 7.9 | 0.40 | 80 | 4.1 | 80 | 4.0 |
| BAY_EAST | 1,185 | 657 | 484 | 45 | 33 | 15 | 11 | 1,598 | 1,177 | 2,315 | 1,705 | 2,252 | 1,658 |
| BAY_EFB | 718 | 0 | 0 | 0 | 0 | 0 | 0 | 1,709 | 762 | 1,709 | 762 | 1,566 | 698 |
| BAY_M01 | 110 | 525 | 36 | 36 | 2.4 | 12 | 0.81 | 1,650 | 113 | 2,223 | 152 | 2,130 | 146 |
| BAY_M02 | 135 | 525 | 44 | 36 | 3.0 | 12 | 1.0 | 1,650 | 138 | 2,223 | 186 | 2,130 | 179 |
| BAY_M03 | 117 | 525 | 38 | 36 | 2.6 | 12 | 0.86 | 1,650 | 119 | 2,223 | 161 | 2,130 | 154 |
| BAY_M04 | 143 | 525 | 47 | 36 | 3.2 | 12 | 1.1 | 1,650 | 146 | 2,223 | 197 | 2,130 | 189 |
| BAY_M05 | 350 | 525 | 114 | 36 | 7.8 | 12 | 2.6 | 1,650 | 358 | 2,223 | 483 | 2,130 | 463 |
| BAY_WFB1 | 419 | 0 | 0 | 0 | 0 | 0 | 0 | 1,401 | 365 | 1,401 | 365 | 1,284 | 334 |
| BAY_WFB2 | 210 | 0 | 0 | 0 | 0 | 0 | 0 | 1,401 | 183 | 1,401 | 183 | 1,284 | 168 |
| BAY_WFB3 | 124 | 0 | 0 | 0 | 0 | 0 | 0 | 1,401 | 108 | 1,401 | 108 | 1,284 | 99 |
| BAY_WFB4 | 328 | 0 | 0 | 0 | 0 | 0 | 0 | 1,401 | 286 | 1,401 | 286 | 1,284 | 262 |
| BAY_WFB5 | 113 | 0 | 0 | 0 | 0 | 0 | 0 | 1,709 | 120 | 1,709 | 120 | 1,566 | 110 |
| BAY_WFB6 | 542 | 0 | 0 | 0 | 0 | 0 | 0 | 1,709 | 576 | 1,709 | 576 | 1,566 | 527 |
| BAY_WFB7 | 136 | 0 | 0 | 0 | 0 | 0 | 0 | 1,709 | 144 | 1,709 | 144 | 1,566 | 132 |
| OBRIEN01 | 320 | 1,480 | 294 | 101 | 20 | 34 | 6.7 | 1,032 | 205 | 2,646 | 526 | 2,605 | 518 |
| OBRIEN02 | 138 | 1,480 | 127 | 101 | 8.7 | 34 | 2.9 | 1,032 | 89 | 2,646 | 227 | 2,605 | 224 |
| OBRIEN03 | 35 | 1,480 | 33 | 101 | 2.2 | 34 | 0.74 | 1,032 | 23 | 2,646 | 58 | 2,605 | 57 |
| OBRIEN04 | 29 | 1,480 | 27 | 101 | 1.8 | 34 | 0.61 | 1,032 | 19 | 2,646 | 48 | 2,605 | 47 |
| OBRIEN05 | 28 | 1,480 | 26 | 101 | 1.8 | 34 | 0.59 | 1,032 | 18 | 2,646 | 46 | 2,605 | 46 |
| OBRIEN06 | 52 | 1,480 | 48 | 101 | 3.3 | 34 | 1.1 | 1,032 | 33 | 2,646 | 85 | 2,605 | 84 |
| OBRIEN07 | 43 | 3,842 | 103 | 262 | 7.0 | 87 | 2.3 | 2,568 | 69 | 6,759 | 181 | 6,589 | 176 |
| OBRIEN08 | 20 | 3,842 | 49 | 262 | 3.3 | 87 | 1.1 | 2,568 | 32 | 6,759 | 85 | 6,589 | 83 |
| OBRIEN09 | 20 | 3,842 | 47 | 262 | 3.2 | 87 | 1.1 | 2,568 | 32 | 6,759 | 83 | 6,589 | 81 |
| OBRIEN10 | 21 | 3,842 | 50 | 262 | 3.4 | 87 | 1.1 | 2,568 | 33 | 6,759 | 87 | 6,589 | 85 |
| OBRIEN11 | 44 | 3,842 | 105 | 262 | 7.2 | 87 | 2.4 | 2,568 | 70 | 6,759 | 185 | 6,589 | 180 |
| OBRIEN12 | 102 | 3,842 | 243 | 262 | 17 | 87 | 5.5 | 2,568 | 162 | 6,759 | 427 | 6,589 | 416 |
| OBRIEN13 | 32 | 3,842 | 76 | 262 | 5.2 | 87 | 1.7 | 2,568 | 51 | 6,759 | 133 | 6,589 | 130 |
| OBRIEN14 | 112 | 3,842 | 268 | 262 | 18 | 87 | 6.1 | 2,568 | 179 | 6,759 | 471 | 6,589 | 459 |
| OBRIEN15 | 242 | 3,870 | 581 | 263 | 40 | 88 | 13 | 2,494 | 374 | 6,715 | 1,008 | 6,546 | 983 |
| OBRIEN16 | 48 | 3,870 | 115 | 263 | 7.8 | 88 | 2.6 | 2,494 | 74 | 6,715 | 200 | 6,546 | 195 |
| OBRIEN17 | 54 | 3,870 | 130 | 263 | 8.8 | 88 | 2.9 | 2,494 | 84 | 6,715 | 225 | 6,546 | 219 |
| UNIV_01 | 110 | 339 | 23 | 23 | 1.6 | 7.7 | 0.53 | 355 | 24 | 725 | 50 | 679 | 46 |
| UNIV_02 | 91 | 339 | 19 | 23 | 1.3 | 7.7 | 0.43 | 355 | 20 | 725 | 41 | 679 | 38 |
| UNIV_03 | 222 | 339 | 47 | 23 | 3.2 | 7.7 | 1.1 | 355 | 49 | 725 | 100 | 679 | 94 |
| UNIV_04 | 121 | 339 | 26 | 23 | 1.7 | 7.7 | 0.58 | 355 | 27 | 725 | 55 | 679 | 51 |
| UNIV_05 | 80 | 339 | 17 | 23 | 1.2 | 7.7 | 0.38 | 355 | 18 | 725 | 36 | 679 | 34 |
| UNIV_06 | 69 | 339 | 15 | 23 | 1.0 | 7.7 | 0.33 | 355 | 15 | 725 | 31 | 679 | 29 |
| UNIV_07 | 258 | 339 | 54 | 23 | 3.7 | 7.7 | 1.2 | 355 | 57 | 725 | 116 | 679 | 109 |
| UNIV_08 | 185 | 410 | 47 | 28 | 3.2 | 9.3 | 1.1 | 560 | 64 | 1,007 | 116 | 963 | 110 |
| UNIV_09 | 142 | 3,255 | 287 | 222 | 20 | 74 | 6.5 | 1,826 | 161 | 5,377 | 473 | 5,258 | 463 |
| UNIV_10 | 310 | 3,243 | 624 | 221 | 42 | 74 | 14 | 1,845 | 355 | 5,382 | 1,036 | 5,275 | 1,015 |
| UNIV_11 | 115 | 3,243 | 232 | 221 | 16 | 74 | 5.3 | 1,845 | 132 | 5,382 | 384 | 5,275 | 377 |
| UNIV_12 | 63 | 3,243 | 128 | 221 | 8.7 | 74 | 2.9 | 1,845 | 73 | 5,382 | 212 | 5,275 | 208 |
| UNIV_13 | 128 | 3,243 | 258 | 221 | 18 | 74 | 5.8 | 1,845 | 147 | 5,382 | 427 | 5,275 | 419 |
| UNIV_14 | 201 | 3,243 | 405 | 221 | 28 | 74 | 9.2 | 1,845 | 230 | 5,382 | 672 | 5,275 | 659 |
| UNIV_15 | 647 | 3,243 | 1,304 | 221 | 89 | 74 | 30 | 1,845 | 742 | 5,382 | 2,164 | 5,275 | 2,121 |
| WILLOW01 | 97 | 89 | 5.3 | 6.0 | 0.36 | 2.0 | 0.12 | 3,143 | 189 | 3,240 | 194 | 3,073 | 184 |
| WILLOW02 | 174 | 89 | 10 | 6.0 | 0.65 | 2.0 | 0.22 | 3,143 | 339 | 3,240 | 350 | 3,073 | 332 |
| WILLOW03 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WILLOW04 | 185 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WILLOW05 | 201 | 0 | 0 | 0 | 0 | 0 | 0 | 6,780 | 848 | 6,780 | 848 | 6,362 | 796 |
| WILLOW06 | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 6,780 | 465 | 6,780 | 465 | 6,362 | 436 |
| WILLOW07 | 281 | 580 | 101 | 39 | 6.9 | 13 | 2.3 | 7,304 | 1,276 | 7,937 | 1,387 | 7,508 | 1,312 |
| WILLOW08 | 93 | 580 | 33 | 39 | 2.3 | 13 | 0.76 | 7,304 | 422 | 7,937 | 459 | 7,508 | 434 |
| WILLOW09 | 39 | 580 | 14 | 39 | 0.95 | 13 | 0.32 | 7,304 | 176 | 7,937 | 191 | 7,508 | 181 |
| WILLOW10 | 31 | 580 | 11 | 39 | 0.76 | 13 | 0.25 | 7,304 | 141 | 7,937 | 153 | 7,508 | 145 |
| WILLOW11 | 180 | 580 | 65 | 39 | 4.4 | 13 | 1.5 | 7,304 | 818 | 7,937 | 889 | 7,508 | 841 |
| WILLOW12 | 256 | 580 | 92 | 39 | 6.3 | 13 | 2.1 | 7,304 | 1,162 | 7,937 | 1,262 | 7,508 | 1,194 |
| WILLOW13 | 216 | 580 | 78 | 39 | 5.3 | 13 | 1.8 | 7,304 | 980 | 7,937 | 1,065 | 7,508 | 1,007 |

**Onsite Roadways[3]**

| Source Group Name | Distance (m) | Volume (vehicles/day) | VMT (mi/day) |
|---|---|---|---|
| ONSITE - Project | 2570 | 10,782 | 17,217 |
| ONSITE - Project + Variant | 2570 | 11,219 | 17,915 |

**Intercampus Shuttles[4]**

| Source Group Name | Distance (m) | Volume (vehicles/day) | VMT (mi/day) |
|---|---|---|---|
| SHUTTLES | 7278 | 361 | 1,633 |

**Notes:**

1. Net new offsite traffic volumes for both the Campus District and the Town Square were provided by Hexagon in the data request received in February 2022. Offsite traffic for the Campus District was modeled using a percent breakdown of the fleet (88% cars, 6% on-demand, 2% trucks), provided by Hexagon. Offsite traffic for the Town Square and Residential/Shopping District was modeled as the default San Mateo fleet. A summary of fleet mix categories can be found in AQTR Table 19. Modeled offsite roadway segments can be found in AQTR Figure 8.

2. The increased residential variant increases the traffic for the Town Square and Residential/Shopping District. Total traffic volumes and VMT are calculated by summing the Facebook Campus District fleets with the Town Square and Residential/Shopping District fleet. The total Project volume and VMT without contributions from the variant are shown for comparison purposes.

3. Net new onsite traffic volumes were provided by Hexagon in the data request received in February 2022 which include the increased traffic volumes due to the residential variant. Onsite traffic volumes were taken as the sum of all net new onsite traffic volumes divided by two to account for round trips. Onsite traffic was modeled exclusively as the cars fleet type. A summary of the cars fleet mix can be found in Table 19. Modeled onsite roadway segments can be found in AQTR Figure 7.

4. Shuttle traffic volumes, which account for the remaining 4% of the offsite fleet mix, were conservatively modeled as the sum of all inbound and outbound vehicle trips across all regions and routes, divided by two to account for round trips. Inbound and outbound vehicle trips were provided by the Project Applicant in June 2021. A summary of the shuttles fleet mix can be found in AQTR Table 19. Modeled shuttle roadway segments can be found in AQTR Figure 9.

**Abbreviations:**

VMT - Vehicle Miles Traveled m - meter mi - mile

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## Table 59V
## Project Variant Cancer Risk at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, CA

| Source Category | Lifetime Excess Cancer Risk[1] (in a million) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| Construction | 86 | 57 | 4.1 | 7.6 | -- | -- |
| Operational Generators | 1.5 | 0.99 | 1.4 | 0.99 | 7.3 | 0.17 |
| Operational Traffic | 1.9 | 0.92 | 2.2 | 0.92 | 0.20 | 3.4 |
| **Total Project Contribution** | **90** | **59** | **7.7** | **9.5** | **7.5** | **3.6** |

**Notes:**

1. Excess lifetime cancer risk from construction and operations are combined since cancer risk is evaluated over a 30-year lifetime. Thus, the risk takes into account exposure to Project emissions beginning during construction and continuing through operations. Off-site receptors are exposed to all Project construction and subsequent Project operations. On-site receptors are exposed to overlapping construction emissions and subsequent Project operations.

   The cancer risks were estimated using the following equation:

   Riskinh = Ci x CF x IFinh x CPFi x ASF
   Where:
   Riskinh = Cancer Risk for the Inhalation Pathway (unitless)
   Ci = Annual Average Air Concentration for Chemical "i" (μg/m3)
   CF = Conversion Factor (mg/μg)
   IFinh = Intake Factor for Inhalation (m3/kg-day)
   CPFi = Cancer Potency Factor for Chemical "i" (mg/kg-day)-1
   ASF = Age Sensitivity Factor (unitless)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project. The maximum total cancer risk was identified across both proposed locations for the pumping station generator. The maximum unmitigated and mitigated on-site MEIR for Construction + Operations occurs when the pumping station generator is located at Location 2. The maximum on-site MEIR for Operations Only occurs when the pumping station generator is located at Location 1.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total cancer risk attributed to the emissions associated with the Project. The maximum total cancer risk was identified across both proposed locations for the pumping station generator. The maximum unmitigated and mitigated off-site MEIR for Construction + Operations occurs when the pumping station generator is located at Location 1. The maximum off-site MEIR for Operations Only occurs when the pumping station generator is located at Location 2.

**Table 59V**
**Project Variant Cancer Risk at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, CA**

5. On-site and off-site MEIR locations are documented below:

| MEIR by Scenario | MEIR Location[6] | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 2 | Scenario 3 | Scenario 4 |
| UTMx (m) | 575,225 | 575,500 | 575,255 | 575,500 | 575,275 | 574,720 |
| UTMy (m) | 4,148,095 | 4,147,960 | 4,148,085 | 4,147,960 | 4,148,145 | 4,147,360 |
| Receptor Height (m) | 1.8 | 1.8 | 1.8 | 1.8 | 22.8 | 1.8 |
| Receptor Type | Residential | Residential | Residential | Residential | Residential | Residential |

6. Three exposure scenarios were modeled. Scenario 1 evaluates off-site receptors and begins at the start of construction. Scenario 2 evaluates off-site receptors and begins at the start of Area 2 Grading and Utilities construction. Scenario 3 evaluates on-site receptors and begins at the conclusion of Town Center and Residential/Shopping District construction when Area 1 residents move in.

**Abbreviations:**

kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
mg - miligram
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate
ug - microgram

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

## Table 60V
## Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, California

| Source Category | Chronic Hazard Index[1] (unitless) | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | Operations Only | |
| | Unmitigated[2] | | Mitigated[2] | | | |
| Project Contribution | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] | On-Site MEIR[3,5] | Off-Site MEIR[4,5] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| Construction | 0.23 | 0.11 | 8.9E-03 | 0.011 | -- | -- |
| Operational Generators | 4.2E-04 | 6.9E-04 | 4.0E-04 | 7.0E-04 | 4.6E-03 | 8.1E-04 |
| Operational Traffic | 2.4E-03 | 1.6E-03 | 2.6E-03 | 3.8E-03 | 2.6E-03 | 4.5E-03 |
| **Total Project Contribution** | **0.23** | **0.11** | **0.012** | **0.015** | **7.3E-03** | **5.3E-03** |

**Notes:**

1. The potential for exposure to result in adverse chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) from construction and operations to the non-cancer chronic REL for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient or HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the hazard quotients for all chemicals are summed, yielding a hazard index or HI.

   The chronic HI for each receptor was estimated using the following equation:

   $HI_{inh} = C_i / cREL$

   Where:

   $HI_{inh}$ = Chronic HI for the Inhalation Pathway (unitless)

   $C_i$ = Annual Average Air Concentration for Chemical "i" ($\mu g/m^3$)

   cREL = Chronic Reference Exposure Level ($\mu g/m^3$)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project. The maximum total chronic HI was identified across both proposed locations for the pumping station generator. The maximum unmitigated and mitigated on-site MEIR for Construction + Operations and the maximum on-site MEIR for Operations Only occurs when the pumping station generator is located at Location 2.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum chronic HI attributed to the emissions associated with the Project. The maximum total chronic HI was identified across both proposed locations for the pumping station generator. The maximum unmitigated off-site MEIR for Construction + Operations occurs when the pumping station generator is located at Location 2. The maximum mitigated off-site MEIR for Construction + Operations and the maximum off-site MEIR for Operations Only occurs when the pumping station generator is located at Location 1.

## Table 60V
## Project Variant Chronic Hazard Index at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, California

5. On-site and off-site MEIR locations are documented below:

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,245 | 575,400 | 575,015 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,065 | 4,148,040 | 4,148,175 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 4.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Elementary School | Recreational | Daycare Child (18 months +) |
| Year | Year 5 | Year 4 | Year 5 | Year 3 | Year I | Year I |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

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**Table 61V**
**Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR**
**Willow Village**
**Menlo Park, California**

| **Source Category** | **$PM_{2.5}$ Concentration[1] ($\mu g/m^3$)** | | | | | |
|---|---|---|---|---|---|---|
| | **Construction + Operations** | | | | **Operations Only** | |
| | **Unmitigated[2]** | | **Mitigated[2]** | | | |
| **Project Contribution** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** | **On-Site MEIR[3,5]** | **Off-Site MEIR[4,5]** |
| | **Scenario 3** | **Scenario 1** | **Scenario 3** | **Scenario 1** | **Scenario 3** | **Scenario 1** |
| Construction | 1.1 | 0.52 | 0.040 | 0.063 | -- | -- |
| Operational Generators | 2.1E-03 | 3.5E-03 | 2.2E-03 | 4.1E-03 | 4.4E-03 | 4.1E-03 |
| Operational Traffic | 0.046 | 0.034 | 0.106 | 0.14 | 0.12 | 0.14 |
| **Total Project Contribution** | **1.1** | **0.56** | **0.15** | **0.20** | **0.13** | **0.14** |

**Notes:**

1. $PM_{2.5}$ concentrations at off-site receptors include contributions from multiple phases of Project construction and subsequent Project operations. $PM_{2.5}$ concentrations at on-site receptors include contributions from overlapping construction emissions and subsequent Project operations.

   The $PM_{2.5}$ concentration at each receptor was estimated using the following equation:

   $C_i = E \times D_i$
   Where:
   C = Concentration of $PM_{2.5}$ at receptor "i" ($\mu g/m^3$)
   $D_i$ = Dispersion factor associated with unit emissions at receptor "i" ($\mu g/m^3$)/(g/s)
   E = Emission Rate (g/s)

2. The Unmitigated Project reflects default construction off-road equipment fleet. The Mitigated Project reflects use of 95 percent Tier 4 construction off-road equipment before residents move on-site and 98 percent Tier 4 construction off-road equipment after residents move on-site. The other 5 percent and 2 percent (before and after on-site residents, respectively) are assumed to have Tier 2 engines. Unmitigated emissions are estimated to be much larger than mitigated emissions as a result of two assumptions made during the calculations: 1) the emission factor for Tractors/Loaders/Backhoes with low HP ratings is significantly higher than that of subsequently higher HP ranges and many construction equipment fall under this classification; and 2) many pieces of construction equipment such as Bobcats were conservatively classified as Tractors/Loaders/Backhoes rather than other equipment types with lower emission factors.

3. On-site Project MEIR was identified as the on-site sensitive receptor location with the maximum total PM2.5 concentration attributed to the emissions associated with the Project. The maximum total $PM_{2.5}$ concentration was identified across both proposed locations for the pumping station generator. The maximum unmitigated on-site MEIR for Construction + Operations occurs when the pumping station generator is located at Location 2. The mitigated maximum on-site MEIR for Construction + Operations and the maximimum on-site MEIR for Operations Only occurs when the pumping station generator is located at Location 1.

4. Off-site Project MEIR was identified as the off-site sensitive receptor location with the maximum total PM2.5 concentration attributed to the emissions associated with the Project. The maximum total $PM_{2.5}$ concentration was identified across both proposed locations for the pumping station generator. The maximum unmitigated off-site MEIR for Construction + Operations occurs when the pumping station generator is located at Location 2. The maximum mitigated off-site MEIR for Construction + Operations and the maximum off-site MEIR for Operations Only occurs when the pumping station generator is located at Location 1.

## Table 61V
## Project Variant $PM_{2.5}$ Concentration at Off-Site and On-Site MEIR
## Willow Village
## Menlo Park, California

5. On-site and off-site MEIR locations are documented below:

| MEIR by Scenario | MEIR Location | | | | | |
|---|---|---|---|---|---|---|
| | Construction + Operations | | | | | |
| | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] | On-Site MEIR[3] | Off-Site MEIR[4] |
| | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 | Scenario 3 | Scenario 1 |
| UTMx (m) | 575,235 | 575,160 | 575,265 | 575,420 | 575,385 | 575,420 |
| UTMy (m) | 4,148,065 | 4,148,040 | 4,148,115 | 4,147,980 | 4,148,085 | 4,147,980 |
| Receptor Height (m) | 4.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| Receptor Type | Residential | High School | Residential | Daycare Child (18 months +) | Recreational | Daycare Child (18 months +) |

**Abbreviations:**

µg - microgram
kg - kilogram
m - meter
MEIR - maximally exposed individual receptor
TRU - Transportation Refrigeration Unit
UTMx - Universal Transverse Mercator x-coordinate
UTMy - Universal Transverse Mercator y-coordinate

**References:**

OEHHA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Appendix 5.3

# Air Quality, Greenhouse Gas, and Energy Analysis of the Willow Village Project Variants

Prepared for
**Peninsula Innovation Partners, LLC**

Prepared by
**Ramboll US Corporation**
**San Francisco, California**

Project Number
**1690010687**

Date
**July 2022**

# ADDITIONAL INFORMATION REGARDING POTENTIAL HEALTH EFFECTS OF CRITERIA AIR POLLUTANT EMISSION IMPACTS

## WILLOW VILLAGE

## MENLO PARK, CALIFORNIA

# CONTENTS



## ATTACHMENTS

# 1. INTRODUCTION

This report presents an estimate of the potential health effects of the emissions of criteria pollutants that may result from the operation of Meta's mixed use development at Willow Village in Menlo Park, California (referred to hereafter as "the Proposed Project" or "Project").

## 1.1 Friant Ranch Decision

As background for this evaluation, Environmental Impact Reports (EIRs) prepared pursuant to the California Environmental Quality Act (CEQA) have long evaluated project-related health effects of toxic air contaminants, such as diesel particulate matter (PM), through quantitative and/or qualitative means relative to air district-issued thresholds of significance. However, EIRs historically have not evaluated the specific health effects of project-related increases in criteria pollutants,[1] other than to note and summarize scientific literature regarding the general effect of those pollutants on health. Instead, in accordance with air district-issued thresholds of significance and industry standard practice at the time, CEQA analysis historically and traditionally focused on estimating project-related mass emissions totals for criteria pollutants and, in certain cases, conducting dispersion modeling to assess impacts on local ambient air quality concentrations.

In this report, Ramboll presents one method that correlates project-related mass emissions totals for criteria pollutants to estimated health-based consequences. More specifically, in order to estimate the health effects of the increases of criteria pollutants for the proposed Project, Ramboll applied a photochemical grid model (PGM) and Comprehensive Air Quality Model with extensions (CAMx) to estimate the increases in concentrations of ozone and $PM_{2.5}$ in the region as a result of the emissions of criteria and precursor pollutants from the Project. We then applied a U.S. Environmental Protection Agency (USEPA)-authored program, the Benefits Mapping and Analysis Program Community Edition (BenMAP-CE, herein referred to as "BenMAP"),[2] to estimate the resulting health effects from the small increases in concentration. Only the health effects of ozone and $PM_{2.5}$ are estimated, as those are the pollutants that USEPA uses in BenMAP to estimate the health effects of emissions of NOx, VOCs, CO, $SO_2$, and $PM_{2.5}$. Ozone and $PM_{2.5}$ have the most critical health effects and thus are the emissions evaluated to determine the Project's health effects.

## 1.2 Additional Evaluation

This analysis estimates the health effects of criteria pollutants and their precursors, specifically those that are evaluated by the USEPA in rulemaking setting the national ambient air quality standards: NOx, VOC [also known as reactive organic gases, or ROG, which are virtually the same as VOC with some slight differences],[3] CO, ozone, $SO_2$, and $PM_{2.5}$. Consistent with USEPA's assessment of health effects of PM, our health effects evaluation

[1] Criteria pollutants are those pollutants with an air pollution standard or pollutants which are precursors to those with a standard. Pollutants with an air pollution standard include nitrogen dioxide, sulfur dioxide, ozone, carbon monoxide, particulate matter smaller than 2.5 microns in diameter and 10 microns in diameter ($PM_{2.5}$ and $PM_{10}$), and ozone. Precursor pollutants to criteria pollutants include oxides of nitrogen (NOx), oxides of sulfur (SOx), carbon monoxide (CO), and volatile organic compounds (VOCs).

[2] https://www.epa.gov/benmap/benmap-ce-manual-and-appendices.

[3] Reactive organic gas (ROG) emissions are quantified and modeled as VOCs in this assessment. ROG means total organic gases minus ARB's "exempt" compounds (e.g., methane, ethane, CFCs, etc.). ROG is similar, but not identical, to USEPA's term "VOC", which is based on USEPA's exempt list, which is slightly different from ARB's list.

focuses on $PM_{2.5}$ and not $PM_{10}$[4] as $PM_{2.5}$ has a much larger body of evidence that this size fraction is associated with health effects due to the sources, composition, chemical properties and lifetime in the atmosphere (USEPA, 2009). $PM_{2.5}$ is capable of penetrating deeper into the lungs because of their size compared to larger particles and this is believed to contribute to greater health effects. Consistent with USEPA health effects evaluations, the health effect functions in BenMAP for PM use fine particulate ($PM_{2.5}$) as the causal PM agent. VOCs are not a criteria air pollutant but, together with NOx and in the presence of sunlight, they form ozone and contribute to the formation of secondary $PM_{2.5}$ and thus are analyzed here. $SO_2$ and CO are not evaluated due to their small contribution to the formation of secondary $PM_{2.5}$ and ozone.  The health effects from ozone and $PM_{2.5}$ are examined for this Project because the USEPA has determined that these criteria pollutants would have the greatest effect on human health. The emissions of other criteria pollutants and precursors, including VOC and NOx, are analyzed in their contribution in the formation of ozone and secondary $PM_{2.5}$.

The evaluation presented herein serves to describe the potential health effects of the criteria pollutant emissions associated with the Project. This evaluation does not make a new significance determination.

[4] $PM_{10}$ is defined as particulate matter with a nominal mean aerodynamic diameter less than or equal to 10 µm.

# 2. TECHNICAL APPROACH

The USEPA's air quality modeling guidelines (Appendix W[5]) and ozone and $PM_{2.5}$ modeling guidance[6] recommend using a PGM to estimate ozone and secondary $PM_{2.5}$ concentrations. The USEPA's modeling guidance does not recommend specific PGMs but provides procedures for determining an appropriate PGM on a case-by-case basis. Both the modeling guidelines and guidance note that the CAMx[7] and the Community Multiscale Air Quality (CMAQ[8]) PGMs have been used extensively in the past and would be acceptable PGMs. As such, the USEPA has prepared a memorandum[9] documenting the suitability for using CAMx and CMAQ for ozone and secondary $PM_{2.5}$ modeling of single-sources or group of sources.

The first step in the process is to run the PGM with appropriate information to assess the increases in ambient air concentrations that the Project emissions may cause. PGMs require a database of information, including the spatial allocation of emissions, in the area to be modeled. This includes both base (background/existing) emissions and Project emissions. The latest publicly available PGM database for Northern California was developed by the Bay Area Air Quality Management District (BAAQMD) in support of the 2000 Central California Ozone Study (CCOS),[10] and was adapted for this analysis. The model domain used is discussed further in Attachment B and encompasses an area of 740 kilometers (km) by 740 km centered around the Central Valley of California. The computational domain roughly extends from Shasta and Trinity counties at the north, to the northern portion of Los Angeles County to the south. The domain includes regions of the Pacific Ocean on its western portion and parts of Nevada on its eastern portion. This PGM database is tailored for Northern California using California-specific input tools (e.g., the EMission FACtors (EMFAC)[11] mobile source emissions model) and uses a high-resolution 4-km horizontal grid to better simulate meteorology and air quality in the complex terrain and coastal environment of California. Project emissions included $NO_X$, respirable ($PM_{10}$) and fine ($PM_{2.5}$) primary PM, and VOCs. As discussed above, $NO_X$ and VOC are precursors to ozone and are also precursors to secondarily formed $PM_{2.5}$.

To estimate the potential outcome of the proposed Project's emissions on ambient air concentrations, the Project's annual emissions were added to the CAMx 4-km annual PGM modeling database.[12] Operational emissions from the Project were estimated as described in the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report.[13] Incremental operational emissions for full buildout were modeled.

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5 https://www3.epa.gov/ttn/scram/appendix_w/2016/AppendixW_2017.pdf.

6 https://www3.epa.gov/ttn/scram/guidance/guide/O3-PM-RH-Modeling_Guidance-2018.pdf.

7 http://www.camx.com/.

8 https://www.epa.gov/cmaq.

9 https://www3.epa.gov/ttn/scram/guidance/clarification/20170804-Photochemical_Grid_Model_Clarification_Memo.pdf.

10 http://www.baaqmd.gov/about-air-quality/research-and-data/research-and-modeling.

11 https://www.arb.ca.gov/emfac/.

12 BAAQMD performed WRF meteorological modeling for the CCOS 4-km domain and 2012 calendar year that has been processed by WRFCAMx to generate CAMx 2012 4-km meteorological inputs for the CCOS domain. The CMAQ 2012 emissions have been converted to the format used by CAMx using the CMAQ2CAMx processor.

13 To the extent that conservative inputs were used to estimate Project-related criteria pollutants and precursors, the analysis provided herein also is conservatively influenced by those inputs.

For use in PGMs, each Project emissions source must be spatially distributed across the modeling grid cells so that they can be incorporated into the gridded emission inventory. The mitigated incremental emission inventory for the Project at full buildout was used in the analysis. This includes architectural coatings, VOCs in consumer products, limited natural gas combustion for commercial culinary, landscaping equipment, emergency generators, and emissions associated with motor vehicle use. The emissions from architectural coatings, consumer products, limited natural gas combustion, landscaping equipment, and emergency generators are located onsite, and were therefore allocated to the grid cell representing the Project site. The mobile source category includes various fleets which are spatially distributed in both the Project site's grid cells, as well as offsite grid cells along nearby travel routes. Annual emission estimates from the Project were spatially gridded, temporally allocated, and chemically speciated to be used for photochemical grid modelling using the Sparse Matrix Operator Kerner Emissions (SMOKE) emissions modelling system supported by the USEPA. The emissions inventory, spatial allocation, and SMOKE inputs and outputs are shown in **Attachment A.**

As discussed above, the Northern California 2000 CCOS modeling database was used for this Project. The Northern California 4-km PGM modeling database is based on a 2012 base meteorological year. The 2035 future year projections were used for this analysis, as described in Attachment B. The Project's emissions were isolated by the source apportionment tools in CAMx to obtain the incremental ozone and $PM_{2.5}$ concentration changes due to the Project's emissions. More details and inputs for the PGM modeling are included in **Attachment B.**

Following completion of the CAMx source apportionment modeling, Ramboll used the USEPA's BenMAP program (USEPA 2022a, USEPA 2022b) to estimate the potential health effects of the Project's contribution to ozone and $PM_{2.5}$ concentrations. BenMAP uses the concentration estimates produced by CAMx, along with population and health effect concentration-response (C-R) functions, to estimate various health effects of the concentration increases. BenMAP has a wide history of applications by the USEPA and others, including for local-scale analysis[14] as needed for assessing the health effects of a project's emissions. We used the BenMAP health effects C-R functions that have been used in national rulemaking, such as the health effects assessments for $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) (USEPA 2010, USEPA 2022b). The health endpoints used for $PM_{2.5}$ include mortality (all causes), hospital admissions (respiratory, asthma, cardiovascular), emergency room visits (asthma, cardiovascular), and acute myocardial infarction (non-fatal). For ozone, the endpoints are mortality (respiratory), emergency room visits (respiratory), and hospital admissions (respiratory). Details on the BenMAP inputs and outputs and definitions for the health effects are shown in **Attachment C.**

[14] https://www.epa.gov/benmap/benmap-ce-applications-articles-and-presentations#local.

# 3. RESULTS

This section presents the results of the health effects analysis for the incremental increases in $PM_{2.5}$ and ozone resulting from primary and precursor emissions for these constituents. The results presented here describe the potential health effects of the criteria pollutant emissions associated with the Project, and the results themselves do not constitute a new significance determination.

There are a number of conservative assumptions built into this evaluation, beginning with the quantification of emissions themselves. These conservative assumptions include, but are not limited to, the following:

- Mitigated incremental emissions without inclusion of reductions from EV charging were conservatively modeled. Incorporation of reductions due to EV charging would result in lower health effect estimates;
- Emissions reductions associated with reduced natural gas usage with the Project compared to existing conditions have conservatively not been included in this analysis (discussed further in Appendix A);
- Emissions reductions associated with various subcategories of mobile emissions (e.g., reductions in NOx emissions from trucks during running mode) have conservatively not been included in this analysis (discussed further in Appendix A);
- Assumption that health effects occur at any concentration, including small incremental concentrations (discussed further in Attachment C); and
- Assumption that all $PM_{2.5}$ is of equal toxicity (discussed further in Attachment C).

As such, results presented below are meant to represent an upper bound of potential health effects, and actual effects may be zero. For example, should health effects in fact only occur above a certain threshold, and the increment from the Project not cause an exceedance of that threshold, actual health effects could be zero.

## 3.1 Potential Health Effects Associated with the Project

Overall, the estimated change in health effects from ozone and $PM_{2.5}$ associated with the Project's additional emissions are minimal relative to background incidences. **Tables 3-1 and 3-2** below show the annual percent of background health incidence for $PM_{2.5}$ and ozone health effects associated with the Project. The "background health incidence" is an estimate of the average number of people that suffer from some adverse health effect in a given population over a given period of time, in the absence of additional emissions from the Project. Health incidence rates and other health data are typically collected by the government as well as the World Health Organization. Background health incident rates presented in this report are over the full model domain, as defined in Attachment B, which has a projected population of 22,502,033 in 2035. Project-related health incidences occur both in closer proximity to Project emissions, particularly for $PM_{2.5}$ health effects (see Attachment B for maps of modeled concentration changes), or over a large area due to the regional nature of emission dispersion and photochemical reactions that occur, particularly for ozone health effects (concentration changes also shown in Attachment B). When taken into context, the small increase in incidences and the small percent of the number of background incidences indicate that these health effects are minimal in a developed environment.

**Table 3-1. BenMAP-Estimated Annual Mean $PM_{2.5}$ Health Effects of the Project Emissions Across the Northern California Model Domain** [1]

| Health Endpoint[2] | Project Mean as Percent of Background Health Incidence (%) (Annual) | Background Health Incidence (Annual) |
|---|---|---|
| Emergency Room Visits, Asthma [0-99] | 0.000080% | 115,302 |
| Emergency Room Visits, Cardiovascular [0-99] | 0.0000093% | 441,046 |
| Mortality, All Cause [30-99] | 0.000086% | 256,043 |
| Hospital Admissions, Asthma [0-64] | 0.000049% | 13,394 |
| Hospital Admissions, All Cardiovascular [65-99] (Bell et al., 2015) | 0.000011% | 220,836 |
| Hospital Admissions, Respiratory [65-99] (Bell et al., 2015) | 0.0000034% | 82,964 |
| Acute Myocardial Infarction, Nonfatal [18-24] | 0.000040% | 27 |
| Acute Myocardial Infarction, Nonfatal [25-44] | 0.000036% | 1,583 |
| Acute Myocardial Infarction, Nonfatal [45-54] | 0.000033% | 4,025 |
| Acute Myocardial Infarction, Nonfatal [55-64] | 0.000037% | 6,762 |
| Acute Myocardial Infarction, Nonfatal [65-99] | 0.000035% | 28,174 |

[1] Health effects are shown terms of incidences of each health endpoint and how it compares to the base values (2035 base year health effect incidences or "background health incidence"). Health effects and background health incidences are across the Northern California model domain.
[2] Affected age ranges are shown in square brackets.

Annual mean $PM_{2.5}$-related health effects attributed to Project-related increases in ambient air concentrations include asthma-related emergency room visits (0.092 incidences per year), cardiovascular-related emergency room visits (0.041 incidences per year), asthma-related hospital admissions (0.0066 incidences per year), all cardiovascular-related hospital admissions (0.023 incidences per year), all respiratory-related hospital admissions (0.0028 incidences per year), mortality (0.22 incidences per year), and nonfatal acute myocardial infarction (0.014 incidences per year across all age groups).

**Table 3-2. BenMAP-Estimated Annual Mean Ozone Health Effects of the Project Emissions Across the Northern California Model Domain[1]**

| Health Endpoint[2] | Project Mean as Percent of Background Health Incidence (%) (Annual) | Background Health Incidence (Annual) |
|---|---|---|
| Hospital Admissions, All Respiratory [65-99] | 0.000025% | 63,783 |
| Mortality, Respiratory [30-99] | 0.00035% | 19,099 |
| Emergency Room Visits, Asthma [0-17] | 0.00048% | 39,464 |
| Emergency Room Visits, Asthma [18-99] | 0.00029% | 38,023 |

1 Health effects are shown terms of incidences of each health endpoint and how it compares to the base values (2035 base year health effect incidences, or "background health incidence"). Health effects and background health incidences are across the Northern California model domain.
2 Affected age ranges are shown in square brackets.

Annual mean ozone-related health effects attributed to Project-related increases in ambient air concentrations include respiratory-related hospital admissions (0.016 incidences per year), respiratory-related mortality (0.067 incidences per year), and asthma-related emergency room visits (0.19 incidences for ages 0-17 and 0.11 incidences for ages 18-99).

The health effects from ozone and $PM_{2.5}$ are minimal in light of background incidences. We did not quantify the potential health effects from other criteria air pollutants, consistent with how USEPA quantifies the health impacts and economic costs for criteria air pollutants (other than ozone and $PM_{2.5}$). Specifically, USEPA relies on studies that evaluate the health effects of $PM_{2.5}$ as a surrogate for general PM effects (including $PM_{10}$) in health effect assessments (e.g., USEPA 2022c). In addition, for $NO_2$, USEPA has noted that uncertainty remains regarding the independent effects of $NO_2$ from other air pollutants, including ozone and $PM_{2.5}$ (USEPA, 2016). Additionally, in 2017, USEPA concluded that a quantitative risk assessment was not supported for $NO_2$, stating that there were significant limitations in the available epidemiological studies including "the potential for co-pollutant confounding of the $NO_2$ association, potential bias due to exposure measurement error, and the shape of the concentration-response function." (USEPA, 2017)

Project Variants and Alternatives

Ramboll's analysis of potential health effects due to Project emissions evaluated the proposed Project mitigated incremental emissions upon full Project build-out. Potential health effects due to Project variants or alternatives would be similar to or less than those modeled in Ramboll's analysis as incremental operational criteria pollutant emissions, specifically ROG, NOx, and $PM_{2.5}$ would be similar to or less than those emissions modeled in the above referenced analysis.

Further, any differences in source types and spatial allocation of emissions in the Project Variants and Alternatives is expected to be minimal. In cases such as this, where overall emissions changes are small, and where there are minimal changes to the sources of emissions and spatial allocations, it is appropriate to use a linear model, based on the refined modeling already completed, to estimate the corresponding changes in health effects due to different Project scenarios. As such, it can be concluded that potential health effects due to the operational emissions generated from a Project Variant or Alternative would be similar to or less than those presented above.

## 3.2 Uncertainty

Analyses that evaluate the changes in concentrations resulting from individual sources and the health impacts of increases or decreases in pollutants as a result of regulation on a localized basis are routinely done. This analysis does not tie the changes in concentration to a specific health effect in an individual; however, it does use scientific correlations of certain types of health effects from pollution to estimate effects on the population at large.

There is a degree of uncertainty in these results from a combination of the uncertainty in the emissions themselves, the change in concentration resulting from the PGM, and the uncertainty of the application of the C-R functions. All simulations of physical processes, whether ambient air concentrations or health effects from air pollution, have a level of uncertainty associated with them due to simplifying assumptions. The overall uncertainty is a combination of the uncertainty associated with each piece of the modeling study, in this case, the emissions quantification, the emissions model, the PGM, and BenMAP. While these results reflect a level of uncertainty, regulatory agencies, including the USEPA have judged that, even with the uncertainty, they provide sufficient information to the public to allow them to understand the potential health effects of increases or decreases in air pollution.

### 3.2.1 PGM Uncertainty

PGMs generally represent the state-of-the-science when the treatment of photochemically formed air pollution is required over multiple spatial scales (e.g., from single-source to continental). PGMs are part of a modeling system in which there are several other major components that determine model performance, including meteorology, emissions inventories (including background), and chemical mechanisms, all of which have associated uncertainties, as discussed further in Attachment B.

Despite these complexities and associated uncertainties, the USEPA recommends using PGMs for a variety of applications including State Implementation Plans and Regional Haze Planning, and CAMx or CMAQ specifically for single-source modeling of ozone and secondary $PM_{2.5}$. The USEPA believes that the relative change in the PGM-predicted concentrations (e.g., the incremental changes due to the emissions from a single-source) is more accurate and reliable than the total predicted concentrations (USEPA, 2020a).

### 3.2.2 C-R Function Uncertainty

The approach and methodology of this analysis ensures that the uncertainty is of a conservative nature. In addition to the conservative assumptions built into the emissions noted above, there are a number of assumptions built into the application of C-R functions in BenMAP that may lead to an overestimation of health effects. In the Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards (NAAQS) for Particulate Matter prepared by the EPA (USEPA, 2022c), the EPA acknowledges the many factors of uncertainty in selected C-R functions and resulting risk estimates, including the shape of the exposure-response function and statistical uncertainty (especially at low concentrations), temporal mismatch between ambient air data and the health effect, exposure measurement error in the epidemiological studies that produced the C-R function, potential confounding of the effect of PM2.5 or ozone on mortality, and compositional and source differences of PM, all of which similarly apply to the results presented above.

Another uncertainty highlighted by the USEPA (2012, 2022c) which applies to potential health effects from both $PM_{2.5}$ and ozone, is the assumption of a log-linear response between exposure and health effects, without consideration for a threshold concentration below which effects may not be measurable. In the latest USEPA Policy Assessment for PM (USEPA, 2022c), while it is noted that some studies show evidence supporting a linear, no-threshold relationship, the USEPA continues to acknowledge that interpreting the shapes of concentration-response relationships is a recognized uncertainty, particularly at lower $PM_{2.5}$ concentrations, where lower data density, possible influence of measurement error, and variability among individuals with response to air pollution health effects can obscure the existence of a threshold or nonlinear relationship. Without consideration of a threshold concentration, any changes in air pollution are assumed to adversely affect health, which is a conservative assumption.

For $PM_{2.5}$ health effects, the USEPA has also stated that results from various studies have shown the importance of considering particle size, composition, and particle source in determining the health effects of PM (USEPA, 2009). Further, the USEPA (2009) found that studies have reported that particles from industrial sources and from coal combustion appear to be the most significant contributors to PM-related mortality, consistent with the findings by Rohr and Wyzga (2012) and others. This is particularly important to note here, as the majority of PM emissions generated from the Project are from brakewear, tirewear, and entrained roadway dust (see Attachment A), and not from combustion. Therefore, by not considering the relative toxicity of PM components, the results presented here are conservative.

For both the $PM_{2.5}$ and ozone health effects calculated, each of the pollutants may be a confounder of the other. That is, in studies that only evaluate health effects from $PM_{2.5}$ exposures, the observed health effects could actually be partly due to ozone, but are attributed fully to $PM_{2.5}$, yielding a higher effect estimate for $PM_{2.5}$. Thus, while C-R functions are from studies that evaluated the effects for each pollutant individually, while sometimes adjusting for the other as a co-pollutant, both air pollutants could contribute to the health effect outcomes evaluated, and thus the overall health effects from a single pollutant may be overstated.

In summary, and with consideration of the uncertainty discussed above, health effects presented in this report are conservatively estimated, and the actual effects may be zero.

Additional discussion of the uncertainty associated with C-R functions and health effect estimates is included in Attachment C.

# REFERENCES

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# ATTACHMENT A
# EMISSIONS INVENTORY, SPATIAL ALLOCATION, AND SMOKE SETUP

# 1. INTRODUCTION

Operational emissions from the Project were estimated using methodologies consistent with the California Emissions Estimator Model (CalEEMod®) and Project-specific data, where available, and CalEEMod defaults. The model employs widely accepted calculation methodologies for emission estimates combined with appropriate default data if site-specific information is not available.

Annual emission estimates from the Project need to be spatially gridded, temporally allocated, and chemically speciated to be used for photochemical grid modeling. The Sparse Matrix Operator Kerner Emissions (SMOKE) emissions modeling system (Coats, 1996; Coats and Houyoux, 1996)[15] is used for this process.

# 2. PROJECT EMISSIONS AND SPATIAL ALLOCATION

Emissions were estimated for the Project to support the photochemical grid model (PGM) and were allocated into 4 km x 4 km grid cells. This section describes those emissions and how they were spatially allocated.

## 2.1 Project Emissions and Spatial Allocation

For use in PGMs, emissions must be spatially allocated over the area so that they can be incorporated into the baseline gridded emission inventory, as developed by the Bay Area Air Quality Management District (BAAQMD), and adapted for this analysis as discussed in Attachment B. The average daily incremental emission inventory modeled for the Project is shown below in **Table 2-1**.[16] Incremental emissions were calculated as the difference between the full Project buildout mitigated emissions and the 2019 baseline emissions. For any emission categories which showed a reduction from 2019 to full buildout, the reduction in emissions were conservatively zeroed out and the reduction was not included in the analysis.[17] For example, emission reductions due to a decrease in natural gas usage were conservatively not modeled here. Similarly, this approach was applied to increments calculated for mobile subcategories, and resulted in some mobile emission reductions being conservatively removed from the analysis, e.g., running NOx emissions from truck activity. As such, this analysis is conservative and the emissions presented in **Table 2-1** below are higher than those presented in the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report. Project emissions modeled in the PGM include oxides of nitrogen (NOx), reactive organic gases (ROG), and fine primary particulate matter ($PM_{2.5}$). Since some of these pollutants incorporate a wide range of chemical species (e.g., ROG and PM), the Project emissions were further speciated into detailed chemical species or groups of species to be used as inputs for the PGM's robust chemistry solver. $NO_X$ and ROG are precursors to ozone and are also precursors to secondarily formed $PM_{2.5}$. Mobile source emissions were split into categories based on the EMFAC2021 emission rates. The following fleets were evaluated: Cars, Trucks, Shuttles, On-Demand Vehicles, and San Mateo County Mix (representing vehicle activity in the Town Square District and Residential/Shopping

[15] https://www.cmascenter.org/smoke/

[16] Average daily emissions are modeled here as the Project's operations are generally consistent throughout the year.

[17] To be conservative and to limit model complexities, we do not model negative emissions and instead set to zero. Overall, this causes the total emissions modeled to be higher than what is presented in the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report.

District). Fleets at full buildout conservatively use 2026 emission factors; refer to the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report for additional detail. For PM, less than 2.5 microns in diameter ($PM_{2.5}$) emissions are used in the modeling; less than 10 microns in diameter ($PM_{10}$) emissions are presented for information below.

**Table 2-1. Average Daily Incremental Emissions**

| Emission Category | ROG/VOC | NOx | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|
| | lbs/day | lbs/day | lbs/day | lbs/day |
| Mobile | 38 | 38 | 37 | 7.3 |
| Diurnal | 11 | -- | -- | -- |
| Hotsoak | 3.0 | -- | -- | -- |
| Idling Exhaust | 0.15 | 0.30 | 7.4E-04 | 5.4E-04 |
| Brakewear | -- | -- | 3.9 | 1.4 |
| Tirewear | -- | -- | 3.7 | 1.0 |
| Road Dust | -- | -- | 29 | 4.3 |
| Running Exhaust | 3.3 | 18 | 0.50 | 0.45 |
| Running Loss | 8.4 | -- | -- | -- |
| Starting Exhaust | 12 | 19 | 0.12 | 0.12 |
| Architectural Coatings | 2.0 | -- | -- | -- |
| Consumer Products | 48.9 | -- | -- | -- |
| Landscaping | 2.1 | 0.8 | 0.4 | 0.4 |
| Energy | -- | -- | -- | -- |
| Emergency Generators | 0.8 | 6.7 | 0.2 | 0.2 |
| **Total** | **92** | **45** | **38** | **7.9** |

**Table 2-2** below shows the breakdown of incremental mobile emissions by fleet, after removing any subcategories that resulted in a negative increment.

**Table 2-2. Daily Incremental Emissions by Fleet**

| Emission Process | CAP Emissions (lb/day) | | | |
|---|---|---|---|---|
| | ROG/VOC | NOx | PM10 | PM2.5 |
| **On-Road Mobile - San Mateo County Mix** | | | | |
| Diurnal | 7.9 | 0 | 0 | 0 |
| Hotsoak | 2.3 | 0 | 0 | 0 |
| Idling Exhaust | 0.11 | 0.015 | 1.1E-04 | 8.3E-05 |
| Brakewear | 0 | 0 | 2.7 | 1.0 |
| Tirewear | 0 | 0 | 2.7 | 0.71 |
| Resting Loss | 0 | 0 | 0 | 0 |
| Road Dust | 0 | 0 | 20 | 3.0 |
| Running Exhaust | 3.2 | 17 | 0.44 | 0.40 |
| Running Loss | 6.4 | 0 | 0 | 0 |
| Starting Exhaust | 10 | 16 | 0.10 | 0.091 |
| **Subtotal** | **30** | **33** | **26** | **5.2** |
| **On-Road Mobile - Cars** | | | | |
| Diurnal | 2.8 | 0 | 0 | 0 |
| Hotsoak | 0.63 | 0 | 0 | 0 |
| Idling Exhaust | 0 | 0 | 0 | 0 |
| Brakewear | 0 | 0 | 0.79 | 0.27 |
| Tirewear | 0 | 0 | 0.85 | 0.21 |
| Resting Loss | 0 | 0 | 0 | 0 |
| Road Dust | 0 | 0 | 8.0 | 1.2 |
| Running Exhaust | 0.013 | 0.0077 | 0.057 | 0.051 |
| Running Loss | 1.9 | 0 | 0 | 0 |
| Starting Exhaust | 2.3 | 1.6 | 0.026 | 0.023 |
| **Subtotal** | **7.7** | **1.6** | **10** | **1.8** |
| **On-Road Mobile - On-Demand Vehicles** | | | | |
| Diurnal | 0.12 | 0 | 0 | 0 |
| Hotsoak | 0.028 | 0 | 0 | 0 |
| Idling Exhaust | 0 | 0 | 0 | 0 |
| Brakewear | 0 | 0 | 0.031 | 0.011 |
| Tirewear | 0 | 0 | 0.038 | 0.0093 |
| Resting Loss | 0 | 0 | 0 | 0 |
| Road Dust | 0 | 0 | 0.36 | 0.053 |
| Running Exhaust | 0 | 0 | 0.0018 | 0.0016 |
| Running Loss | 0.086 | 0 | 0 | 0 |
| Starting Exhaust | 0.022 | 0.055 | 0.0013 | 0.0012 |
| **Subtotal** | **0.26** | **0.055** | **0.43** | **0.076** |

**Table 2-2. Daily Incremental Emissions by Fleet**

| Emission Process | CAP Emissions (lb/day) | | | |
|---|---|---|---|---|
| | ROG/VOC | NOx | PM10 | PM2.5 |
| **On-Road Mobile - Trucks** | | | | |
| Diurnal | 0 | 0 | 0 | 0 |
| Hotsoak | 0 | 0 | 0 | 0 |
| Idling Exhaust | 0.018 | 0.019 | 6.3E-04 | 4.6E-04 |
| Brakewear | 0 | 0 | 0.13 | 0.031 |
| Tirewear | 0 | 0 | 0.023 | 0.0045 |
| Resting Loss | 0 | 0 | 0 | 0 |
| Road Dust | 0 | 0 | 0.17 | 0.025 |
| Running Exhaust | 0 | 0 | 1.4E-05 | 3.4E-06 |
| Running Loss | 0 | 0 | 0 | 0 |
| Starting Exhaust | 5.3E-06 | 0.10 | 0 | 0 |
| **Subtotal** | **0.018** | **0.12** | **0.32** | **0.061** |
| **On-Road Mobile - Shuttles** | | | | |
| Diurnal | 0 | 0 | 0 | 0 |
| Hotsoak | 0 | 0 | 0 | 0 |
| Idling Exhaust | 0.020 | 0.27 | 0 | 0 |
| Brakewear | 0 | 0 | 0.28 | 0.14 |
| Tirewear | 0 | 0 | 0.071 | 0.026 |
| Resting Loss | 0 | 0 | 0 | 0 |
| Road Dust | 0 | 0 | 0.022 | 0.0033 |
| Running Exhaust | 0.030 | 1.3 | 0 | 0 |
| Running Loss | 0 | 0 | 0 | 0 |
| Starting Exhaust | 0 | 1.2 | 0 | 0 |
| **Subtotal** | **0.050** | **2.7** | **0.37** | **0.17** |
| **Total Mobile Emissions** | **38** | **38** | **37** | **7.3** |

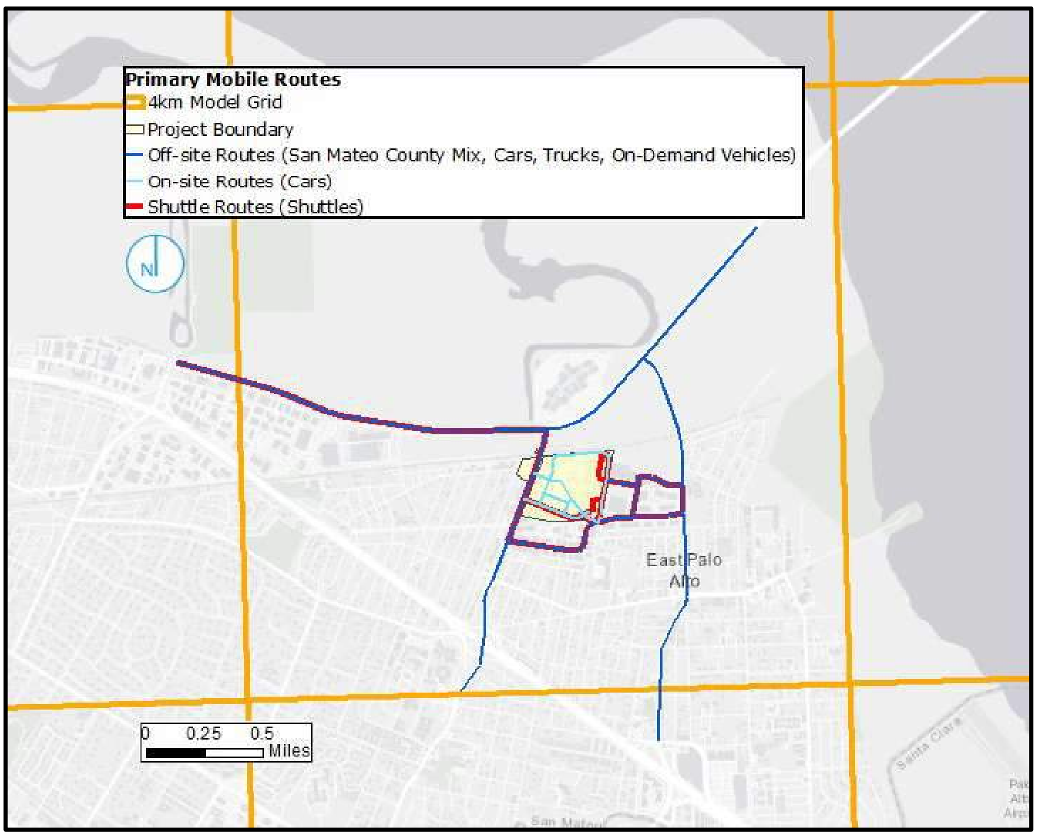
**Table 2-3** provides a summary of the spatial distribution of mobile emissions across each of the mobile fleets evaluated. San Mateo County Mix, On-Demand, and Truck fleets are spatially allocated to off-sites routes; the Cars fleet is spatially allocated to both on-site and off-site routes; and the Shuttle fleet is allocated to designated shuttle routes. Off-site, on-site, and shuttle routes are shown in **Figure 2-1**. Spatial allocation of off-site fleets (Cars, Trucks, On-Demand Vehicles, and San Mateo County Mix) were calculated consistent with the CEQA Air Quality, Greenhouse Gas, and Health Risk Assessment Technical Report, based on the traffic volumes by roadway and expected fleet mix provided by the Transportation Engineer. The Cars fleet travels on both on-site and off-site routes. Emissions from shuttles and on-site routes were assumed to be distributed evenly along their respective routes, calculated by dividing individual segment lengths by the total route length.

**Table 2-3. Roadway Spatial Allocation by Fleet**

| Fleet | Emissions Allocation by Roadway (%) | | |
|---|---|---|---|
| | On-Site | Off-Site | Shuttles |
| Cars | 73.7% | 26.3% | -- |
| Trucks | -- | 100% | -- |
| On-Demand Vehicles | -- | 100% | -- |
| Shuttles | -- | -- | 100% |
| San Mateo County Mix | -- | 100% | |

Project emissions are allocated across the Project site into 4 km x 4 km grid cells for the PGM. **Figure 2-1** below shows the Project boundary overlaid with the 4-km grid. Off-site, on-site, and shuttle routes are shown as well, with allocations as outlined in Table 2-3 above.

**Figure 2-1. Project Site and Modeled Roadways**




## 2.2 Converting Project Inventories to SMOKE Input Format

The first step in the emissions processing was to convert the Project emission inventory into the Flat File 2010 (FF10) format for input to SMOKE. We assigned appropriate Source

Classification Codes (SCCs) to the Project emissions sources. **Table 2-4** provides SCC assigned to each project source.

**Table 2-4. Assigned SCC to Project Emission Sources**

| Emission Source | SCC | SCC Description |
|---|---|---|
| Mobile -LDA | 220100111B | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Vehicles (LDGV); Rural Interstate: Brake Wear |
| Mobile -LDA | 220100111S | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Vehicles (LDGV); Rural Interstate: Start |
| Mobile -LDA | 220100111T | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Vehicles (LDGV); Rural Interstate: Tire Wear |
| Mobile -LDA | 220100111V | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Vehicles (LDGV); Rural Interstate: Evap (except Refueling) |
| Mobile -LDA | 220100111X | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Vehicles (LDGV); Rural Interstate: Exhaust |
| Mobile -LDT1 | 220102011B | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5); Rural Interstate: Brake Wear |
| Mobile -LDT1 | 220102011S | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5); Rural Interstate: Start |
| Mobile -LDT1 | 220102011T | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5); Rural Interstate: Tire Wear |
| Mobile -LDT1 | 220102011V | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5); Rural Interstate: Evap (except Refueling) |
| Mobile -LDT1 | 220102011X | Mobile Sources; Highway Vehicles - Gasoline; Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5); Rural Interstate: Exhaust |
| Mobile -HHDT | 220107011B | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Brake Wear |
| Mobile -HHDT | 220107011I | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Idling |
| Mobile -HHDT | 220107011S | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Start |
| Mobile -HHDT | 220107011T | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Tire Wear |
| Mobile -HHDT | 220107011V | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Evap (except Refueling) |
| Mobile -HHDT | 220107011X | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Interstate: Exhaust |
| Mobile -HHDT | 220107013B | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Brake Wear |

| Table 2-4. Assigned SCC to Project Emission Sources | | |
|---|---|---|
| **Emission Source** | **SCC** | **SCC Description** |
| Mobile -HHDT | 220107013I | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Idling |
| Mobile -HHDT | 220107013S | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Start |
| Mobile -HHDT | 220107013T | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Tire Wear |
| Mobile -HHDT | 220107013V | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Evap (except Refueling) |
| Mobile -HHDT | 220107013X | Mobile Sources; Highway Vehicles - Gasoline; Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV); Rural Other Principal Arterial: Exhaust |
| Mobile -MC | 220108011B | Mobile Sources; Highway Vehicles - Gasoline; Motorcycles (MC); Rural Interstate: Brake Wear |
| Mobile -MC | 220108011S | Mobile Sources; Highway Vehicles - Gasoline; Motorcycles (MC); Rural Interstate: Start |
| Mobile -MC | 220108011T | Mobile Sources; Highway Vehicles - Gasoline; Motorcycles (MC); Rural Interstate: Tire Wear |
| Mobile -MC | 220108011V | Mobile Sources; Highway Vehicles - Gasoline; Motorcycles (MC); Rural Interstate: Evap (except Refueling) |
| Mobile -MC | 220108011X | Mobile Sources; Highway Vehicles - Gasoline; Motorcycles (MC); Rural Interstate: Exhaust |
| Mobile -LDA | 223000111B | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Vehicles (LDDV); Rural Interstate: Brake Wear |
| Mobile -LDA | 223000111T | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Vehicles (LDDV); Rural Interstate: Tire Wear |
| Mobile -LDA | 223000111X | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Vehicles (LDDV); Rural Interstate: Exhaust |
| Mobile -LDDT | 223006011B | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT); Rural Interstate: Brake Wear |
| Mobile -LDDT | 223006011T | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT); Rural Interstate: Tire Wear |
| Mobile -LDDT | 223006011X | Mobile Sources; Highway Vehicles - Diesel; Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT); Rural Interstate: Exhaust |
| Mobile - LHDT1 | 223007111B | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 2B; Rural Interstate: Brake Wear |
| Mobile - LHDT1 | 223007111I | Mobile Sources; Highway Vehicles – Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 2B; Rural Interstate: Idling |

**Table 2-4. Assigned SCC to Project Emission Sources**

| Emission Source | SCC | SCC Description |
|---|---|---|
| Mobile - LHDT1 | 223007111T | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 2B; Rural Interstate: Tire Wear |
| Mobile - LHDT1 | 223007111X | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 2B; Rural Interstate: Exhaust |
| Mobile -MHDT | 2230072110 | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5; Rural Interstate: Total |
| Mobile -MHDT | 223007211B | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5; Rural Interstate: Brake Wear |
| Mobile -MHDT | 223007211I | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5; Rural Interstate: Idling |
| Mobile -MHDT | 223007211T | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5; Rural Interstate: Tire Wear |
| Mobile -MHDT | 223007211X | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5; Rural Interstate: Exhaust |
| Mobile -HHDT | 223007311B | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7; Rural Interstate: Brake Wear |
| Mobile -HHDT | 223007311I | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7; Rural Interstate: Idling |
| Mobile -HHDT | 223007311S | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7; Rural Interstate: Start |
| Mobile -HHDT | 223007311T | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7; Rural Interstate: Tire Wear |
| Mobile -HHDT | 223007311X | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7; Rural Interstate: Exhaust |
| Mobile -LDT1 | 220932008T | Mobile Sources; Highway Vehicles - Electricity; Light Commercial Truck: All on and off-network processes except refueling: Tire Wear |
| Mobile -OBUS | 220941008B | Mobile Sources; Highway Vehicles - Electricity; Intercity Bus: All on and off-network processes except refueling: Brake Wear |
| Mobile -OBUS | 220941008T | Mobile Sources; Highway Vehicles - Electricity; Intercity Bus: All on and off-network processes except refueling: Tire Wear |
| Mobile -OBUS | 220942008B | Mobile Sources; Highway Vehicles - Electricity; Transit Bus: All on and off-network processes except refueling: Brake Wear |
| Mobile -OBUS | 220942008T | Mobile Sources; Highway Vehicles - Electricity; Transit Bus: All on and off-network processes except refueling: Tire Wear |
| Mobile -SBUS | 220943008B | Mobile Sources; Highway Vehicles - Electricity; School Bus: All on and off-network processes except refueling: Brake Wear |

**Table 2-4. Assigned SCC to Project Emission Sources**

| Emission Source | SCC | SCC Description |
|---|---|---|
| Mobile -SBUS | 220943008T | Mobile Sources; Highway Vehicles - Electricity; School Bus: All on and off-network processes except refueling: Tire Wear |
| Mobile -MDV | 220952008T | Mobile Sources; Highway Vehicles - Electricity; Single Unit Short-haul Truck: All on and off-network processes except refueling: Tire Wear |
| Mobile -MDV | 220953008B | Mobile Sources; Highway Vehicles - Electricity; Single Unit Long-haul Truck: All on and off-network processes except refueling: Brake Wear |
| Mobile -MDV | 220953008T | Mobile Sources; Highway Vehicles - Electricity; Single Unit Long-haul Truck: All on and off-network processes except refueling: Tire Wear |
| Mobile -OBUS | 223007513B | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Buses (School & Transit); Rural Other Principal Arterial: Brake Wear |
| Mobile -OBUS | 223007513I | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Buses (School & Transit); Rural Other Principal Arterial: Idling |
| Mobile -OBUS | 223007513S | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Buses (School & Transit); Rural Other Principal Arterial: Start |
| Mobile -OBUS | 223007513T | Mobile Sources; Highway Vehicles – Diesel ; Heavy Duty Diesel Buses (School & Transit);Rural Other Principal Arterial: Tire Wear |
| Mobile -OBUS | 223007513X | Mobile Sources; Highway Vehicles - Diesel; Heavy Duty Diesel Buses (School & Transit); Rural Other Principal Arterial: Exhaust |
| Fugitive Dust | 2294000000 | Mobile Sources; Paved Roads; All Paved Roads; Total: Fugitives |
| Landscaping Equipment | 2265004010 | Mobile Sources; Off-highway Vehicle Gasoline, 4-Stroke; Lawn and Garden Equipment; Lawn Mowers (Residential) |
| Emergency Generators | 20300101 | Internal Combustion Engines; Commercial/Institutional; Distillate Oil (Diesel); Reciprocating |
| Architectural Coating | 2401001000 | Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types |
| Consumer Products | 2460000000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Processes; Total: All Solvent Types |
| Consumer Products | 2460100000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Personal Care Products; Total: All Solvent Types |
| Consumer Products | 2460200000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Household Products; Total: All Solvent Types |
| Consumer Products | 2460400000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Automotive Aftermarket Products; Total: All Solvent Types |

**Table 2-4. Assigned SCC to Project Emission Sources**

| Emission Source | SCC | SCC Description |
|---|---|---|
| Consumer Products | 2460500000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Coatings and Related Products; Total: All Solvent Types |
| Consumer Products | 2460600000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Adhesives and Sealants; Total: All Solvent Types |
| Consumer Products | 2460800000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All FIFRA Related Products; Total: All Solvent Types |
| Consumer Products | 2460900000 | Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Miscellaneous Products (Not Otherwise Covered); Total: All Solvent Types |

### 2.2.1 Generate Spatial Surrogates for 4-km Domains

As part of the analysis, the Project source emissions need to be spatially allocated to appropriate geographic locations. The emissions can be allocated to modeling grid cells using gridding surrogates. To process the Project emissions, a Project area-based spatial surrogate was developed. The surrogate was developed using the US Environmental Protection Agency (USEPA's) Spatial Allocation Tool,[18] which combines geographical information system (GIS)-based data (shapefiles) and modeling domain definitions to generate the appropriate gridded surrogate data set. The Project sources were then assigned specific surrogates for gridding by cross-referencing the SCCs. As mentioned above, all Project emissions were distributed in the modeling grid cells where the Project is located as shown in **Figure 2-1**. The mobile sources were spatially distributed in the site's grid cells and surrounding grid cells, as outlined in **Table 2-3**.

### 2.2.2 SMOKE 4 km Processing of Project Emissions

SMOKE system was used to process emissions for the Northern California 4-km modeling grid shown in **Figure 2-1**. Although CAMx is run for each day of the year using each day's meteorological data, emissions are processed using a representative week from each month (seven days a month) to represent the entire month's emissions. This method is used for emissions to avoid redundancy in data and save disk space and computational time since emissions, temporally, during one week of a given month are likely very similar to emissions from a different week of the same month. Holidays were modeled separately as if they were a Sunday. SMOKE was applied to perform the following tasks:

1. Chemical Speciation: Emission estimates of criteria air pollutants were speciated for the SAPRC07 AERO6 chemical mechanism employed in CMAQ in SMOKE processing. We used speciation profiles compatible with the SAPRC07 AERO6 mechanism for $PM_{2.5}$ from the BAAQMD's modeling system to be consistent with the regional modeling emissions. We then converted those emissions into CAMx-ready formats using CMAQ2CAMx conversion program and species mapping.

2. Temporal Allocation: Annual emission estimates were resolved on an hourly timescale for CAMx modeling. These allocations were determined from the particular source category,

[18] https://www.cmascenter.org/sa-tools/documentation/4.2/html/srgtool/SurrogateToolUserGuide_4_2.pdf

specified by the SCC. Monthly, weekly, and diurnal profiles were cross-referenced to SCC to provide the appropriate temporal resolution. The temporal profiles were also obtained from the BAAQMD's emissions modeling system.

3. Spatial Allocation: The Project emission estimates were spatially resolved to the grid cells for modeling using spatial surrogates as described above.

### 2.2.3 QA/QC of Emissions Modeling

Standard quality assurance/quality control (QA/QC) was conducted during all aspects of the SMOKE emissions processing. These steps followed the approach recommended in USEPA modeling guidance (USEPA, 2007). SMOKE includes quality assurance (QA) and reporting features to keep track of the adjustments at each processing stage and ensure that data integrity is not compromised. We carefully reviewed the SMOKE log files for error messages and ensured that appropriate source profiles were used. All error records reported during processing were reviewed and resolved. This is important to ensure that source categories are correctly characterized. We also compared SMOKE input and output emissions: Summary tables were generated to compare input inventory totals against model-ready output totals to confirm consistency. Spatial plots were generated to visually verify correct spatial allocation of the emissions.

### 2.2.4 Merge SMOKE Pre-merged Emissions to Generate CAMx-ready Emission Inputs

The final step in the emissions processing is to merge the Project gridded emissions with other regional components through the gridded merge program (MRGUAM) for CAMx. We merged the daily emissions in the time format required by CAMx.

### 2.2.5 Emissions Summary

Summaries of the Project gridded CAMx model-ready emissions data are provided in this section. **Table 2-5** and **Table 2-6** summarize the annual emission inventory data input to SMOKE from the FF10 data files in pounds per day by project source types and by pollutants. The consistency in data in Table 2-5 and Table 2-6 as well as Table 2-1 offer confidence in the correct operation of the SMOKE emissions processing for CAMx.

**Table 2-5. Project Emission Inventory Data Input to SMOKE by Source Type ( Average lbs/day)**

| Type | ROG/VOC | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|
| **Mobile (Total)** | **38.0** | **37.6** | **37.0** | **7.3** |
| Offsite Mobile | 30.0 | 33.1 | 26.1 | 5.2 |
| Cars | 7.7 | 1.6 | 9.8 | 1.8 |
| On-Demand | 0.3 | 0.1 | 0.4 | 0.1 |
| Trucks | 0.02 | 0.1 | 0.3 | 0.1 |
| Shuttles | 0.05 | 2.7 | 0.4 | 0.2 |
| **Onsite Area (Total)** | **53.9** | **7.5** | **0.6** | **0.6** |
| Architectural Coatings | 2.0 | -- | -- | -- |
| Consumer Products | 48.9 | -- | -- | -- |
| Landscaping | 2.1 | 0.8 | 0.4 | 0.4 |
| Emergency Generators | 0.8 | 6.7 | 0.2 | 0.2 |
| **Total** | **91.9** | **45.1** | **37.6** | **7.9** |

**Table 2-6. Project Emission Inventory Data Output from SMOKE by Source Types (Average lbs/day)**

| Type | ROG/VOC | $NO_X$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|
| Mobile | 38 | 37.6 | 37.0 | 7.3 |
| Non-Mobile Sources | 53.9 | 7.5 | 0.6 | 0.6 |
| **Total** | 91.9 | 45.1 | 37.6 | 7.9 |

Spatial displays of the gridded emissions data are presented below. We examined the gridded emissions in 4-km grid to verify accurate spatial allocation by SMOKE. **Figures 2-2** through **2-5** displays gridded emissions for the Project inventory in the 4-km modeling grid.

**Figure 2-2. Spatial Distribution of $NO_x$ Emissions (in lbs/day) for the Project in the Northern California 4-km Domain**

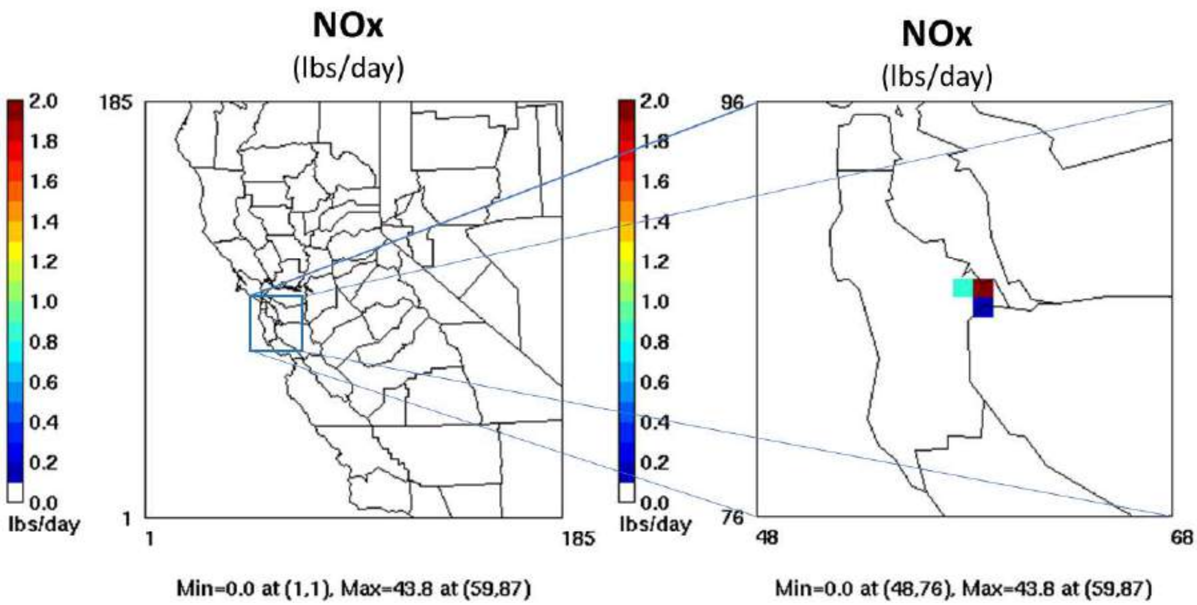



**Figure 2-3. Spatial Distribution of VOC Emissions (in lbs/day) for the Project in the Northern California 4-km Domain**

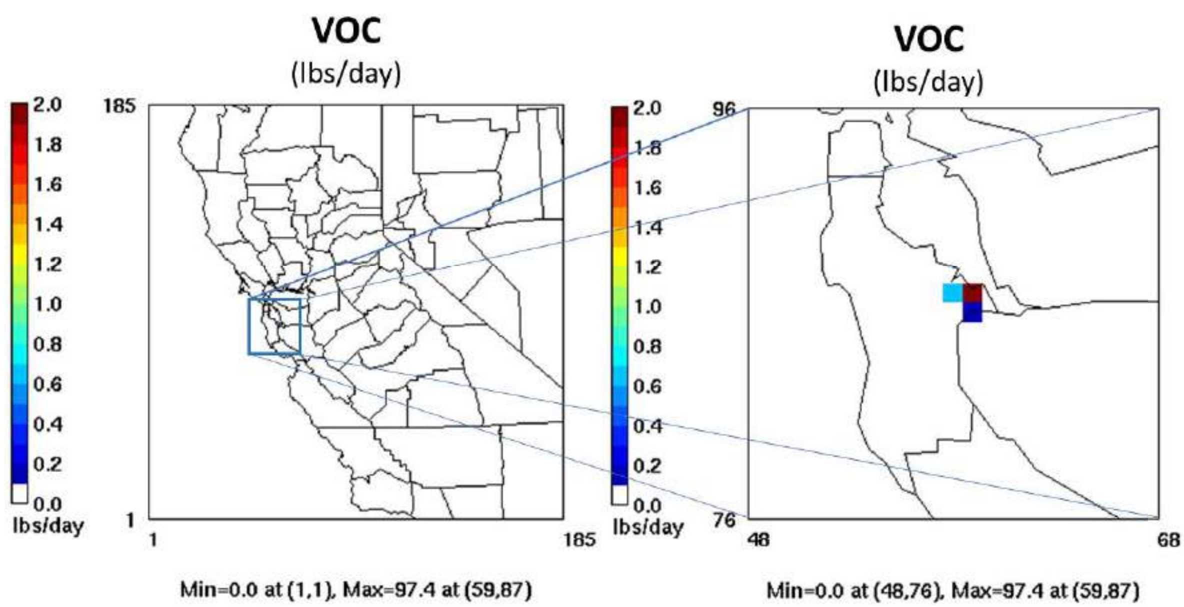


**Figure 2-4. Spatial Distribution of $PM_{10}$ Emissions (in lbs/day) for the Project in the Northern California 4-km Domain**

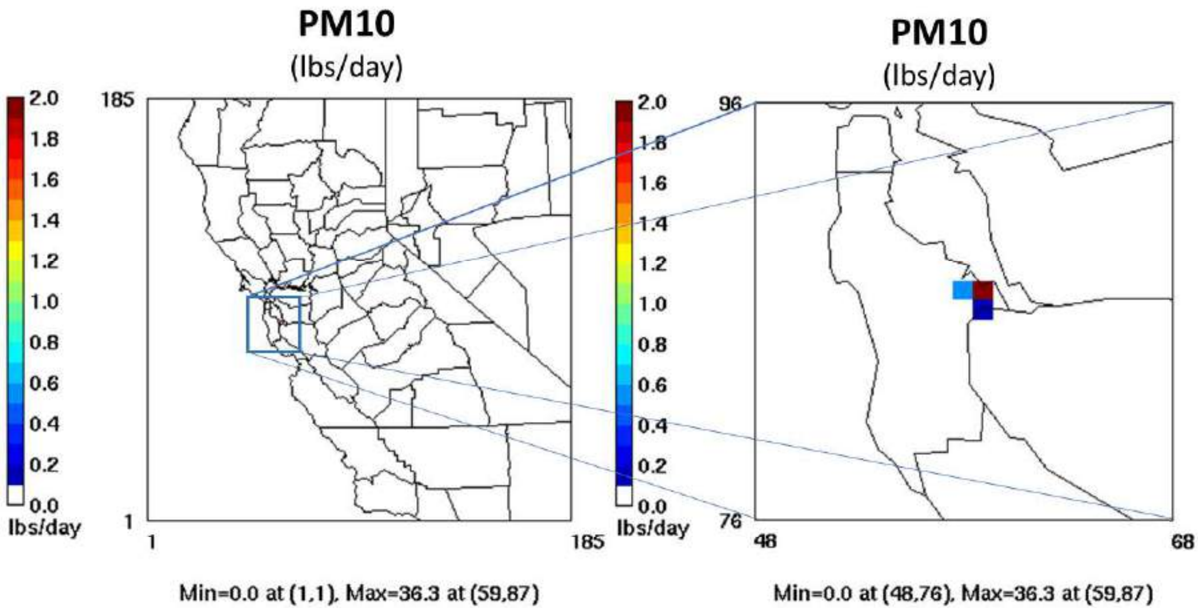
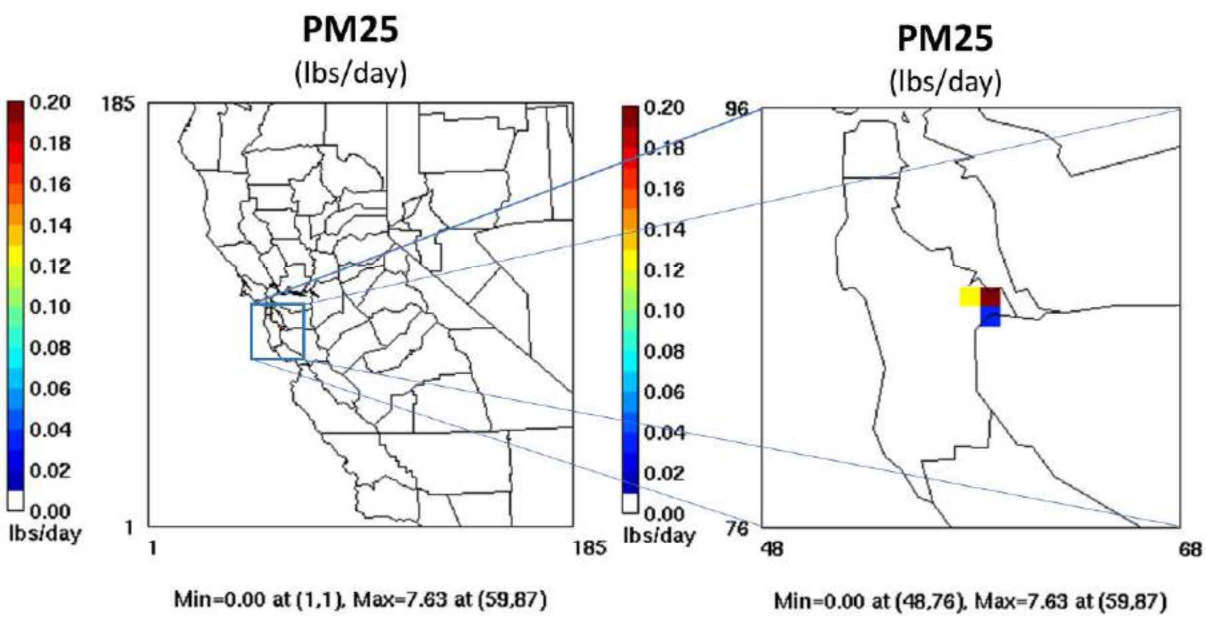



**Figure 2-5. Spatial Distribution of $PM_{2.5}$ Emissions (in lbs/day) for the Project in the Northern California 4-km Domain**



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# ATTACHMENT B
# PGM INPUTS, OUTPUTS, AND ASSUMPTIONS

# 1. REGIONAL AIR QUALITY MODELING PLATFORM

The latest publicly available Photochemical Grid Model (PGM) database for Northern California was developed by the Bay Area Air Quality Management District (BAAQMD) in support of the 2000 Central California Ozone Study (CCOS), and was adapted for this analysis.[19] The Northern California 2012 4-km CAMx modeling database and a projected 2035 emissions database was used in this assessment.[20] The 2012 base case is based on a PGM modeling databases developed by the BAAQMD. The BAAQMD PGM database is tailored for California using California-specific input tools (e.g., the EMFAC[21] mobile source emissions model) and use a high-resolution 4-km horizontal grid to better simulate meteorology and air quality in the complex terrain and coastal environment of California. This contrasts with the United States Environmental Protection Agency's (USEPA)national modeling platforms[22] used for national rulemakings (e.g., transport rules such as CSAPR[23] or defining new NAAQS) that use a coarser 12-km horizontal grid resolution.

The BAAQMD selected the computational domain shown in **Figure 1-1** below to keep consistency with the 2000 CCOS (BAAQMD, 2009). The CCOS was established to understand and investigate the ozone formation in Central California, therefore the computational domain included all Central California and portions of Northern California.

Details of the model inputs, configuration, and results are presented in Section 2 of this Attachment.

[19] http://www.baaqmd.gov/about-air-quality/research-and-data/research-and-modeling.

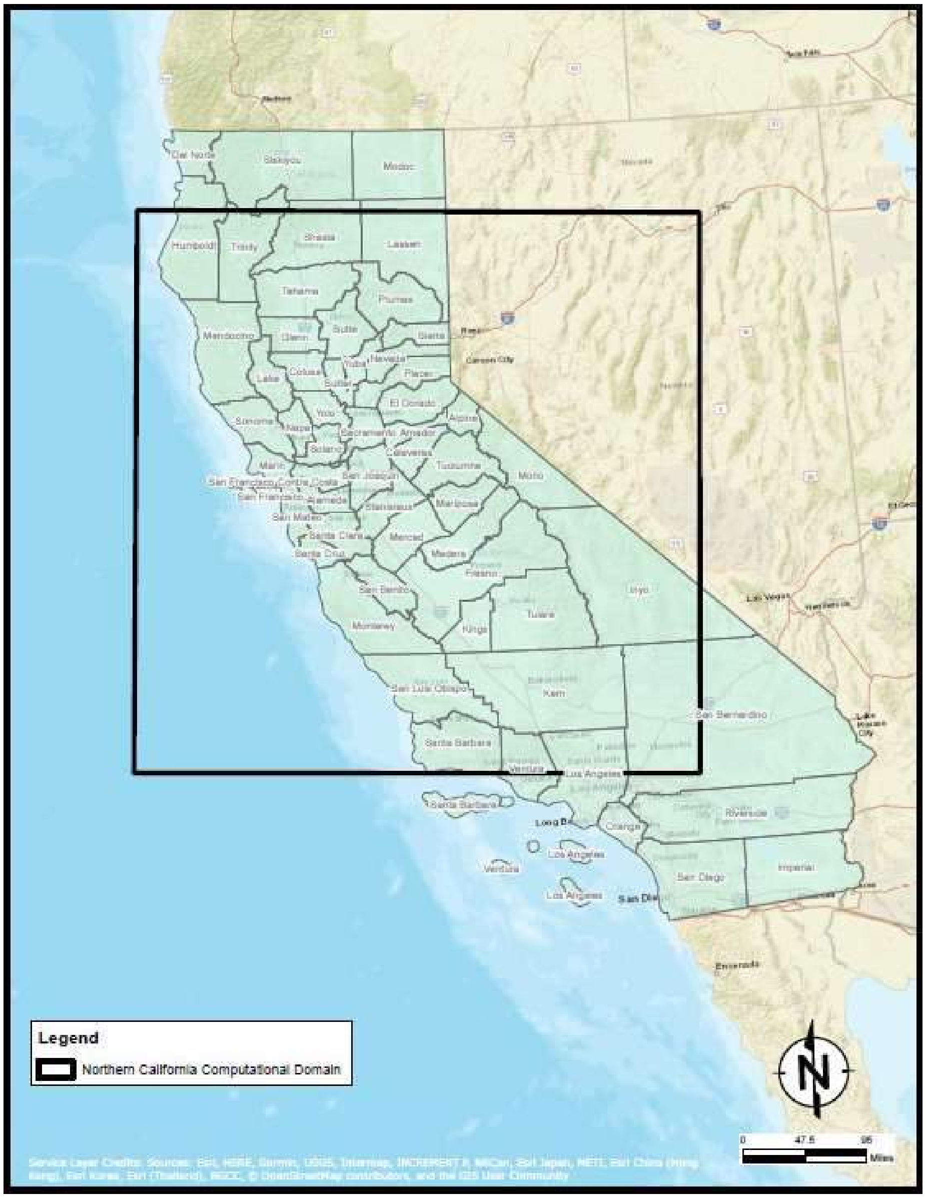
[20] Full project buildout is expected to occur as early as year 2026 and emissions were conservatively quantified assuming year 2026 emission factors. Year 2035 was selected for the PGM based on availability of modeling and emission databases for the Northern California domain at the time of the analysis. For consistency, Year 2035 populations are conservatively used in BenMAP, as discussed in Attachment C.

[21] https://www.arb.ca.gov/emfac/

[22] https://www.epa.gov/air-emissions-modeling/2014-2016-version-7-air-emissions-modeling-platforms

[23] https://www.epa.gov/csapr

**Figure 1-1. Air quality modeling domain for Northern California**[24]




# 2. REGIONAL GRID MODELING

In this section we describe the regional PGM modeling setup to assess the outcome of the Project emissions on the ambient $PM_{2.5}$ levels in the region. The 2012 base case modeling databases were developed by the BAAQMD for the Community Multiscale Air Quality (CMAQ) PGM. The CMAQ annual 2012 4-km modeling database and annual 2012 4-km Weather Research and Forecasting (WRF) meteorological model output files were obtained from the BAAQMD. The BAAQMD CMAQ and WRF 2012 4-km data were then processed to obtain 2012 4-km annual PGM modeling database for the Comprehensive Air Quality Model with

[24] https://ww3.arb.ca.gov/research/cabots/docs/9a-cabots-baaqmd-20170419.pdf

extensions (CAMx). The following paragraphs described how Ramboll developed the CAMx 2012 4-km annual database used in this study, starting with the BAAQMD CMAQ and WRF 2012 4-km data. Preparation of the Project emissions inputs for CAMx is discussed in Attachment A.

## 2.1 Model Inputs and Configuration

Ramboll converted the 2012 CMAQ 2-D and in-line point emissions files from BAAQMD to CAMx area-/point-source emissions files using the CMAQ2CAMx interface program.[25] Seasalt emissions were developed using an emissions processor that integrates published sea spray flux algorithms to estimate sea salt particulate matter (PM) emissions for input to CAMx. The CAMx sea salt emissions were then merged with area emissions files. On-road mobile sources in the BAAQMD database were based on EMFAC2014. Thus, on-road mobile sources were first updated to EMFAC2021 using county and pollutant specific scaling factors. We then projected on-road emissions to 2035 using projection factors derived from EMFAC2021. All other anthropogenic sources were also projected to 2035 using county, pollutant and source category-specific growth factors derived from ARB's California Emissions Projection Analysis Model (CEPAM) 2016 state implementation plan (SIP) inventory. The farthest future year available in the CEPAM is 2035. CEPAM estimates emissions for a specific year based on growth and control factors. The growth factors account for county-specific economic activity profiles, population forecasts, and other socio/demographic activity. The control factors reflect the effects of adopted emission control rules.

The most commonly used prognostic meteorological models to provide meteorological fields for air quality modeling are the WRF model (Skamarock et al., 2005) and the Fifth-Generation Mesoscale Model (MM5; Grell et al, 1994). MM5, a nonhydrostatic, prognostic meteorological model developed in the 1970s by Pennsylvania State University and the National Center for Atmospheric Research (NCAR), has been widely used for urban- and regional-scale photochemical, fine particulate, and regional haze regulatory modeling studies. However, development of MM5 ceased in 2006 and WRF has become the new standard model for regulatory air quality applications in the US. WRF was jointly developed by NCAR and the National Center for Environmental Prediction in late 1990s. It has been under continuous development, improvement, testing and open peer-review and is used world-wide by hundreds of researchers and practitioners. BAAQMD adopted WRF version 3.8 for the 2012 simulations. For the current application, the meteorology remains unchanged for the future year simulation and BAAQMD WRF 2012 4-km model outputs were processed using the WRFCAMx[26] processor to generate the meteorological fields ready for CAMx. The WRF model employs a terrain-following coordinate system defined by pressure, using multiple layers that extend from the surface to 50 millibars (approximately 19 kilometers above ground level [AGL]). A layer averaging scheme is adopted for CAMx simulations to reduce the computational burden. **Table 2-1** presents the mapping from the WRF vertical layer structure to the CAMx vertical layers.

[25] http://www.camx.com/download/support-software.aspx.

[26] WRFCAMx is available on the CAMx website (http://www.camx.com/download/support-software.aspx)

**Table 2-1. Vertical layer structure for WRF and CAMx modeling.**

| WRF | | CAMx | | | |
|---|---|---|---|---|---|
| **Layer** | **Height (m)** | **Layer** | **Height (m)** | **Thickness (m)** | **Sigma[a]** |
| 50 | 19260 | 28 | 19260 | 2625 | 0.0000 |
| 49 | 16635 | | | | |
| 48 | 14423 | | | | |
| 47 | 12436 | 27 | 12436 | 1849 | 0.1339 |
| 46 | 10587 | | | | |
| 45 | 9234 | | | | |
| 44 | 8100 | 26 | 8100 | 960 | 0.3119 |
| 43 | 7140 | | | | |
| 42 | 6324 | | | | |
| 41 | 5629 | 25 | 5629 | 594 | 0.4630 |
| 40 | 5034 | | | | |
| 39 | 4524 | | | | |
| 38 | 4086 | 24 | 4086 | 376 | 0.5806 |
| 37 | 3710 | | | | |
| 36 | 3387 | | | | |
| 35 | 3097 | 23 | 3097 | 261 | 0.6668 |
| 34 | 2835 | | | | |
| 33 | 2600 | | | | |
| 32 | 2389 | 22 | 2389 | 191 | 0.7341 |
| 31 | 2198 | | | | |
| 30 | 2028 | | | | |
| 29 | 1873 | 21 | 1873 | 139 | 0.7863 |
| 28 | 1735 | | | | |
| 27 | 1609 | | | | |
| 26 | 1497 | 20 | 1497 | 102 | 0.8261 |
| 25 | 1396 | | | | |
| 24 | 1304 | 19 | 1304 | 87 | 0.8471 |
| 23 | 1217 | | | | |
| 22 | 1133 | 18 | 1133 | 81 | 0.8661 |
| 21 | 1052 | | | | |
| 20 | 974 | 17 | 974 | 75 | 0.8840 |
| 19 | 899 | | | | |
| 18 | 827 | | | | |
| 17 | 758 | 16 | 758 | 66 | 0.9088 |
| 16 | 692 | 15 | 692 | 64 | 0.9165 |
| 15 | 628 | | | | |
| 14 | 566 | 14 | 566 | 59 | 0.9312 |
| 13 | 507 | 13 | 507 | 57 | 0.9382 |
| 12 | 450 | 12 | 450 | 53 | 0.9450 |
| 11 | 398 | 11 | 398 | 50 | 0.9513 |
| 10 | 348 | 10 | 348 | 46 | 0.9573 |
| 9 | 302 | 9 | 302 | 44 | 0.9629 |
| 8 | 258 | 8 | 258 | 40 | 0.9682 |
| 7 | 218 | 7 | 218 | 38 | 0.9731 |
| 6 | 180 | 6 | 180 | 36 | 0.9777 |
| 5 | 144 | 5 | 144 | 32 | 0.9821 |
| 4 | 112 | 4 | 112 | 31 | 0.9861 |
| 3 | 81 | 3 | 81 | 29 | 0.9899 |
| 2 | 52 | 2 | 52 | 27 | 0.9935 |
| 1 | 25 | 1 | 25 | 25 | 0.9969 |
| 0 | 0 | 0 | 0 | 0 | 1.0000 |

[a] The sigma vertical coordinate system is used to simplify the equations solved by atmospheric models and is defined as sigma = $(p-p_T)/(p_S - p_T)$ where p is pressure and the subscripts T and S stand for the top and surface values of the model atmosphere, respectively.

The lateral boundary conditions (BCs) for the 4-km state-wide modeling grid were extracted from a global model simulation for the year 2012. The Model for Ozone and Related Chemical Tracers Version 4 (MOZART-4; Emmons et al., 2010) is a global chemical transport model developed jointly by NCAR, the Geophysical Fluid Dynamics Laboratory, and the Max Planck Institute for Meteorology. It simulates chemistry and transport of tropospheric gases and bulk aerosols. The MOZART-4 simulation with updated meteorological fields derived from the National Aeronautics and Space Administration's Goddard Earth Observing System Model Version 5 (GEOS-5)[27] were downloaded from the UCAR website[28] and the MOZART2CAMx processor was used to derive both the boundary and the initial conditions for the modeling. Five days of spin-up periods were used for the 4-km grids to minimize the influence of the initial conditions.

Additional data used in the air quality modeling include ozone column data from the Ozone Monitoring Instrument (OMI) which continues the Total Ozone Mapping Spectrometer (TOMS) record for total ozone and other atmospheric parameters related to ozone chemistry (OMI officially replaced the TOMS ozone column satellite data on January 1, 2006). OMI data are available every 24-hours and are obtained from the TOMS ftp site.[29] The CAMx O3MAP program reads the OMI ozone column text file data and interpolates to fill gaps and generated gridded daily ozone column input data. The OMI data is used in the CAMx (TUV) radiation models which is a radiative transfer model that develops clear-sky photolysis rate inputs for CAMx. The landuse file was generated with the WRFCAMx processor and modified to remove lakes and set coastal waters with a surf zone width of 50 m, this file was used to update the emissions database and provide more realistic representation of sea salt emissions.

**Table 2-2** presents the CAMx configuration used for the modeling in this Project analysis. SAPRC07TC (Carter, 2010) is the chemistry mechanism used for California SIPs was used here. It includes additional model species to explicitly represent selected toxics and reactive organic compounds and uses numerical expressions of rate constants that are compatible with the current chemistry mechanism solver. The partitioning of inorganic aerosol constituents (sulfate, nitrate ammonium and chloride) between gas and aerosol phases is performed using the ISORROPIA module. The SOAP semi-volatile equilibrium scheme performs the organic aerosol-gas partitioning. These processes are described in more detailed in the CAMx user guide.

[27] http://www.acd.ucar.edu/wrf-chem/mozart.shtml
[28] https://www.acom.ucar.edu/wrf-chem/mozart.shtml
[29] ftp://toms.gsfc.nasa.gov/pub/omi/data/

**Table 2-2. CAMx modeling configuration.**

| Science Option | Configuration | Notes |
|---|---|---|
| Model Code | CAMx v6.5 | Released April 2018 |
| Horizontal Grid | 4-km 1-way nesting | |
| O3 and PM 4-km | 185 x 185 grid cells | |
| Vertical Grid | 28 vertical layers extending up to ~19 km AGL | Collapsed from 50 WRF/MM5 layers (see Table 3-1) |
| Initial Conditions | Extracted from the MOZART global model outputs | 5-day spin-up for 4-km domain |
| Boundary Conditions | Extracted from the MOZART global model outputs | Boundary concentration set for 4-km domain extracted using MOZART2CAMx |
| Photolysis Rate | Photolysis rates lookup table | Derived from satellite measurements and TUV processor |
| Gas-phase Chemistry | SAPRC07TC | Solved by the Euler Backward Iterative (EBI) solver |
| Aerosol-phase Chemistry | ISORROPIA (inorganic aerosol)<br>SOAP v2.1 (organic aerosol) | |
| Meteorological Input Preprocessor | WRFCAMx v4.7 | |
| Advection | Piecewise Parabolic Method (PPM) | |
| Diffusion | Eddy diffusion algorithm | |

## 2.2 Model Results

The future modeling scenario was simulated using the CAMx source apportionment technology. Both cumulative concentrations from all the sources and the concentrations from Project-specific emissions are derived from a single simulation following the previous section model configuration. The model results of hourly $PM_{2.5}$ concentrations were processed into aggregated metrics that are relevant to health effects.

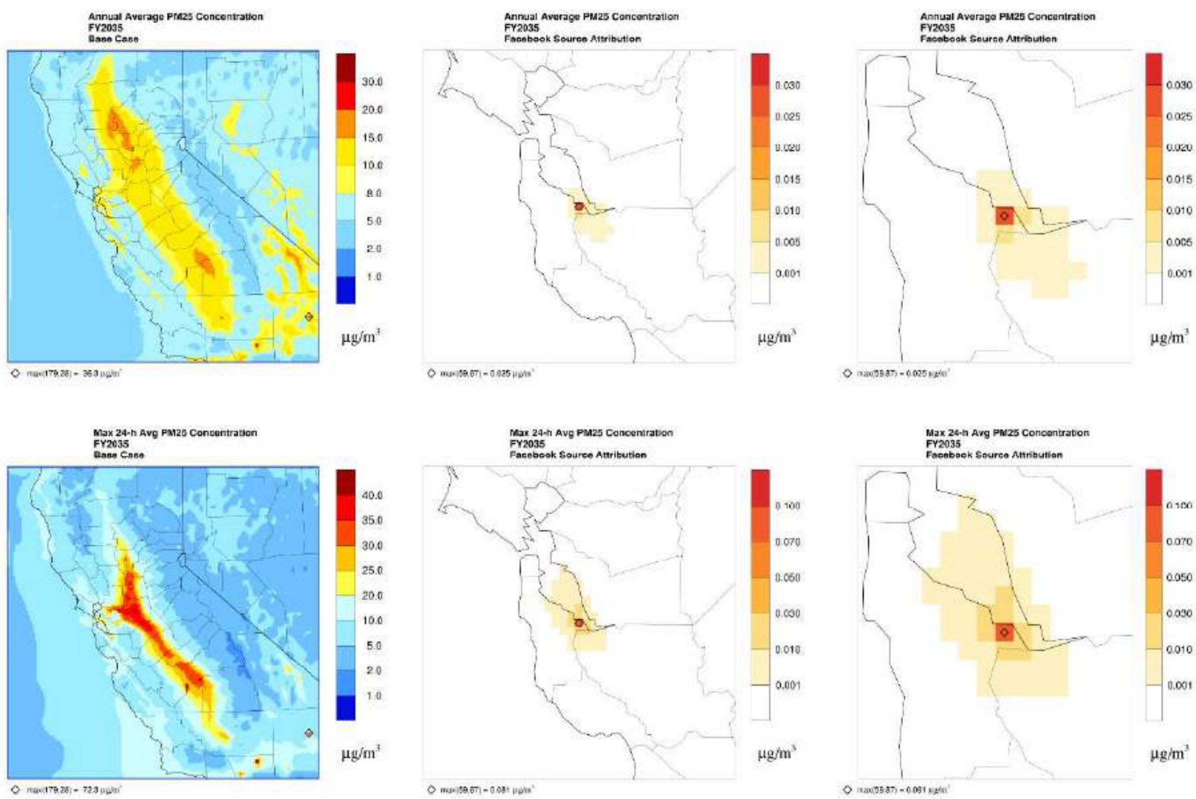
The metrics relevant to the $PM_{2.5}$ health effects selected in this study are 24-hour annual average concentrations (see Attachment C).

**Figure 2-1** shows spatial plots of annual average and a single day episode maximum 24-hour average $PM_{2.5}$ concentrations from the base case. In the base case, the central valley of California shows annual $PM_{2.5}$ concentrations that range between 8 and 20 $\mu g/m^3$. Isolated regions in San Bernardino and Los Angeles counties could reach up to 36 $\mu g/m^3$. The largest increases in $PM_{2.5}$ concentrations from the Project occur over the grid cell where the Project is located, followed by the immediately adjacent grid cells. Contributions of the Project emissions to annual average $PM_{2.5}$ are 0.025 $\mu g/m^3$ at the most affected areas and represent a 0.3 percent increase over the base case concentrations at that location. Contributions to the maximum 24-hour average are 0.081 $\mu g/m^3$ at the most affected area and represent a

0.4 percent increase over the base case concentrations at that location. **Figure 2-2** presents increases in quarterly average and maximum 24-hour average $PM_{2.5}$ due to the Project by $PM_{2.5}$ component at the grid cell of maximum concentration change. It confirms that the $PM_{2.5}$ increases due to the Project are mostly due to primary PM components (the sum of "other", EC and POA in the chart).

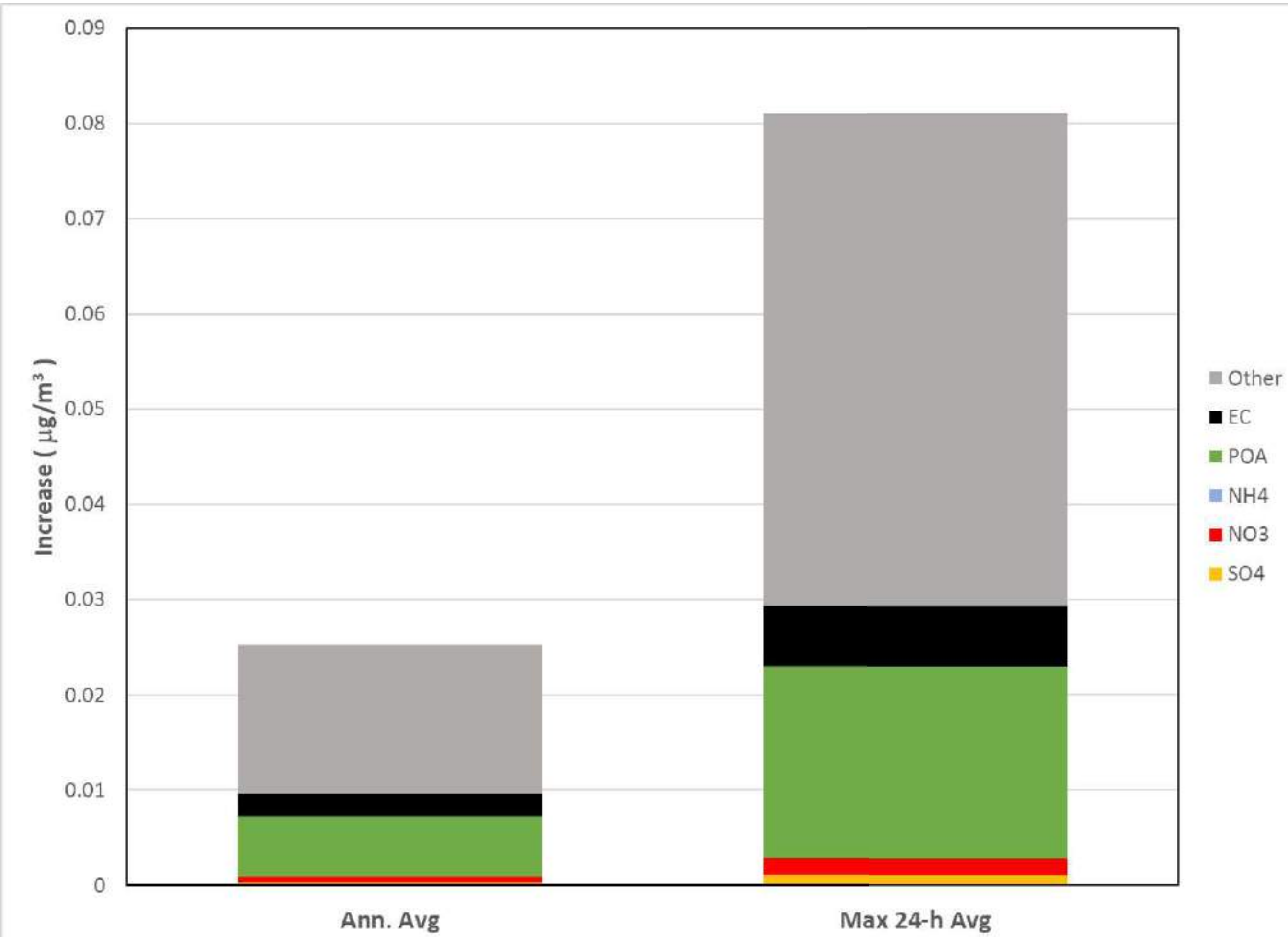
**Figure 2-1. Results of the 4 km $PM_{2.5}$ Modeling Domain**

**$PM_{2.5}$ Concentrations from the Base Case Scenario (left panels); Increases in $PM_{2.5}$ due to the Project (center panels show most of the modeling domain[30] and right panels show local project area); Annual Averages (top panels); Maximum 24-hour Averages (bottom panels)**




30 The center panel was zoomed in slightly from the full modeling domain given locality of impacts.

**Figure 2-2. Increases in Annual Average and Episode Maximum 24-hour Average $PM_{2.5}$ Concentrations due to the Project by $PM_{2.5}$ Component: fine particulate sulfate ($SO_4$), nitrate ($NO_3$), ammonium ($NH_4$), primary organic aerosol (POA), elemental carbon (EC), and other primary PM (Other); Where the Maximum Change due to Project Emissions Occurred**




The metrics relevant to the ozone health effects selected in this study are consistent with the ozone NAAQS (see Attachment C). The model provides hourly concentrations that are further post-processed to produce maximum daily average 8-hour (MDA8) ozone concentrations for each day.

**Figure 2-3** displays spatial plots of the annual average MDA8 ozone for the 2035 emissions scenario and the corresponding annual average MDA8 increases to ozone concentrations due to the Project emissions. In the base case, counties located in the south-eastern portion of the domain (San Bernardino, Inyo, Tulare, Kern) show the highest MDA8 annual average ozone concentration between 45 and 50 ppb with isolated regions in Kern county with up to 53 ppb. The maximum increase in the annual average MDA8 ozone concentrations due to the Project is 0.005 ppb and occurs in Santa Clara County where it represents a 0.012 percent increase over the base case concentrations.

**Figure 2-4** displays MDA8 ozone for the base case and increases in MDA8 ozone due to the project on October 2 of the simulation year, the day that the Project has the highest ozone contribution. The highest MDA8 ozone contribution due to the Project is 0.047 ppb (Figure 2-4, right) and occurs in Santa Clara County where it represents a 0.06 percent increase over the base case concentrations.

**Figure 2-3. Annual Average MDA8 Ozone Concentrations from the Base Case Scenario (left) and Increases in Highest MDA8 Ozone Concentrations due to the Project (center for modeling domain and right for local project area) for the Annual Modeling of the 2035 Emissions Scenario**

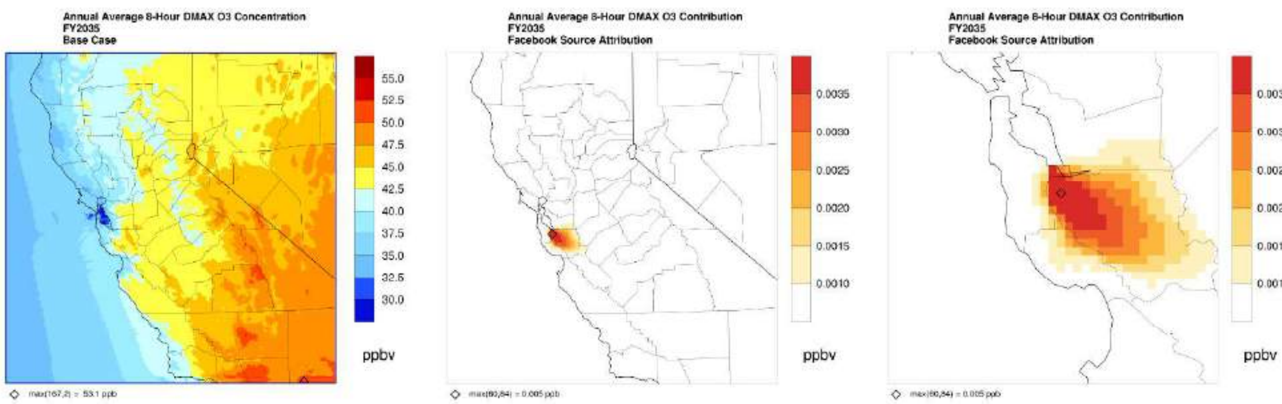
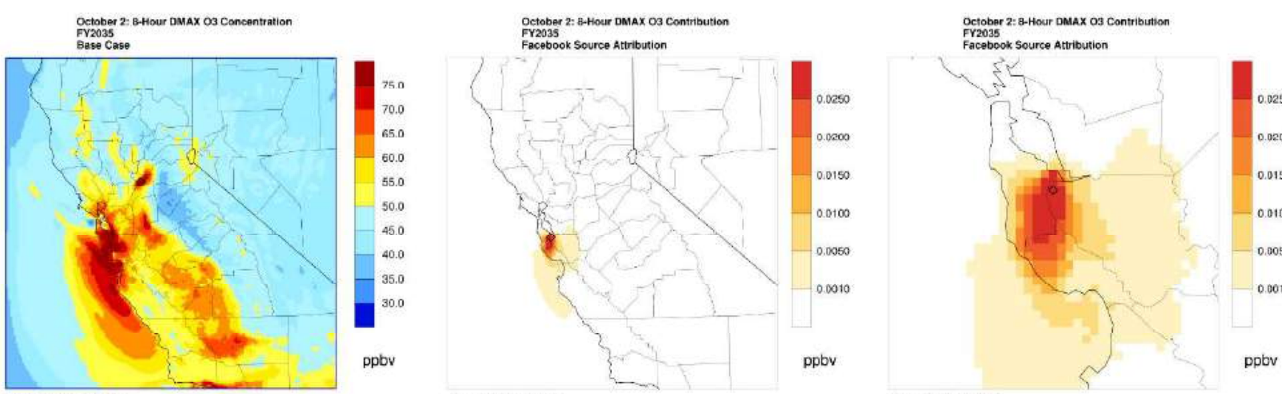



**Figure 2-4. MDA8 Ozone Concentrations from the Base Case Scenario (left) and Increases in MDA8 Ozone Concentrations due to the Project (center for modeling domain and right for local project area) on October 2nd, the Day with the Highest Project Ozone Contributions for the Annual Modeling of the 2035 Emissions Scenario**



## 2.3 PGM Uncertainty

PGMs generally represent the state-of-the-science when the treatment of photochemically formed air pollution is required over multiple spatial scales (e.g., from single-source to continental). PGMs are part of a modeling system in which there are several other major components that determine model performance, including meteorology, emissions inventories (including background), and chemical mechanisms. It is important to note that both the meteorological models that inform the PGMs and PGM predictions, themselves, in accordance with EPA guidance, are compared with available observations through multiple statistical metrics to characterize any biases and errors.

One of the largest sources of uncertainty for PGM is the processing and accurate accounting of all emission sources into the model. PGMs are Eulerian models that require gridded data that vary in space and time. An accurate prediction of secondary formed pollutants, like ozone and secondary $PM_{2.5}$, requires a comprehensive accounting of all possible sources of pollution and not only those specific to a Project. This typically requires a significant level of effort to construct spatially and temporally varying emission inventories where there may be uncertainties in the characterization of emissions.

A second source of uncertainty is introduced by the meteorological inputs. PGMs require gridded meteorological inputs that are typically provided by mesoscale meteorological model (e.g., WRF) that provide three-dimensional characterization of winds, temperature, humidity and other meteorological variables.

An additional source of uncertainty pertains to the PGM formulations themselves. For example, the models' chemical mechanism represents a simplification of the thousands of chemical reactions involving hundreds of species that take place in the atmosphere in order to reduce the computational burden. PGM being state-of-the-science can only reflect what is understood or established on any given aspect: chemistry, transport, aerosol formation, etc. As the science advances and certain processes are better understood, the models' formulations are modified with the expectation to improve their predictions.

Despite these complexities and associated uncertainties, the USEPA recommends using PGM's for a variety of applications including State Implementation Plans and Regional Haze Planning, and CAMx/CMAQ specifically for single-source modeling of ozone and secondary $PM_{2.5}$. The USEPA believes that the relative change in the PGM-predicted concentrations (e.g., the incremental changes due to the emissions from a single-source) is more accurate and reliable than the total predicted concentrations (USEPA, 2020a).

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# ATTACHMENT C
# BENMAP AND HEALTH EFFECTS

# 1. HEALTH EFFECTS ANALYSIS

The potential health effects of ozone and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) concentrations due to the Project's emissions were estimated using the Environmental Benefits Mapping and Analysis Program (BenMAP), Community Edition v1.5.8.17 (March 2022) (USEPA, 2022a).[31] BenMAP, developed by the United States Environmental Protection Agency (USEPA), is a powerful and flexible tool that helps users estimate human health effects and economic benefits resulted from changes in air quality. BenMAP outputs include PM- and ozone-related health endpoints such as premature mortality, hospital admissions, and emergency room visits. BenMAP uses the following simplified formula to relate changes in ambient air pollution to certain health endpoints (USEPA, 2022b)[32]:

$$\text{Health Effect} = \text{Air Quality Change} \times \text{Health Effect Estimate} \times \text{Exposed Population} \times \text{Background Health Incidence Rate}$$

- Air Quality Change - The difference between the starting air pollution level (the base) and the air pollution level after some change, such as a new source.
- Health Effect Estimate - An estimate of the percentage change in an adverse health effect due to a one unit change in ambient air pollution. Effect estimates, also referred to as concentration-response (C-R) functions, are obtained from epidemiological studies.
- Exposed Population - The number of people affected by the air quality change. The government census office is a good source for this information. This analysis uses data from PopGrid, which is an add-on program to BenMAP that allocates the block-level U.S. Census population to a user-defined grid.[33]
- Background Health Incidence Rate - An estimate of the average number of people over a given population that suffer from some adverse health effect over a given period of time. For example, the health incidence for asthma emergency room visits is the number of people over a given population who might visit the ER due to asthma in a given year. Health incidence rates and other health data are typically collected by the government as well as the World Health Organization. BenMAP calculates background health incidence rates based on the available health statistics and population data, with preference given to individual-level data counts (e.g., mortality counts or hospital and emergency department discharges) at the County-level. For California counties, data were available at the individual-level. The background health incidence data are also based on different years depending on data availability. For example, hospital admissions and emergency department visits for California are based on 2011 data. For mortality background incidence rates, USEPA obtained data for 2012-2014 from the Centers for Disease Control WONDER database (http://wonder.cdc.gov) and generated age-, cause-, and county-specific mortality rates as described in the BenMAP manual.[36] The projected mortality

[31] https://www.epa.gov/benmap

[32] The common function used for calculating health impacts is the following log-linear function: Health Effect = Background Health Incidence Rate x [1 – exponential (Health Effect Estimate * Air Quality Change)] x Exposed Population

[33] https://www.epa.gov/sites/production/files/2015-04/documents/benmap-ce_user_manual_march_2015.pdf

rates for the years 2015-2035 are then calculated using Census Bureau projected life tables.[34]

The health endpoints analyzed in this study and the BenMAP results are presented in Section 2 of this attachment.

# 2. HEALTH EFFECTS ANALYSIS RESULTS

This section presents the health effects of the Project emissions on the population in the northern California domain, estimated by the BenMAP model. The Comprehensive Air Quality Model with extensions (CAMx) modeling results are processed to generate aggregated daily and annual average $PM_{2.5}$ and maximum daily 8-hour ozone concentrations appropriate for various health endpoints. The CAMx simulation results from the full year (January to December) are used to estimate the health effects of $PM_{2.5}$ and ozone. BenMAP translates increases in the pollutant concentration due to the Project emissions to changes in the incidence rate for each health effect using a C-R function derived from previously published epidemiological studies. BenMAP often provides multiple C-R functions based on different epidemiological studies for a given health endpoint. C-R functions selected here have been used in past USEPA regulatory assessments when evaluating health effects. This analysis uses population data from PopGrid, which allocates the census population to each modeled 4x4 kilometer (km) grid cell.

The population used for both the quantified health effects and the background health incidence presented here is future year 2035. The PopGrid program was used to project 2010 block-level U.S. Census population to 2035. BenMAP reads this file to incorporate population changes into its health effect calculations. The population in the Northern California domain is projected to be 22,502,033 in 2035.

## 2.1 $PM_{2.5}$ Health Effects

Consistent with USEPA's assessment of health effects of particulate matter, our health effects evaluation focuses on $PM_{2.5}$ and not $PM_{10}$, as $PM_{2.5}$ has a much larger body of evidence that this size fraction is associated with health effects due to the sources, composition, chemical properties and lifetime in the atmosphere (USEPA 2009). $PM_{2.5}$ is capable of penetrating deeper into the lungs because of their size compared to larger particles and this is believed to contribute to greater health effects. Consistent with USEPA health effects evaluations, the health effect functions in BenMAP for PM use fine particulate ($PM_{2.5}$) as the causal PM agent.

Although there are a large number of potential health endpoints that could be included in the analysis as described above, we selected health endpoints that have been the focus of United States Environmental Protection Agency (USEPA) risk assessments (e.g., USEPA, 2010; USEPA, 2014; USEPA, 2022c). For example, the USEPA notes that health endpoints were selected based on consideration of at-risk populations (e.g. asthmatics), endpoints that have public health significance, and endpoints for which information is sufficient to support a quantitative C-R relationship (USEPA, 2014).

The health endpoints and associated C-R functions examined in this study are presented in **Table 2-1**. Each C-R function is based on a certain age range for the given health endpoint depending on the underlying epidemiological study on which it is based. Increases in the BenMAP-estimated health effect incidences and percent of background health incidence due to the Project emissions are presented in **Table 2-2**. Mean incidence rates are presented

[34] https://www.census.gov/programs-surveys/popproj/data/tables.html

along with 2.5 and 97.5 percentiles to demonstrate the potential range in estimated health effects. These values reflect the total health effects across the Northern California model domain, though the regions of primary health effect results are shown in Figures 2-1 and 2-2 of Attachment B.

**Table 2-1. Summary of $PM_{2.5}$ Health Endpoints Used in this Study**

| Health Endpoint | Age Range | Daily Metric | Seasonal Metric | Annual Metric | C-R Function Selected |
|---|---|---|---|---|---|
| Emergency Room Visits, Asthma | 0-99 | 24-hr mean | | | Mar et al., 2010[1] |
| Emergency Room Visits, Cardiovascular | 0-99 | 24-hr mean | | | Ostro et al., 2016 |
| Mortality, All Cause | 30-99 | 24-hr mean | Quarterly mean | Mean | Turner et al., 2016[1] |
| Hospital Admissions, Asthma | 0-64 | 24-hr mean | - | - | Sheppard, 2003[1] |
| Hospital Admissions, Cardiovascular | 65-99 | 24-hr mean | - | - | Bell et al., 2015 |
| Hospital Admissions, Respiratory | 65-99 | 24-hr mean | - | - | Bell et al., 2015 |
| Acute Myocardial Infarction, Nonfatal | 18-24 | 24-hr mean | - | - | Zanobetti et al., 2009[1] |
| Acute Myocardial Infarction, Nonfatal | 25-44 | 24-hr mean | - | - | |
| Acute Myocardial Infarction, Nonfatal | 45-54 | 24-hr mean | - | - | |
| Acute Myocardial Infarction, Nonfatal | 55-64 | 24-hr mean | - | - | |
| Acute Myocardial Infarction, Nonfatal | 65-99 | 24-hr mean | - | - | |

[1] C-R functions available in BenMAP (USEPA, 2020a; USEPA, 2022a)

The results show that the highest health effect is for all-cause mortality, with an estimated mean increased incidence of 0.22 deaths per year due to the Project emissions. Smaller mean increased incidences per year were estimated for other relevant $PM_{2.5}$-related health effects: 0.092 increase in incidence of asthma related emergency room visits, 0.038 increase in incidence of respiratory hospital admissions, and a 0.023 increase in incidence of cardiovascular and respiratory hospital admissions.

It should be noted, however, that the estimated increased incidence in those health effects is quite minor compared to the background health incidence values (shown in **Table 2-2** as percent of Background Health Incidence). For example, for asthma emergency room visits, the increase of 0.092 incidences per year due to Project emissions represents 0.000080% of the total emergency room visits due to asthma for people ages 0 to 99.

**Table 2-2. BenMAP-Estimated $PM_{2.5}$ Annual Health Effects of the Project Emissions Across the Northern California Model Domain[1]**

| Health Endpoint[2] | Project Incidences (Annual) | | | Background Health Incidence (Annual) | Project Mean as Percent of Background Health Incidence[4] (%) |
|---|---|---|---|---|---|
| | 2.5 Percentile[3] | Mean | 97.5 Percentile[3] | | |
| Emergency Room Visits, Asthma [0-99] | 0.024 | 0.092 | 0.16 | 115,302 | 0.000080% |
| Emergency Room Visits, Cardiovascular [0-99] | -0.016 | 0.041 | 0.097 | 441,046 | 0.0000093% |
| Mortality, All Cause [30-99] | 0.15 | 0.22 | 0.29 | 256,043 | 0.000086% |
| Hospital Admissions, Asthma [0-64] | 0.0025 | 0.0066 | 0.011 | 13,394 | 0.000049% |
| Hospital Admissions, All Cardiovascular [65-99] | 0.017 | 0.023 | 0.030 | 220,836 | 0.000011% |
| Hospital Admissions, All Respiratory [65-99] | 0.00011 | 0.0028 | 0.0055 | 82,964 | 0.0000034% |
| Acute Myocardial Infarction, Nonfatal [18-24] | 0.0000053 | 0.000011 | 0.0000162 | 27 | 0.000040% |
| Acute Myocardial Infarction, Nonfatal [25-44] | 0.00028 | 0.00057 | 0.00086 | 1,583 | 0.000036% |
| Acute Myocardial Infarction, Nonfatal [45-54] | 0.00063 | 0.0013 | 0.0020 | 4,025 | 0.000033% |
| Acute Myocardial Infarction, Nonfatal [55-64] | 0.0012 | 0.0025 | 0.0038 | 6,762 | 0.000037% |
| Acute Myocardial Infarction, Nonfatal [65-99] | 0.0048 | 0.010 | 0.015 | 28,174 | 0.000035% |

[1] Health effects are shown terms of incidences of each health endpoint and how it compares to the base (2035 base year health effect incidences) values.

[2] Affected age ranges are shown in square brackets.

[3] The percentiles are generated in BenMAP using a Monte Carlo analysis and represent the statistical uncertainty in the incidence associated with the CRF, but do not include other potential sources of uncertainty (i.e., in the air modeling, in estimates of projected background incidence or populations). These confidence bounds are typically used by USEPA to represent the 95% confidence intervals around the mean estimate.

[4] The percent of background health incidence uses the mean incidence.

## 2.2 Ozone Health Effects

As noted above, although a larger number of health endpoints could be evaluated, we selected the health endpoints based on USEPA risk assessments (USEPA, 2010; USEPA, 2014; USEPA, 2021; USEPA, 2022c). The health endpoints and associated C-R functions examined in this study are presented in **Table 2-3.** Each C-R function is associated with a certain age range for the given health endpoint depending on the epidemiological study on which it is based. Increases in the BenMAP-estimated health effect incidences and percent of background health incidence due to the Project emissions are presented in **Table 2-4.** Mean incidence rates are presented along with 2.5 and 97.5 percentiles to demonstrate the potential range in estimated health effects. These values reflect the total health effects across the Northern California model domain, though the regions of primary health effect results are shown in Figures 2-3 and 2-4 of Attachment B.

**Table 2-3. Summary of Ozone Health Endpoints Used in this Study.**

| Health Endpoint | Age Range | Daily Metric | Seasonal Metric | Annual Metric | C-R Function Selected |
|---|---|---|---|---|---|
| Hospital Admissions, All Respiratory | 65 - 99 | MDA8 | - | - | Katsouyanni et al., 2009[1] |
| Mortality, Respiratory | 30-99 | MDA8 | | | Turner et al., 2016 |
| Emergency Room Visits, Asthma | 0 - 17 | MDA8 | - | - | Mar and Koenig, 2009[1] |
| Emergency Room Visits, Asthma | 18 - 99 | MDA8 | - | - | Mar and Koenig, 2009[1] |

[1] C-R functions available in BenMAP (USEPA, 2020a; USEPA, 2022a)

For this Project, asthma-related emergency room visits are associated with the highest health effects due to the Project emissions in the northern California domain (0.11 incidences per year for adults ages 18 to 99 and 0.19 incidences per year for children ages 0 to 17). Mortality due to respiratory issues and hospital admissions due to respiratory issues for adults age 65-99 have lower incidence increases (0.067 and 0.016 incidences per year, respectively).

The estimated increases in those health effect incidences are quite minor compared to the background health incidence (shown in Table 2-4 as percent of Background Health Incidence). For example, the increase in asthma emergency room visits of 0.11 per year represents 0.00029% of the total asthma-related emergency room visits for adults.

**Table 2-4. BenMAP-Estimated Mean Ozone Annual Health Effects of the Project Emissions Across the Northern California Model Domain[1]**

| Health Endpoint[2] | Project Incidences (Annual) | | | Background Health Incidence (Annual) | Project Mean as Percent of Background Health Incidence[4] (%) |
|---|---|---|---|---|---|
| | 2.5 Percentile[3] | Mean | 97.5 Percentile[3] | | |
| Hospital Admissions, All Respiratory [65-99] | -0.0043[5] | 0.016 | 0.036 | 63,783 | 0.000025% |
| Mortality, Respiratory [30-99] | 0.047 | 0.067 | 0.087 | 19,099 | 0.00035% |
| Emergency Room Visits, Asthma [0-17] | 0.034 | 0.19 | 0.34 | 39,464 | 0.00048% |
| Emergency Room Visits, Asthma [18-99] | -0.043[5] | 0.11 | 0.26 | 38,023 | 0.00029% |

[1] Health effects are shown terms of incidences of each health endpoint and how it compares to the base (2035 base year health effect incidences) values.

[2] Affected age ranges are shown in square brackets.

[3] The percentiles are generated in BenMAP using a Monte Carlo analysis and represent the statistical uncertainty in the incidence associated with the CRF, but do not include other potential sources of uncertainty (i.e., in the air modeling, in estimates of projected background incidence or populations). These confidence bounds are typically used by USEPA to represent the 95% confidence intervals around the mean estimate.

[4] The percent of background health incidence uses the mean incidence.

[5] The negative lower bound of the confidence interval represents the statistical uncertainty in the CRF, which in this case is inclusive of a zero increase in the incidence.

## 2.3 Conclusion

The $PM_{2.5}$ and ozone concentration changes modeled by CAMx were converted to potential health effects on various health endpoints including premature mortality, hospitalizations, and emergency room visits, using the BenMAP health effects assessment model and health endpoints typically used in past USEPA regulatory assessments. Estimated changes in the annual health effect incidences are presented across the California grids in the northern California domain. Across the board, the estimated increases in those health effect incidences are quite minor compared to the background health incidence values with the largest $PM_{2.5}$ health effect (all-cause mortality) from the Project (2035 build out) representing 0.000086% of the total of all deaths, and the largest health effect for ozone (asthma related emergency room visits by children) representing 0.00048% of all emergency room visits.

Project-related health incidences occur both in closer proximity to Project emissions, particularly for $PM_{2.5}$ health effects (see Attachment B for maps of modeled concentration changes), or over a large area due to the regional nature of emission dispersion and photochemical reactions that occur, particularly for ozone health effects (concentration changes also shown in Attachment B). When taken into context, the small increase in incidences and the small percent of the number of background incidences indicate that these health effects are minimal in a developed environment.

### 2.3.1 Uncertainty

The approach and methodology of this analysis ensures that the uncertainty is of a conservative nature. In addition to the conservative assumptions built into the emissions noted above, there are a number of assumptions built into the application of C-R functions in BenMAP that may lead to an overestimation of health effects. In the Policy Assessment for the Reconsideration of the National Ambient Air Quality Standards (NAAQS) for Particulate Matter prepared by the EPA (USEPA, 2022c), the EPA acknowledges the many factors of uncertainty in selected C-R functions and resulting risk estimates, including the shape of the exposure-response function and statistical uncertainty (especially at low concentrations), temporal mismatch between ambient air data and the health effect, exposure measurement error in the epidemiological studies that produced the C-R function, potential confounding of the effect of $PM_{2.5}$ or ozone on mortality, and compositional and source differences of PM, all of which similarly apply to the results presented above.

Another uncertainty highlighted by the USEPA (2022c) which applies to potential health effects from both $PM_{2.5}$ and ozone, is the assumption of a log-linear response between exposure and health effects, without consideration for a threshold concentration below which effects may not be measurable. In the latest USEPA Policy Assessment for PM (USEPA, 2022c), while it is noted that some studies show evidence supporting a linear, no-threshold relationship, the USEPA continues to acknowledge that interpreting the shapes of concentration-response relationships is a recognized uncertainty, particularly at lower $PM_{2.5}$ concentrations, where lower data density, possible influence of measurement error, and variability among individuals with response to air pollution health effects can obscure the existence of a threshold or nonlinear relationship. The issue of a threshold for $PM_{2.5}$ and ozone is highly debated and can have significant implications for health effects analyses as it requires consideration of current air pollution levels and calculating effects only for areas that exceed threshold levels. Without consideration of a threshold concentration, any changes in air pollution are assumed to adversely affect health, which is a conservative assumption. Although the USEPA traditionally does not consider thresholds in its cost-benefit analyses, the NAAQS itself is a health-based threshold level that the USEPA has developed based on evaluating the most current evidence of health effects.

For all-cause mortality effects from $PM_{2.5}$, uncertainty stems from the limitations of epidemiological studies, such as mismeasured exposure estimates and the different statistical adjustments to minimize potential confounding from incompletely measured individual lifestyle factors (such as smoking, diet, and others) that may be related to $PM_{2.5}$ or ozone exposure and mortality. Even when studies adjusted for potential confounders, residual confounding may still occur and distort the C-R function.

Several reviews have evaluated the scientific evidence of health effects from specific particulate components (e.g., Rohr and Wyzga 2012; Lippmann and Chen, 2009; Kelly and Fussell, 2007). These reviews indicate that the evidence is strongest for combustion-derived components of PM including elemental carbon (EC), organic carbon (OC) and various metals (e.g., nickel and vanadium), however, there is still no definitive data that points to any particular component of PM as being more toxic than other components. The USEPA has also stated that results from various studies have shown the importance of considering particle size, composition, and particle source in determining the health effects of PM (USEPA, 2009). Further, USEPA (2009) found that studies have reported that particles from industrial sources and from coal combustion appear to be the most significant contributors to PM-related mortality, consistent with the findings by Rohr and Wyzga (2012) and others. This is particularly important to note here, as the majority of PM emissions generated from the Project are from brakewear, tirewear, and entrained roadway dust (see Attachment A), and not from combustion. Therefore, by not considering the relative toxicity of PM components, the results presented here are conservative.

For both the PM2.5 and ozone health effects calculated, each of the pollutants may be a confounder of the other. Thus, while the C-R functions are from studies that evaluated the effects for each pollutant individually, while sometimes adjusting for the other as a co-pollutant, both air pollutants could contribute to the health effect outcomes evaluated, and thus the overall health effects from a single pollutant may be overstated.

Specific to potential health effects from ozone, the Integrated Science Assessment for Ozone and Related Photochemical Oxidants (USEPA, 2020b) retained the conclusion that long-term exposure to ozone is likely to be a causal relationship with respiratory effects. Therefore, potential respiratory-related mortality is conservatively evaluated. However, as outlined in the Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards (USEPA, 2020c), the USEPA concluded that currently available evidence for total mortality is suggestive of, but not sufficient to infer, a causal relationship with short-term (as well as long-term) ozone exposures.

As noted above, the health effects estimation using this method presumes that health effects may be seen at any concentration difference, with no consideration of potential thresholds below which health effects may not occur. This methodology of linearly scaling health effects is broadly accepted for use in regulatory evaluations and is considered as being health protective (USEPA, 2010).

In summary, and with consideration of the uncertainty discussed above, health effects presented in this report are conservatively estimated, and the actual effects may be zero.

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