Appendix 3.4.1

Air Quality Technical Report

DRAFT

Prepared for
Peninsula Innovation Partners, LLC

Prepared by
Ramboll US Corporation
San Francisco, California

Project Number
1690010687

Date
March 2022

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

WILLOW VILLAGE

MENLO PARK, CALIFORNIA

RAMBOLL

CONTENTS

TABLES

FIGURES

APPENDICES

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 (μg/m³).

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 μg/m³.

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.

---

[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-

---

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

---

[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.

---

[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.

---

[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.

---

[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

---

[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*

[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.

Mitigated Emissions	80	21	37	7.0	-1,056
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				

[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.

2.5 Proposed Mitigation Measures

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

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 χ/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,

[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.

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 6**. 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]

---

[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 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.

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)

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

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 $chemical_i$ ($\mu g/m^3$)

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 ($\mu g/m^3$)

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

6.6 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.

6.7 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.

6.7.1 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. 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	172	*Yes*	58	*Yes*	9.8	*No*	9.2	*No*
Chronic HI	1	0.23	*No*	0.11	*No*	0.011	*No*	0.014	*No*
$PM_{2.5}$ Concentration (µg/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									

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	25	*No*	23	*No*
Chronic HI	10	0.015	*No*	0.016	*No*
$PM_{2.5}$ Concentration (µg/m^3)	0.8	0.44	*No*	0.68	*No*
Source: Table 64 of the Appendix					

8. REFERENCES

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

BAAQMD. 2012a. Recommended Methods for Screening and Modeling Local Risks and Hazards. May. Available at: https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en

BAAQMD. 2012b. Diesel Internal Combustion (IC) Engine Distance Multiplier Tool. June 13. Available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools

BAAQMD. 2012c. Gasoline Dispensing Facility Distance Multiplier Tool. June 13. Available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools

BAAQMD. 2015. Roadway Screening Analysis Calculator. April. Available online at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools

BAAQMD. 2020a. Permitted Sources Risk and Hazards Map. June. Available at: https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65

BAAQMD. 2020b. Health Risk Calculator with Distance Multipliers. 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

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

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

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

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

California ARB. 2020. Vision Scenario Planning. Available at: https://ww2.arb.ca.gov/resources/documents/vision-scenario-planning

California ARB. 2016. Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling. Available at: https://ww2.arb.ca.gov/sites/default/files/classic/msprog/truck-idling/13ccr2485_09022016.pdf. Accessed: November 2021.

California Environmental Protection Agency (Cal/EPA), Office of Environmental Health Hazard Assessment (OEHHA). 1998. Findings of the Scientific Review Panel on The Report on Diesel Exhaust, as adopted at the Panel's April 22, 1998, meeting.

CAPCOA. 2020b. California Emissions Estimator Model Users Guide Appendix F. Available at: http://www.CalEEMod.com/. Accessed: November 2021.

CARB. 2011. Final Regulations Order: Amendments to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines. Available at: https://ww2.arb.ca.gov/sites/default/files/classic/diesel/documents/finalreg2011.pdf. Accessed: November 2021.

CARB. 2011a. Off Road Mobile Source Emission factors. Available at: http://www.arb.ca.gov/msei/msei.htm. Accessed: March 2019.

CARB. 2011b. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: March 2019.

CARB. 2021. EMFAC2021 Volume III Technical Document. April. Available at: https://ww2.arb.ca.gov/sites/default/files/2021-08/emfac2021_technical_documentation_april2021.pdf

City of East Palo Alto. 2017. Zoning Map. Available at: https://web.archive.org/web/20171116062849/http://www.ci.east-palo-alto.ca.us:80/DocumentCenter/View/6City of Menlo Park Zero Waste Management Plans. Available at: https://www.menlopark.org/zerowastemanagementplans

City of Menlo Park. 2016. ConnectMenlo: General Plan Land Use & Circulation Elements and M-2 Area Zoning Update. Available online at: https://www.menlopark.org/DocumentCenter/View/12063/ConnectMenloFEIR_101016?bidId=

City of Menlo Park. 2019. Zoning Map. Available at: https://www.menlopark.org/DocumentCenter/View/15011/Figure_5_GeneralPlanLandUseDesignations_rev1013?bidId=

Office of Environmental Health Hazard Assessment (OEHHA). 2009. Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values, and adjustments to allow for early life stage exposures. Office of Environmental Health Hazard Assessment. May. Available at: https://oehha.ca.gov/air/crnr/technical-support-document-cancer-potency-factors-2009

Office of Environmental Health Hazard Assessment (OEHHA). 2015a. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. Available at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Office of Environmental Health Hazard Assessment (OEHHA). 2015b. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. Appendix D: Risk Assessment Procedures to Evaluate Particulate Emissions from Diesel-Fueled Engines. February.

Peninsula Innovation Partners. January 2021. Willow Village Master Plan Conditional Development Permit. Available online at:

https://www.menlopark.org/DocumentCenter/View/27129/Willow-Village-Masterplan-Entire-Site

Personal communication between Virginia Lau, BAAQMD and Shari Libicki, Ramboll on February 3, 2016.

SB-100. 2018. California Renewables Portfolio Standard Program: emissions of greenhouse gases. September. Available at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100

SCAQMD. 2008. Localized Significance Threshold Methodology. July. Available online at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/localized-significance-thresholds

Sonoma Technology, Inc (STI). 2011. Default Modeling Parameters for Stationary Sources. Memo from STI to BAAQMD. April 21.

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

USEPA. 2021. 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://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_userguide.pdf

USEPA 2021. Air Quality Dispersion Modeling - Preferred and Recommended Models. U.S. EPA. Available at: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models

USEPA. 2012. Haul Road Workgroup Final Report Submission to EPA-OAQPS. Available at: https://www.epa.gov/sites/default/files/2020-10/documents/haul_road_workgroup-final_report_package-20120302.pdf

United States Geological Survey (USGS). 2013. National Elevation Dataset. Available at: http://viewer.nationalmap.gov/viewer/.

TABLES

DRAFT

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

Land Use Type[4]	Percent Operational by Year		
Partial Buildout by Year[3]			
	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%

Land Use Type[4]	Size	Units[2]	Square Footage
Full Buildout			
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/

RAMBOLL

DRAFT

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.

RAMBOLL

[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.

DRAFT

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

DRAFT

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

DRAFT

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

RAMBOLL

DRAFT

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

DRAFT

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

RAMBOLL

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%

D R A F T

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%

RAMBOLL

DRAFT

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%

RAMBOLL

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

D R A F T

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]	Average Vendor Trips[3]	Hauling Trips[3]
			(trips/day)	(trips/day)	(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

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

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

DRAFT

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

RAMBOLL

DRAFT

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

RAMBOLL

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/)

RAMBOLL

DRAFT

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/ft²)[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		
				ft²	ft²	ft²	ft²	ft²	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**

D R A F T

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

DRAFT

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

D R A F T

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

RAMBOLL

DRAFT

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

DRAFT

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

DRAFT

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/

D R A F T

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/

D R A F T

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

DRAFT

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

DRAFT

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

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/

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	Fuel Type	Annual Operation[3]
			HP		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)				(MT/yr)
		ROG	NO_x	PM_{10}	$PM_{2.5}$	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.

DRAFT

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

DRAFT

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/

IPCC. 2007. AR4 Climate Change 2007: The Physical Science Basis. Available online at: https://www.ipcc.ch/report/ar4/wg1/

PG&E 2017 Corporate Resonsibility Report. Available at: https://www.pgecorp.com/corp_responsibility/reports/2017/assets/PGE_CRSR_2017.pdf. Accessed: July 2021.

PG&E 2018 Corporate Responsibility Report. Available at: https://www.pgecorp.com/corp_responsibility/reports/2018/assets/PGE_CRSR_2018.pdf. Accessed: July 2021

PG&E 2019 Corporate Responsibility Report. Available at: https://www.pgecorp.com/corp_responsibility/reports/2019/assets/PGE_CRSR_2019.pdf. Accessed: July 2021

The Climate Registry. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/. Accessed: July 2021.

Peninsula Clean Energy. Energy Sources. Available at: https://www.peninsulacleanenergy.com/energy-sources/ Accessed: April 2021

SB-100 California Renewables Portfolio Standard Program. Available at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100.

DRAFT

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

DRAFT

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_2e / yr)	(MT CO_2e / yr)	(MT CO_2e / yr)	(MT CO_2e / 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_2e - 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/

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

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

DRAFT

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

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	2.9	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

RAMBOLL

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

DRAFT

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.

RAMBOLL

DRAFT

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.

RAMBOLL

DRAFT

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.

RAMBOLL

D R A F T

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.

RAMBOLL

DRAFT

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.

RAMBOLL

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	170	57	7.2	7.6	--	--
Operational Generators	1.6	0.65	1.4	0.65	1.4	0.55
Operational Traffic	1.1	0.89	1.1	0.89	2.0	2.9
Total Project Contribution	172	58	9.8	9.2	3.3	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)	575,225	575,500	575,245	575,500	575,275	574,840
UTMy (m)	4,148,065	4,147,960	4,148,135	4,147,960	4,148,145	4,147,800
Receptor Height (m)	4.8	1.8	4.8	1.8	1.8	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	Lifetime Excess 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	4.0E-04	6.6E-04	4.0E-04	2.1E-04	3.3E-04	3.0E-03
Operational Traffic	2.1E-03	1.4E-03	2.1E-03	3.3E-03	6.0E-03	1.3E-03
Total Project Contribution	**0.23**	**0.11**	**0.011**	**0.014**	**6.3E-03**	**4.3E-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.
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	575,235	575,400	575,385	574,980
UTMy (m)	4,148,065	4,148,040	4,148,065	4,148,040	4,148,085	4,148,040
Receptor Height (m)	4.8	1.8	4.8	1.8	1.8	1.8
Receptor Type	Residential	High School	Residential	Elementary School	Recreational	High School
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	Excess $PM_{2.5}$ 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	3.3E-03	1.7E-03	1.3E-03	1.6E-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 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

DRAFT

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	--	$\mu g/m^3$	feet				unitless			in a million	unitless	$\mu g/m^3$
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	--	$\mu g/m^3$	feet				unitless			in a million	unitless	$\mu g/m^3$
18066	Menlo Business Park	0.58	3.6	0	1,875	1,875	1,822	Diesel ICE	0	0	0	0	0	0
20079	Pacific Biosciences	1.5	0.057	0.54	755	755	848	Diesel ICE	0.070	0.070	0.060	0.11	4.0E-03	0.033
21312	West Bay Sanitary District	0.033	0.0013	0	1,331	1,331	1,357	Diesel ICE	0	0	0	0	0	0
22664	CS Bio Company	0.13	0.0052	0	523	523	484	Diesel ICE	0.12	0.12	0.14	0.016	6.3E-04	0
100092	Chevron	15	0.073	0	1,141	1,141	1,234	Generic Decay	0	0	0	0	0	0
108593	United Parcel Service	4.7	0.023	0	1,545	1,545	1,525	Generic Decay	0	0	0	0	0	0
											Total:	**0.12**	**4.6E-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

$\mu g/m^3$ - 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

RAMBOLL

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

D R A F T

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	0.12	3.8E-03	0.033
Roadways[3]	1.3	8.5E-04	0.20	0.22	2.2E-04	7.6E-03
Highways[4]	8.0	--	0.21	9.1	--	0.19
Major Streets[4,5]	2.1	--	0.086	3.9	--	0.077
Railways[4]	2.5	--	4.6E-03	2.4	--	4.6E-03
Project Construction	7.6	0.011	0.063	7.2	8.9E-03	0.038
Project Operational Generators	0.65	2.1E-04	1.3E-03	1.4	4.0E-04	1.7E-03
Project Operational Traffic	0.89	3.3E-03	0.12	1.1	2.1E-03	0.092
Total	**23**	**0.016**	**0.68**	**25**	**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

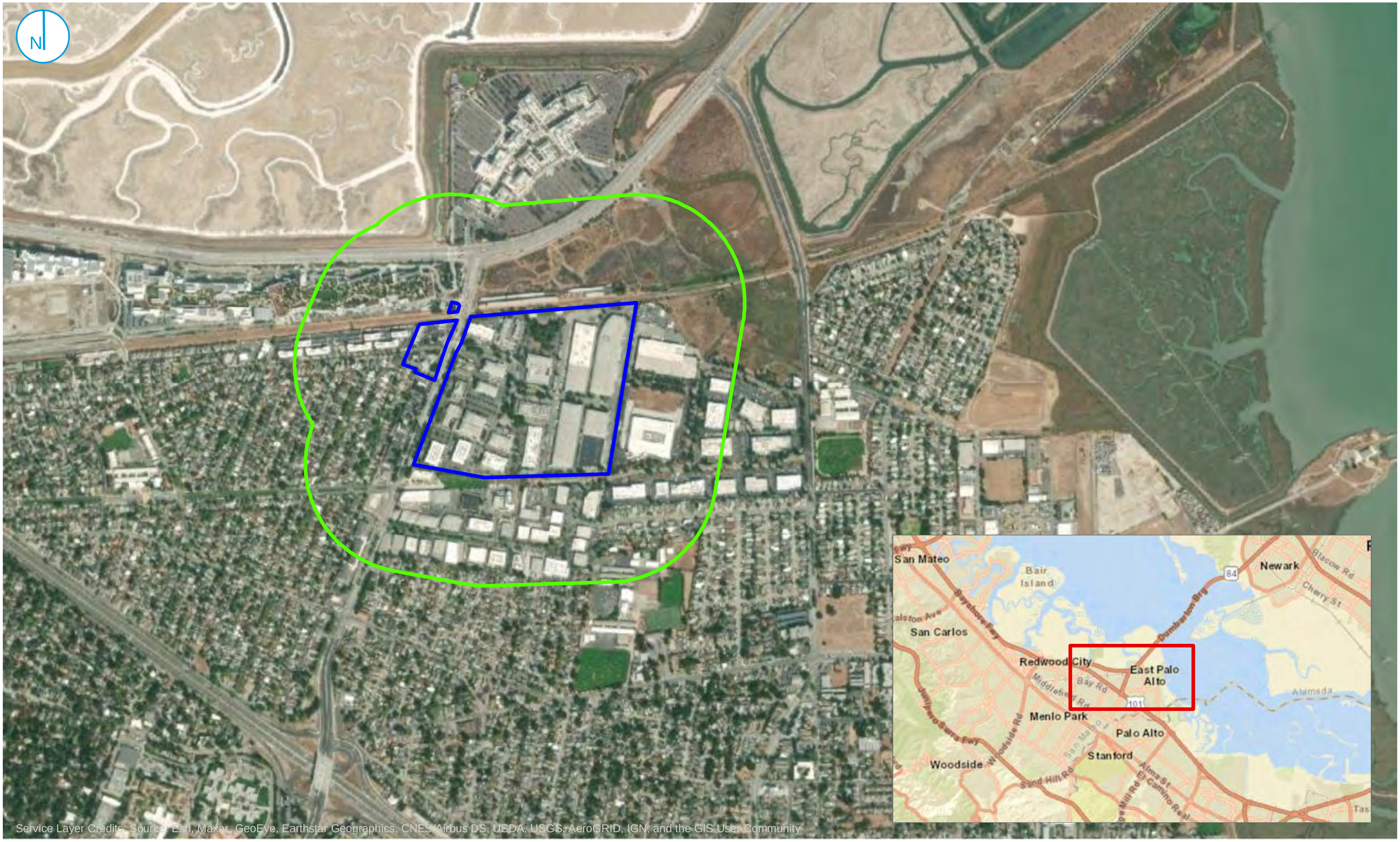
City of Menlo Park. Traffic volume data. Available at: https://www.menlopark.org/1543/Traffic-volume-data

FIGURES

D R A F T

PROJECT: 1690010687-004| DATED: 9/15/2021 | DESIGNER: MMCCARTHY

C:\Users\mmccarthy\OneDrive - Ramboll\ArcGIS Local\FB Willow Village\Figure1_revised.mxd



Project Boundary

1000 ft Buffer

0 500 1,000 2,000 Meters

PROJECT AREA AND BOUNDARY

Willow Village
Menlo Park, California

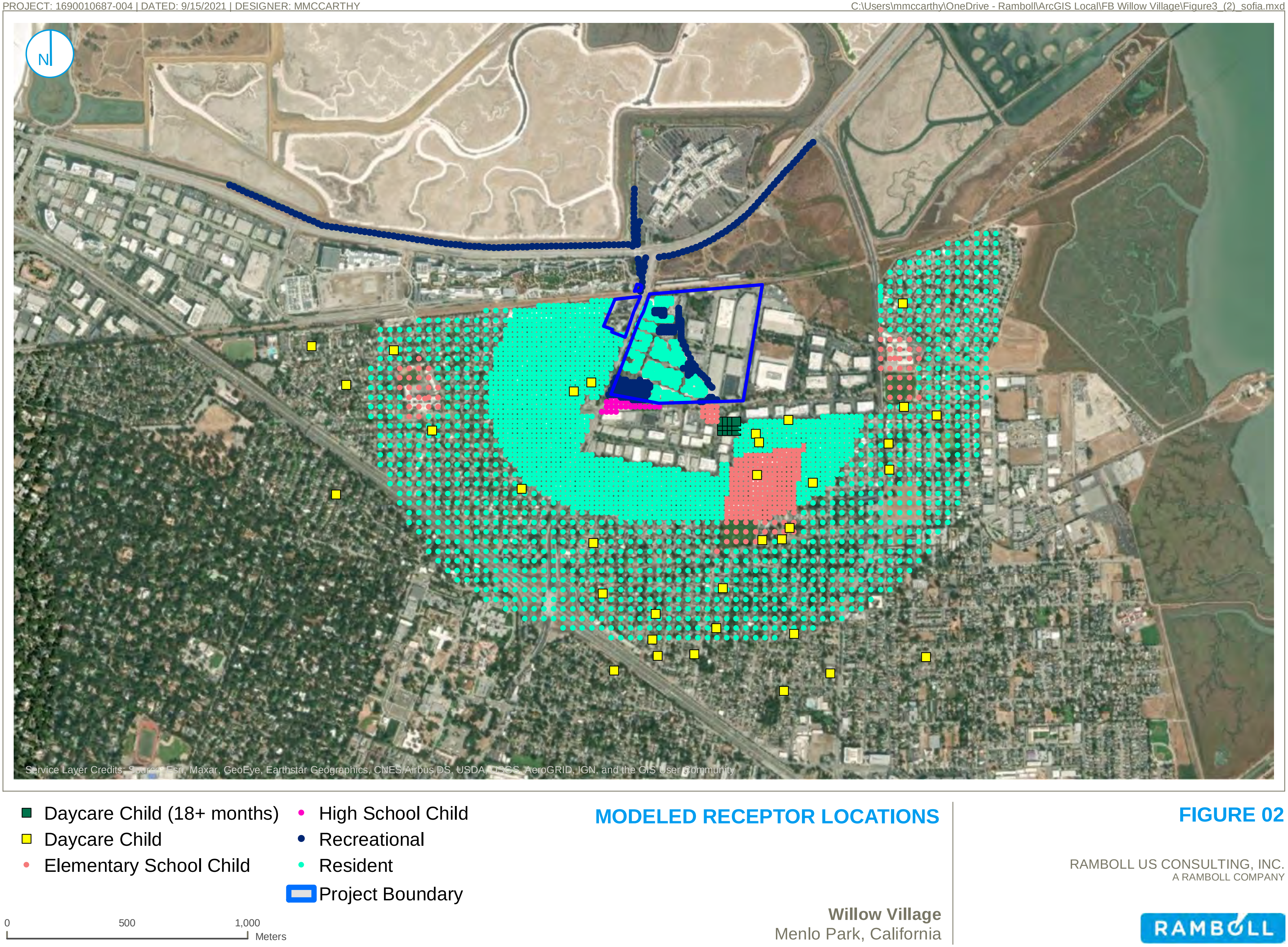
FIGURE 01

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690010687-004 | DATED: 9/15/2021 | DESIGNER: MMCCARTHY

C:\Users\mmccarthy\OneDrive - Ramboll\ArcGIS Local\FB Willow Village\Figure3_(2)_sofia.mxd



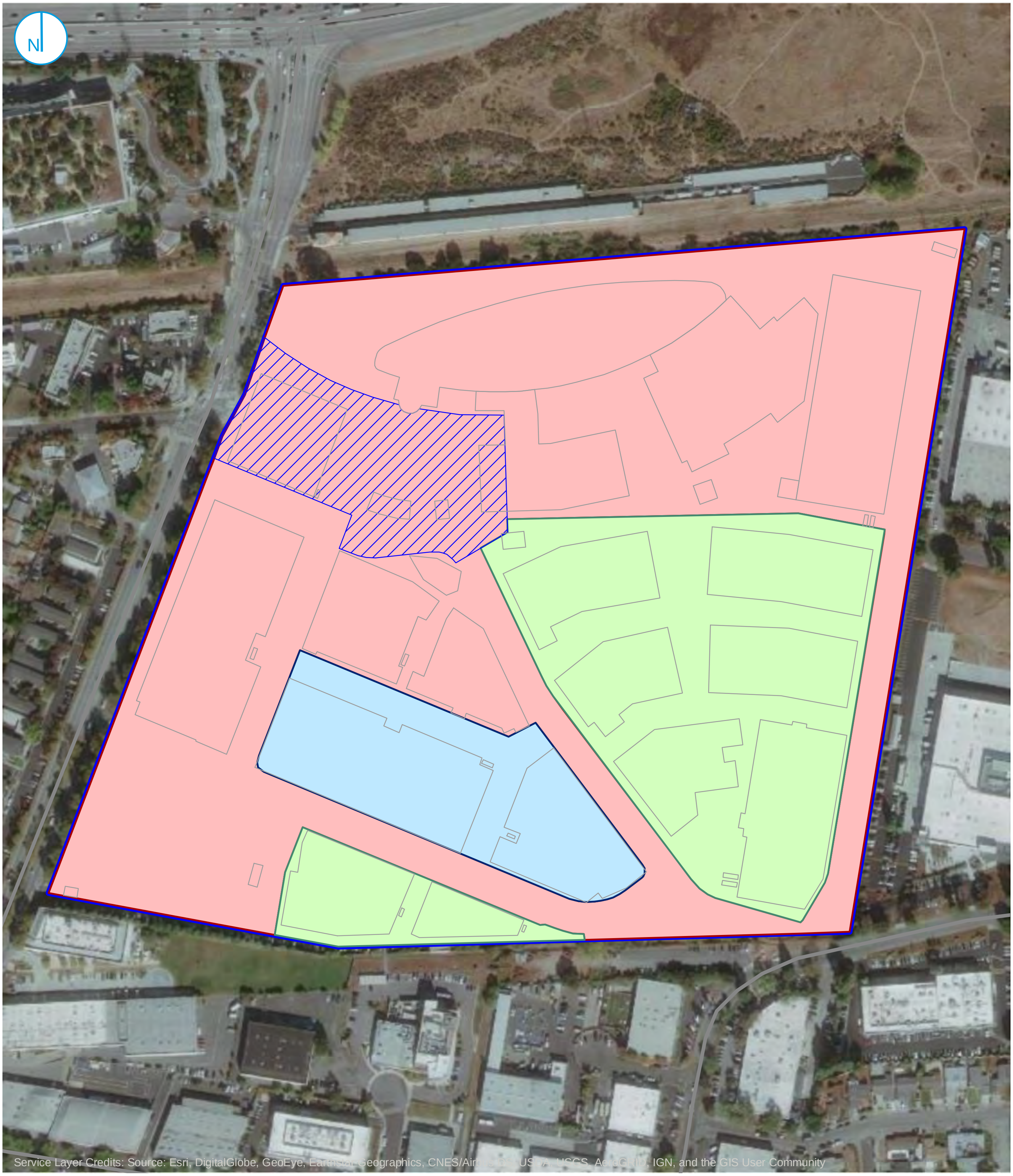
MODELED RECEPTOR LOCATIONS

Willow Village
Menlo Park, California

FIGURE 02

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

DRAFT



C:\ArcGIS\facebook.willow\cons.fig2.mxd

PROJECT: 1690010687-004 | DATED: 6/29/2021 | DESIGNER: DWILTON

Project Boundary Grading Phases

- Area 1
- Area 2
- Area 3
- Specific Hotel Excavation Area (Excavation for RS2 and RS3 are in the areas shown in Figure 4)

0 100 200 Meters

CONSTRUCTION SOURCES (GRADING AND EXCAVATION)

Willow Village
Menlo Park, California

FIGURE 03

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

DRAFT

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 4A

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

RAMBOLL

DRAFT

Substation Improvements
Feeder Line North Route
Feeder Line East Route
Intersection Improvements

OFF-SITE CONSTRUCTION SOURCES

FIGURE 4B

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

Willow Village
Menlo Park, California

RAMBOLL

DRAFT

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

DRAFT

PROJECT: 1690010687-004 | DATED: 11/11/2021 | DESIGNER: SBISOGNO

C:\Users\sbisogno\OneDrive - Ramboll\Desktop\FB GIS\Figure 9.mxd

Project Boundary
1000 ft Buffer
Onsite Vehicle Routes

0 500 1,000 Meters

MODELED ONSITE TRAFFIC ROUTES

Willow Village
Menlo Park, California

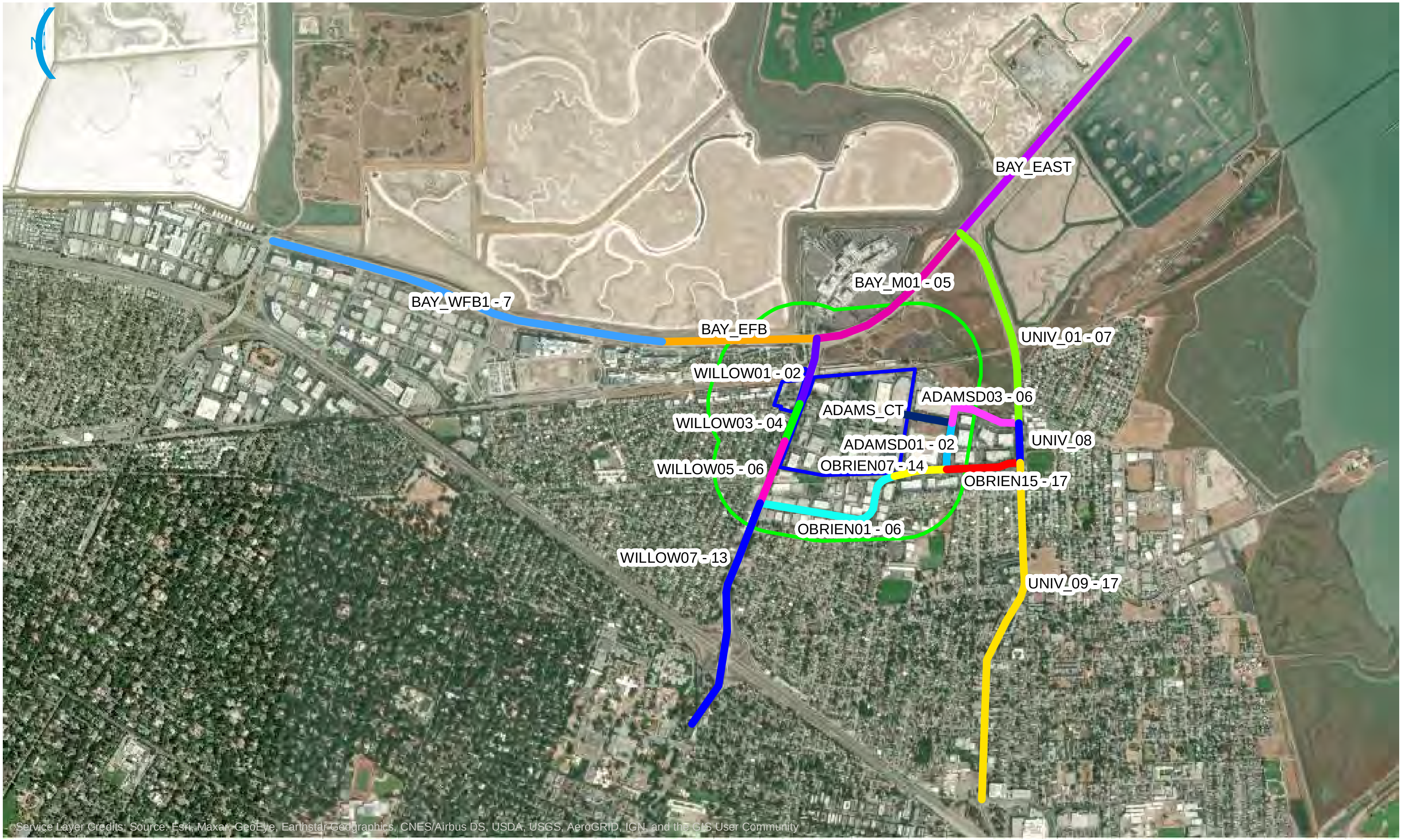
FIGURE 06

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

DRAFT

PROJECT: 1690010687-004 | DATED: 11/11/2021 | DESIGNER: SBISOGNO

C:\Users\sbisogno\OneDrive - Ramboll\Desktop\FB GIS\Figure 8.mxd



Project Boundary

1000 ft Buffer

0 500 1,000 Meters

MODELED OFFSITE TRAFFIC ROUTES

Willow Village
Menlo Park, California

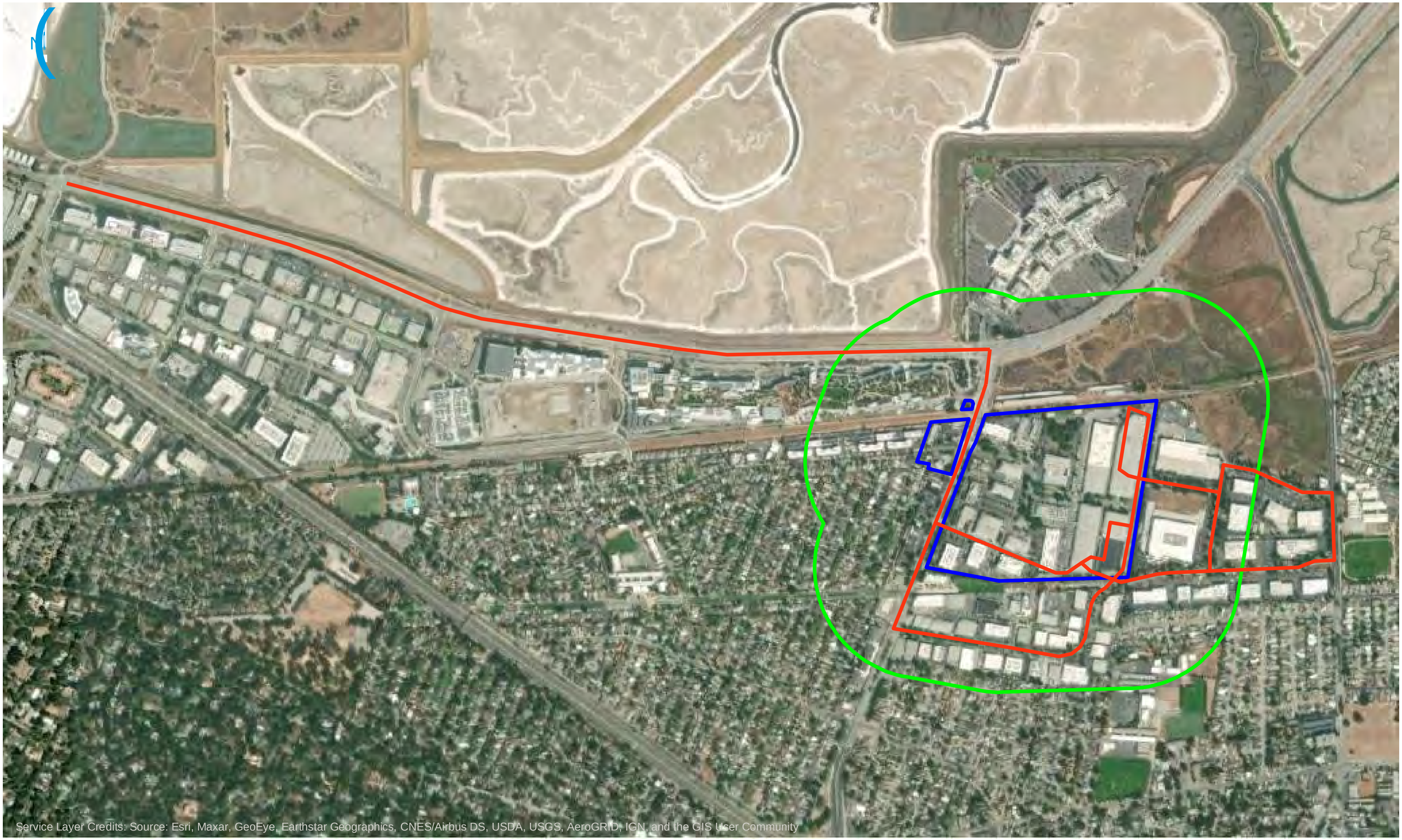
FIGURE 07

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

DRAFT

PROJECT: 1690010687-004 | DATED: 11/11/2021 | DESIGNER: SBISOGNO

C:\Users\sbisogno\OneDrive - Ramboll\Desktop\FB GIS\Figure 7.mxd



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

RAMBOLL

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:

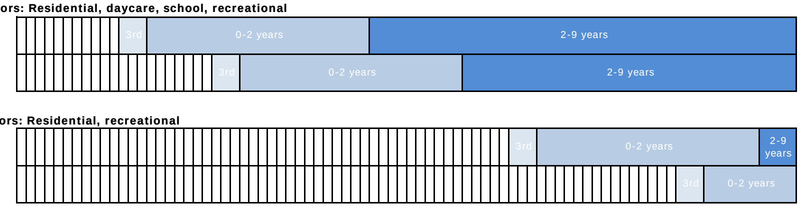
- Active Construction Period
- Full Operation

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



Scenario	End Date[1]
Scenario 1	Q4 Year 32
Scenario 2	Q4 Year 32
Scenario 3	Q3 Year 35
Scenario 4	Q1 Year 37

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: • Improve biking/walking network • Provide bicycle amenities • Improve public transit service • Car share program • Tram service • Commuter shuttles • Parking management • Emergency ride-home program • Carpool and vanpool programs • Commute assistance center • On-site housing 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

	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. 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.

	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.

	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. 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

		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: • Improve biking/walking network • Provide bicycle amenities • Improve public transit service • Car share program • Tram service • Commuter shuttles • Parking management • Emergency ride-home program • Carpool and vanpool programs • Commute assistance center • On-site housing 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

	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: • 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. • 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. • 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*.

---

[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: • Improve biking/walking network • Provide bicycle amenities • Improve public transit service • Car share program • Tram service • Commuter shuttles • Parking management • Emergency ride-home program • Carpool and vanpool programs • Commute assistance center • 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.

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: • Improve biking/walking network • Provide bicycle amenities • Improve public transit service • Car share program • Tram service • Commuter shuttles • Parking management • Emergency ride-home program • Carpool and vanpool programs • Commute assistance center • On-site housing
	Reduce vehicle operating and maintenance costs due to pavement conditions	**Consistent.** The roads would be maintained consistent with municipal requirements.

	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**
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.

	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.

		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.

		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: • 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. • 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. • • 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

			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: • Improve biking/walking network • Provide bicycle amenities • Improve public transit service • Car share program • Tram service • Commuter shuttles • Parking management • Emergency ride-home program • Carpool and vanpool programs • Commute assistance center • 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.

[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 <u>background</u> 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

<u>Notes:</u>

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**

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
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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(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** Estimated Diesel tank capacity is 4,000 Gallons	**NOISE RATING** 85 dBA
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Estimated generator size (2) @ 750kW	**ENCLOSURE COLOR** Generators located interior of parking garage
ROUTE FOR FUELING HOSE ACCESS Remote fuel station located on exterior of the building	**PARKING LOCATION OF FUELING TRUCK** Exterior, drive up to remote fill station
FREQUENCY OF REFUELING Two times per year	**HOURS OF SERVICE ON A FULL TANK** 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

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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(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** Estimated Diesel tank size is 3,200 gallons.	**NOISE RATING** Internal acoustical dampening to 75db at 23'
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Estimated generator size (2) @ 1750kW; 2900hp	**ENCLOSURE COLOR** Generators located interior of parking garage
ROUTE FOR FUELING HOSE ACCESS Remote fuel fill station located on exterior of buildling	**PARKING LOCATION OF FUELING TRUCK** Exterior, drive up to remote fuel fill station
FREQUENCY OF REFUELING two times per year	**HOURS OF SERVICE ON A FULL TANK** 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

CITY OF MENLO PARK

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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(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** Estimated Diesel tank size is 1,350 gallons.	**NOISE RATING** Internal acoustical dampening to 75db at 23'
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Estimated generator size (1) @ 600kW, 900hp	**ENCLOSURE COLOR** Generators located interior of parking garage basement level
ROUTE FOR FUELING HOSE ACCESS Remote fuel fill station located on exterior of buildling	**PARKING LOCATION OF FUELING TRUCK** Exterior, drive up to remote fuel fill station
FREQUENCY OF REFUELING two times per year	**HOURS OF SERVICE ON A FULL TANK** 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

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

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 660 gallons (approx) Fuel type: diesel	**NOISE RATING** 75.3db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 1000 kW (approx) Engine output: 1490 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 9 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: RS3

CITY OF MENLO PARK

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 660 gallons (approx) Fuel type: diesel	**NOISE RATING** 75.3db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 750 kW (approx) Engine output: 1220 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 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

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 270 gallons (approx) Fuel type: diesel	**NOISE RATING** 73db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 500 kW (approx) Engine output: 755 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 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: RS5

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 270 gallons (approx) Fuel type: diesel	**NOISE RATING** 73db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 500 kW (approx) Engine output: 755 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 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

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 270 gallons (approx) Fuel type: diesel	**NOISE RATING** 72db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 250 kW (approx) Engine output: 464 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 14 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: RS7

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION
701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 270 gallons (approx) Fuel type: diesel	**NOISE RATING** 72db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 150 kW (approx) Engine output: 324 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 24 hours at generator fully rated load

PROPOSED TESTING SCHEDULE (including frequency, days of week, and time of day)

Monthly, Sunday, AM

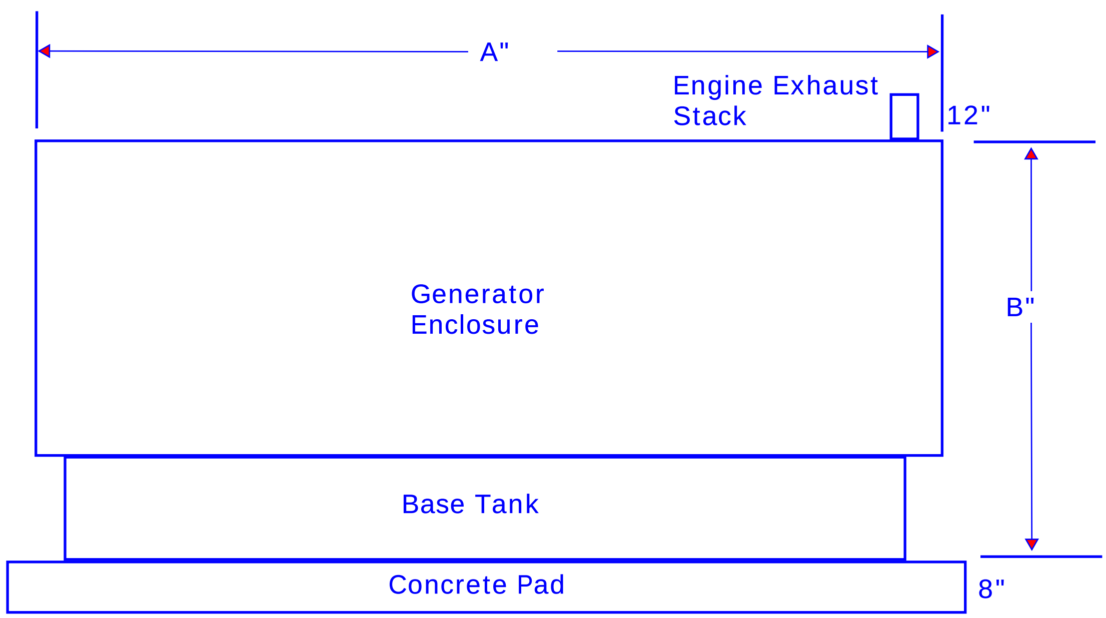
ALARMS AND/OR AUTOMATIC SHUTOFFS (for leaks during use and/or spills/over-filling during fueling, if applicable)

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)

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.

Model	Standby rating 60 Hz kW (kVA)	Prime rating 60 Hz kW (kVA)	Continuous rating 60 Hz kW (kVA)	Data sheets 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 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)

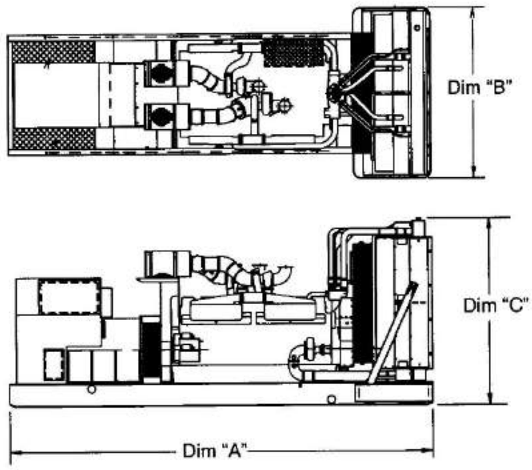
Ratings definitions

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.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		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.
	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.
	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.™

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, m^3/min (scfm)	88 (3150)	81 (2880)	
Maximum air cleaner restriction, kPa (in H_2O)	6.2 (25)		
Alternator cooling air, m^3/min (cfm)	204 (7300)		

Exhaust

	Standby rating	Prime rating	Continuous rating
Exhaust flow at set rated load, m^3/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

	Standby rating	Prime rating	Continuous rating
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, m^3/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

	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)			
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.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™

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 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	• 127/220	• 230/380	• 277/480
• 115/200	• 139/240	• 240/416	• 347/600
• 120/208	• 220/380	• 255/440	

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.

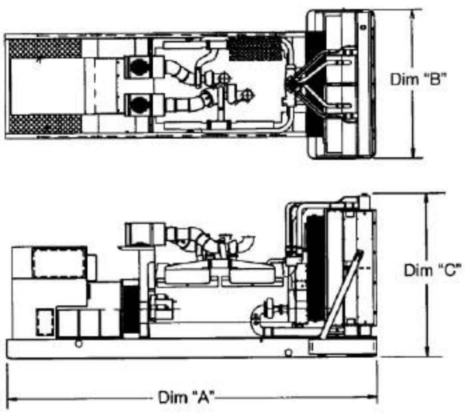
Ratings definitions

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.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		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.
	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.
	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: 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

	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

Our energy working for you.™

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 kW (kVA)	60 Hz kW (kVA)	60 Hz 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 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 ℃ (40℉)
- 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 ℃ (40℉)
- 120 V 300 W lube oil heater
- Heavy duty air cleaner with safety element

Alternator

- 80 ℃ rise
- 105 ℃ rise
- 150 ℃ 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 ℃ 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 ℃ to +70 ℃ 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

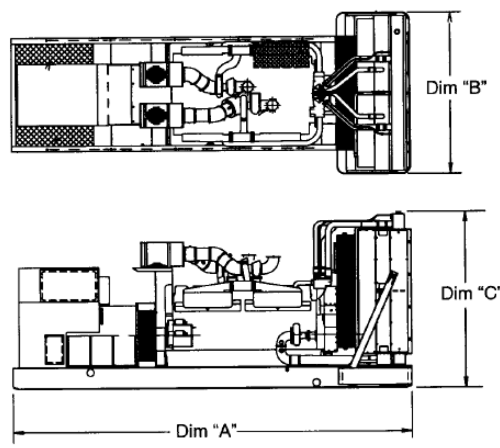
For further detail on PC 2.3 see document S-1569.
For further detail on PC 3.3 see document S-1570.

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.

	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		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.
	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.
	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: 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

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

	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]

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 1901	120/208 1737	110/220 1642	115/230 1571	139/240 1505	220/380 951	230/400 903	240/416 868	255/440 821	277/480 753	347/600 602	

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

$$\frac{\text{kW x 1000}}{\text{Voltage x 1.73 x 0.8}}$$

Single phase output

$$\frac{\text{kW x SinglePhaseFactor x 1000}}{\text{Voltage}}$$

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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA

Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

Power Generation

power.cummins.com

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 • 139/240 • 240/416	• 120/208 • 120/240 • 254/440	• 277/480 • 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 °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

- 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):

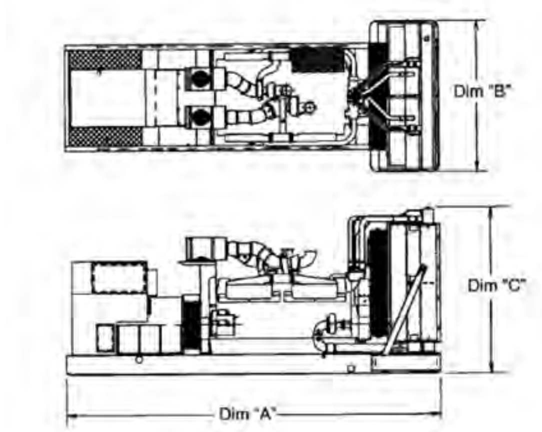
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

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.
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

Our energy working for you.™

Generator set data sheet

Model:	**DQDAA**
Frequency:	**60 Hz**
Fuel type:	**Diesel**
kW rating:	**250 Standby** **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	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	120/208 867	127/220 820	139/240 752	220/380 475	240/416 434	254/440 410	277/480 376	347/600 301	

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	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.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™

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

250-500 kW

For 250kW & 500kW

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

Our energy working for you.™

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):

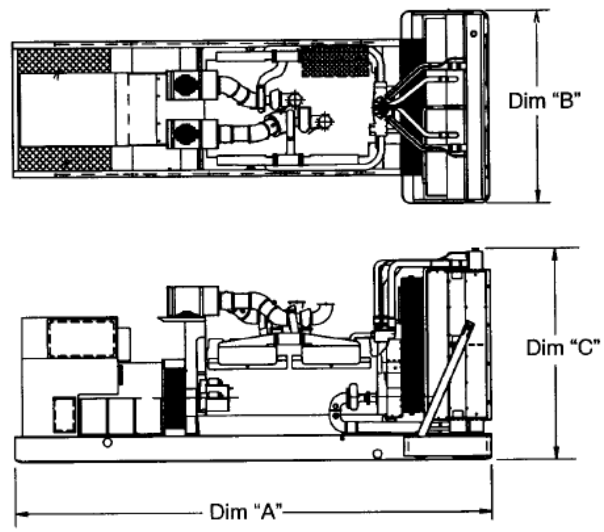
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

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

Our energy working for you.™

NAS-6370-EN.DOCX (04/19) A061F585

Generator Set Data Sheet

Model:	C150D6D
Frequency:	60 Hz
Fuel Type:	Diesel
KW Rating:	150 Standby
	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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

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

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

power.cummins.com

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:

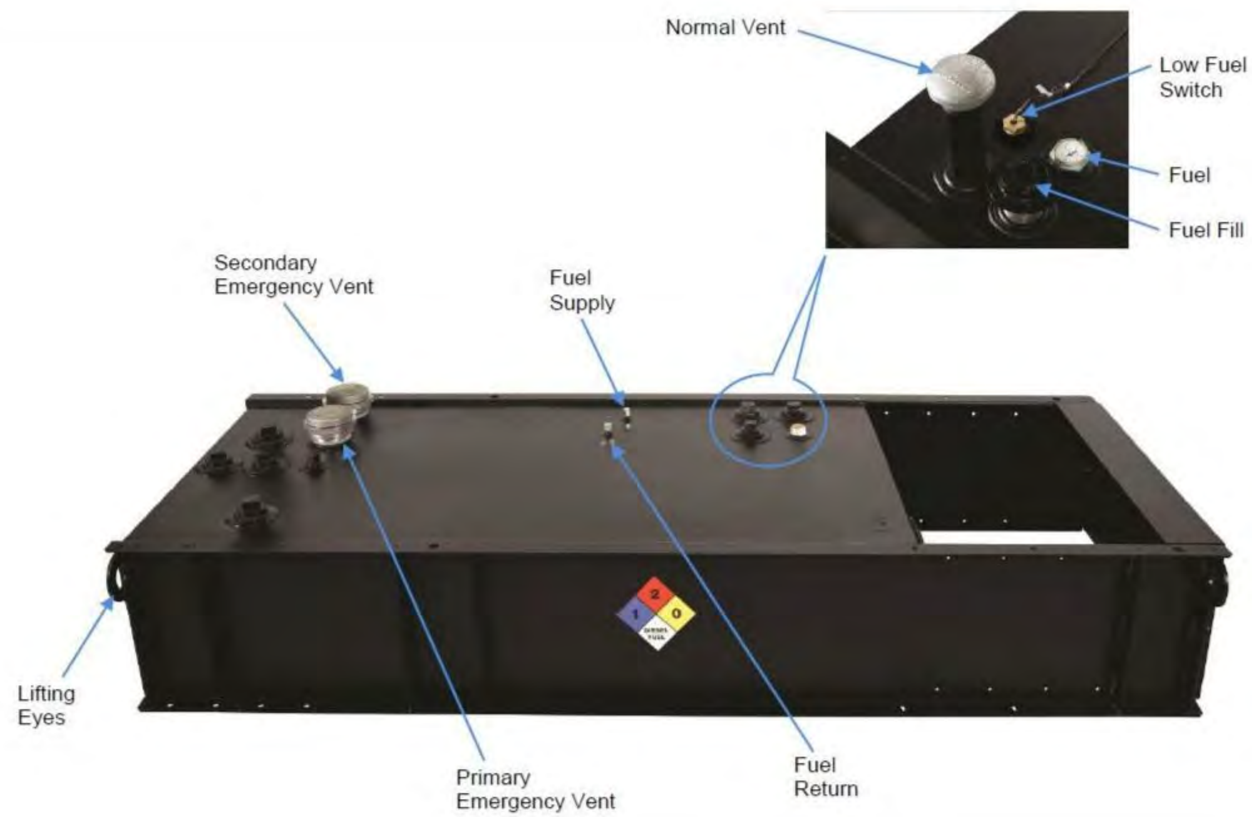
Secondary containment basin switch (rupture switch) - Activates a warning in the event of a primary tank leak. Side mounted.

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.

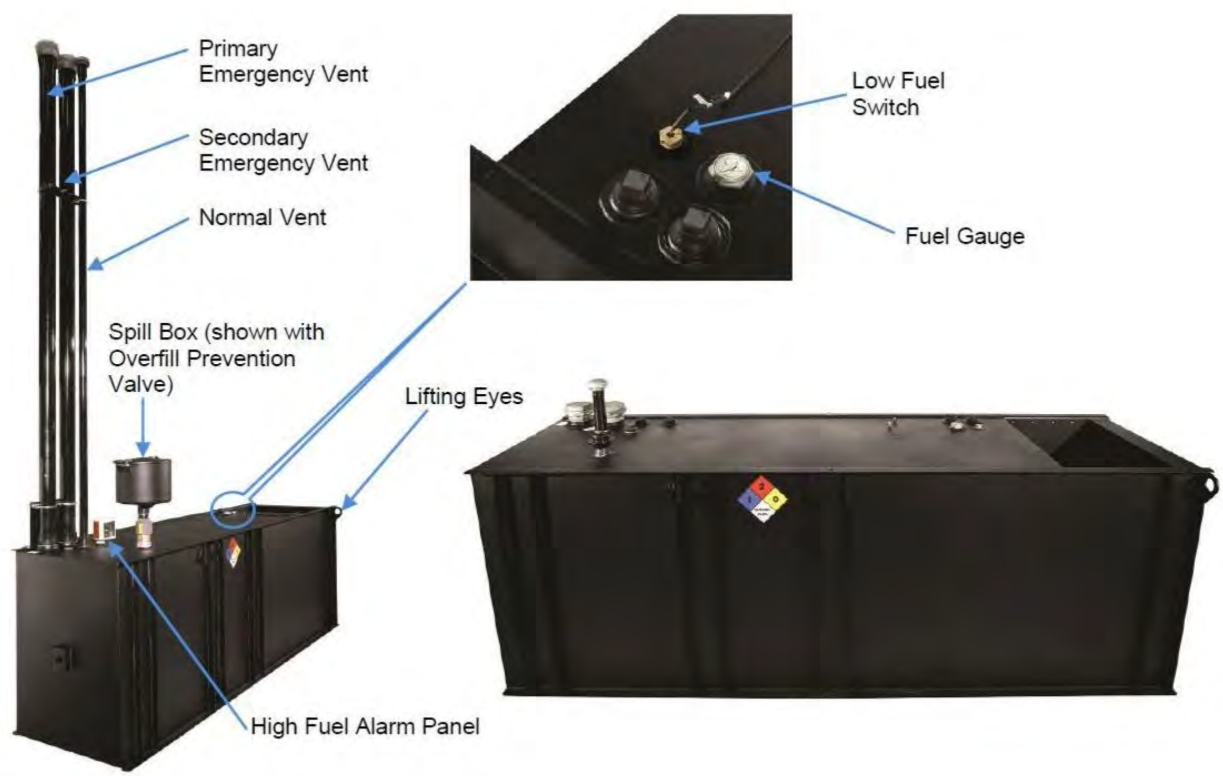
High fuel alarm panel - Provides audible & visual alarm when fuel level reaches 90% of full fuel level.

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.™

BUILDING ID: RS7

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION

701 Laurel Street
Menlo Park, CA 94025
phone: (650) 330-6702
fax: (650) 327-1653
planning@menlopark.org
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** Fuel tank size: 270 gallons (approx) Fuel type: diesel	**NOISE RATING** 72db(A) @ 7meters
SIZE (output in both kW (kilowatt) and hp (horsepower) measurements) Power output: 150 kW (approx) Engine output: 324 hp	**ENCLOSURE COLOR** Green or gray
ROUTE FOR FUELING HOSE ACCESS 75ft max distance, direct from fueling truck to generator fuel tank	**PARKING LOCATION OF FUELING TRUCK** Building exterior at drivable surface
FREQUENCY OF REFUELING 2 times / year	**HOURS OF SERVICE ON A FULL TANK** 24 hours at generator fully rated load

PROPOSED TESTING SCHEDULE (including frequency, days of week, and time of day)

Monthly, Sunday, AM

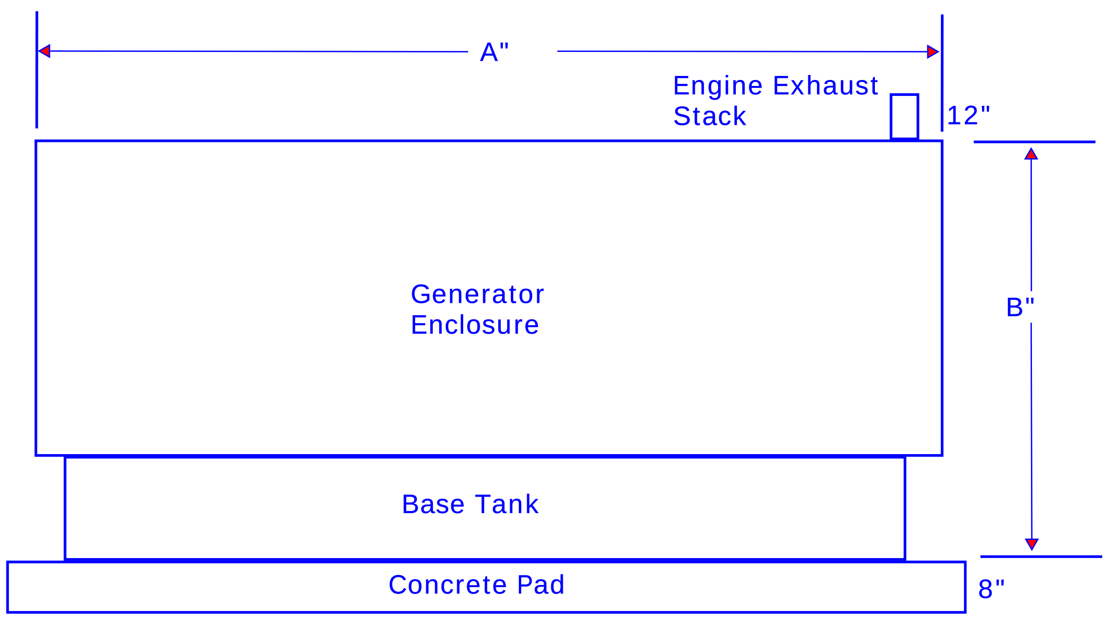
ALARMS AND/OR AUTOMATIC SHUTOFFS (for leaks during use and/or spills/over-filling during fueling, if applicable)

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 °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):

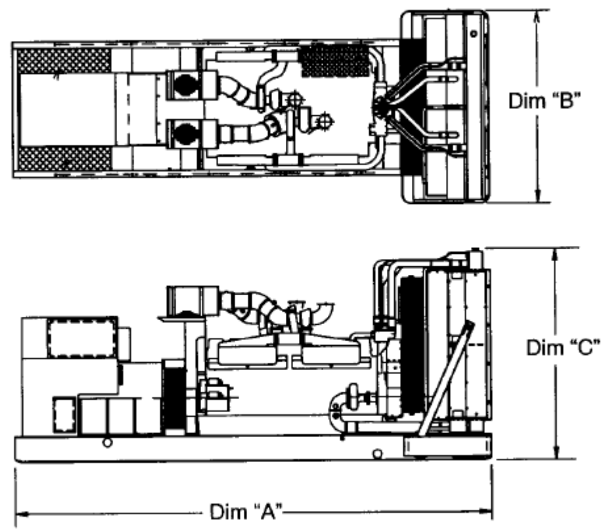
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

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

Our energy working for you.™

Generator Set Data Sheet

Model:	C150D6D
Frequency:	60 Hz
Fuel Type:	Diesel
KW Rating:	150 Standby
	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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

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

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

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.

North America
1400 73rd Avenue N.E.
Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

Our energy working for you.™

NAD-6372-EN (08/20) A061F587

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:

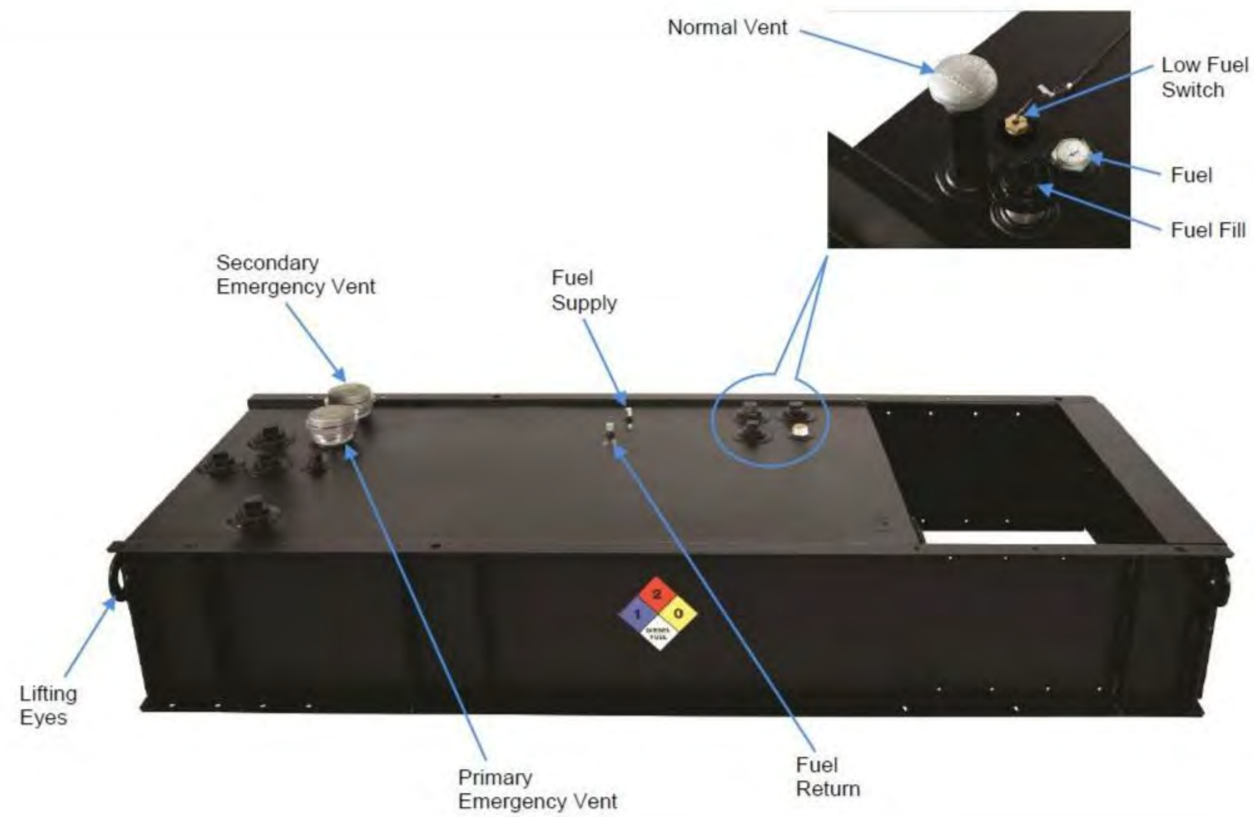
Secondary containment basin switch (rupture switch) - Activates a warning in the event of a primary tank leak. Side mounted.

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.

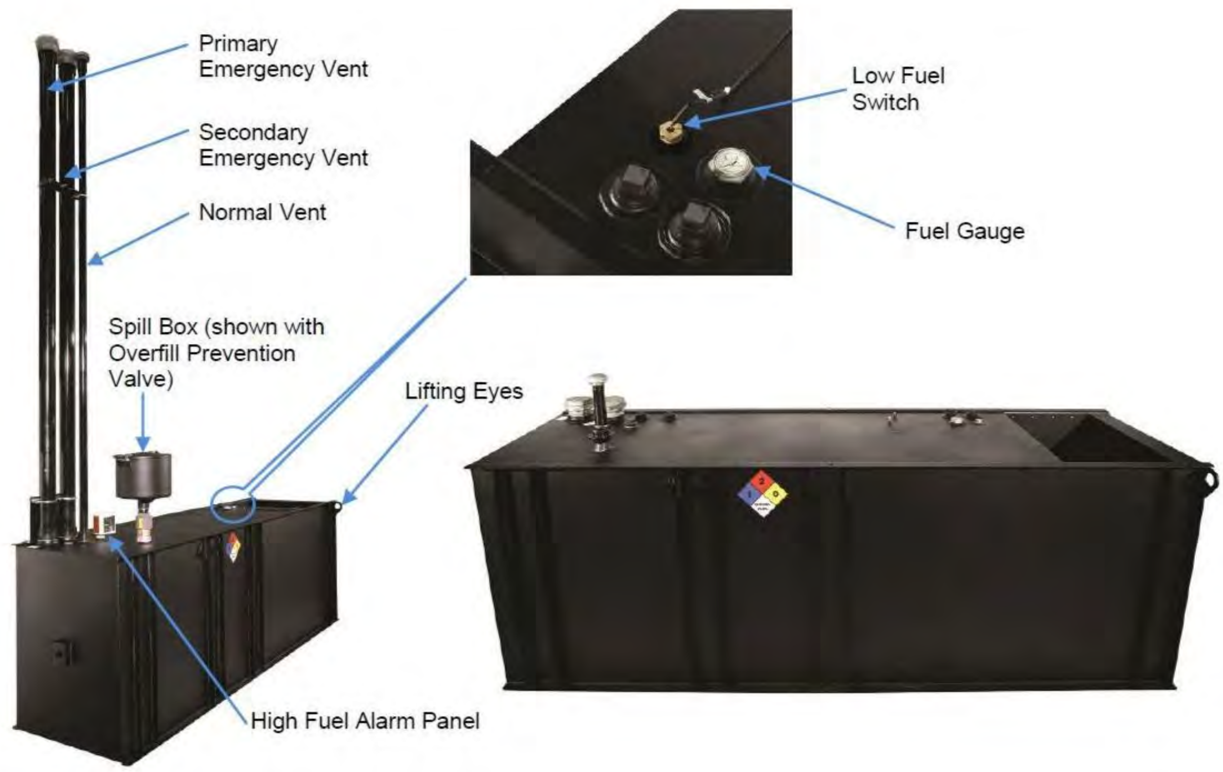
High fuel alarm panel - Provides audible & visual alarm when fuel level reaches 90% of full fuel level.

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.™

NAAC-5868-EN (02/18)

REVISIONS			
NO.	DATE	DR.	NATURE

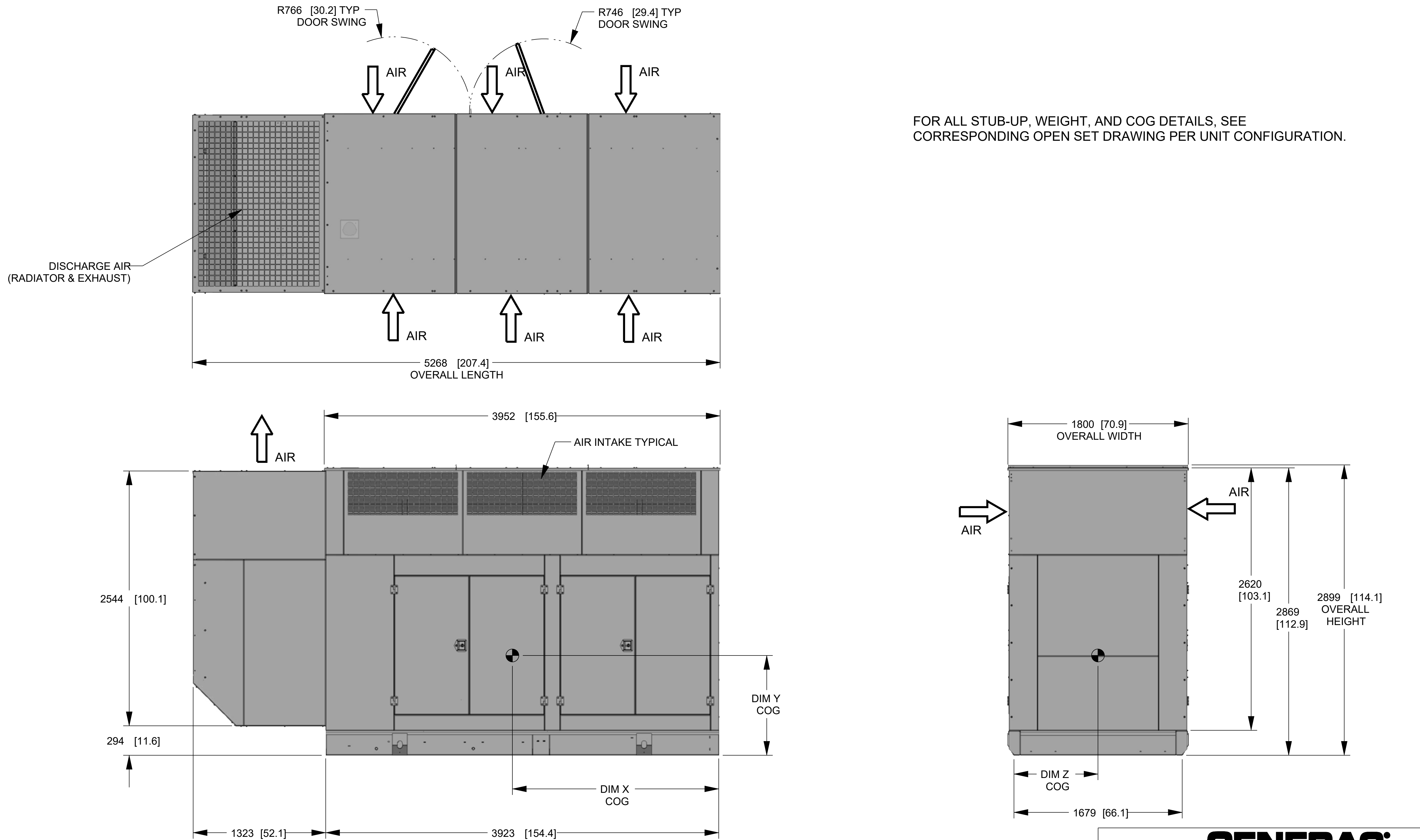
SITE PLAN

SERVICE STATION #207718
1399 WILLOW ROAD
MENLO PARK, CA 94025

Chevron

DATE: 08/26/20
DRAWN BY: GRH
SCALE: 1"=10'-0"
FILENAME: 207718RCIP6

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

GENERAC | INDUSTRIAL POWER

Standby Power Rating

500 kW, 625 kVA, 60 Hz

Prime Power Rating*

450 kW, 563 kVA, 60 Hz

*Assembled in the USA using domestic and foreign parts

*EPA Certified Prime ratings are not available in the US or its Territories

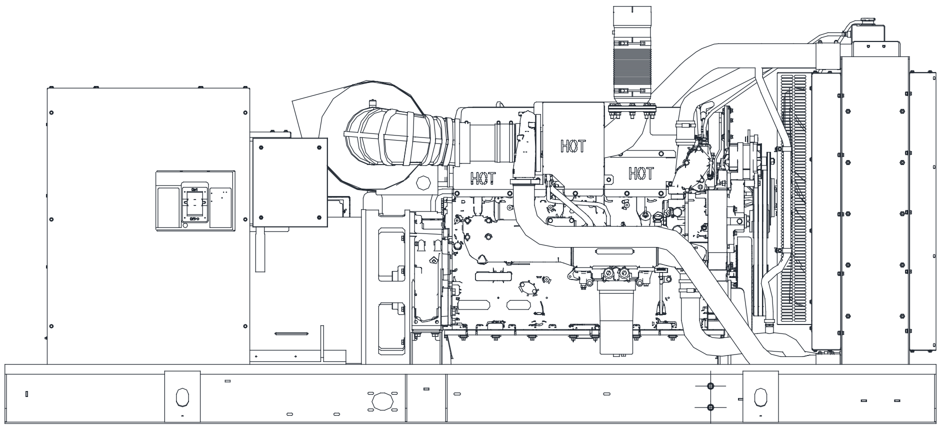


Image used for illustration purposes only

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.

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)

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

SD500 | 15.2L | 500 kW

INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

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%

GENERAC INDUSTRIAL POWER

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.

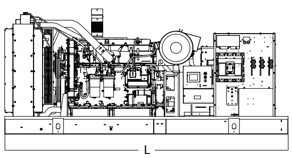
SD500 | 15.2L | 500 kW

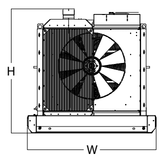
INDUSTRIAL DIESEL GENERATOR SET

EPA Certified Stationary Emergency

GENERAC | INDUSTRIAL POWER

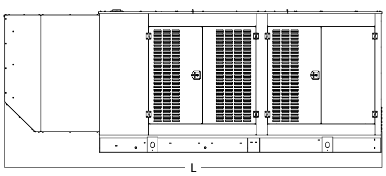
DIMENSIONS AND WEIGHTS*

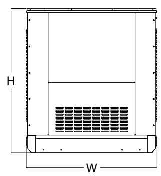




OPEN SET (Includes Exhaust Flex)

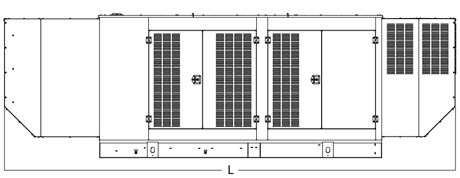
Run Time Hours	Usable Capacity Gal (L)	L x W x H - in (mm)	Weight - lbs (kg)
No Tank	-	154.4 (3,923) x 71.0 (1,803) x 67.3 (1,709)	10,435 (4,733)
9	334	158.5 (4,025) x 71.0 (1,803) x 81.3 (2,065)	12,110 (5,493)
28	1,001	158.5 (4,025) x 71.0 (1,803) x 103.3 (2,623)	15,272 (6,927)
28	1,001	228.0 (5,791) 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)

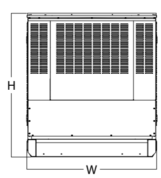




WEATHER PROTECTED ENCLOSURE

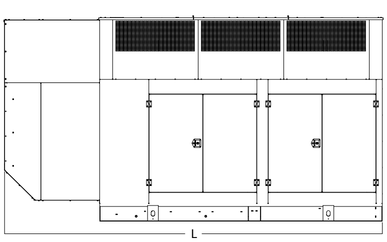
Run Time Hours	Usable Capacity Gal (L)	L x W x H - in (mm)	Weight - lbs (kg)	
			Steel	Aluminum
No Tank	-	207.4 (5,268) x 70.9 (1,800) x 79.9 (2,031)	12,672 (5,748)	12,017 (5,451)
9	334	207.4 (5,268) x 70.9 (1,800) x 93.9 (2,387)	14,347 (6,508)	13,692 (6,211)
28	1,001	207.4 (5,268) x 70.9 (1,800) x 115.9 (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)

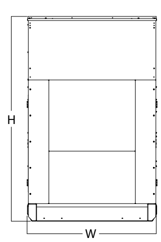




LEVEL 1 SOUND ATTENUATED ENCLOSURE

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.

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.

---

[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:

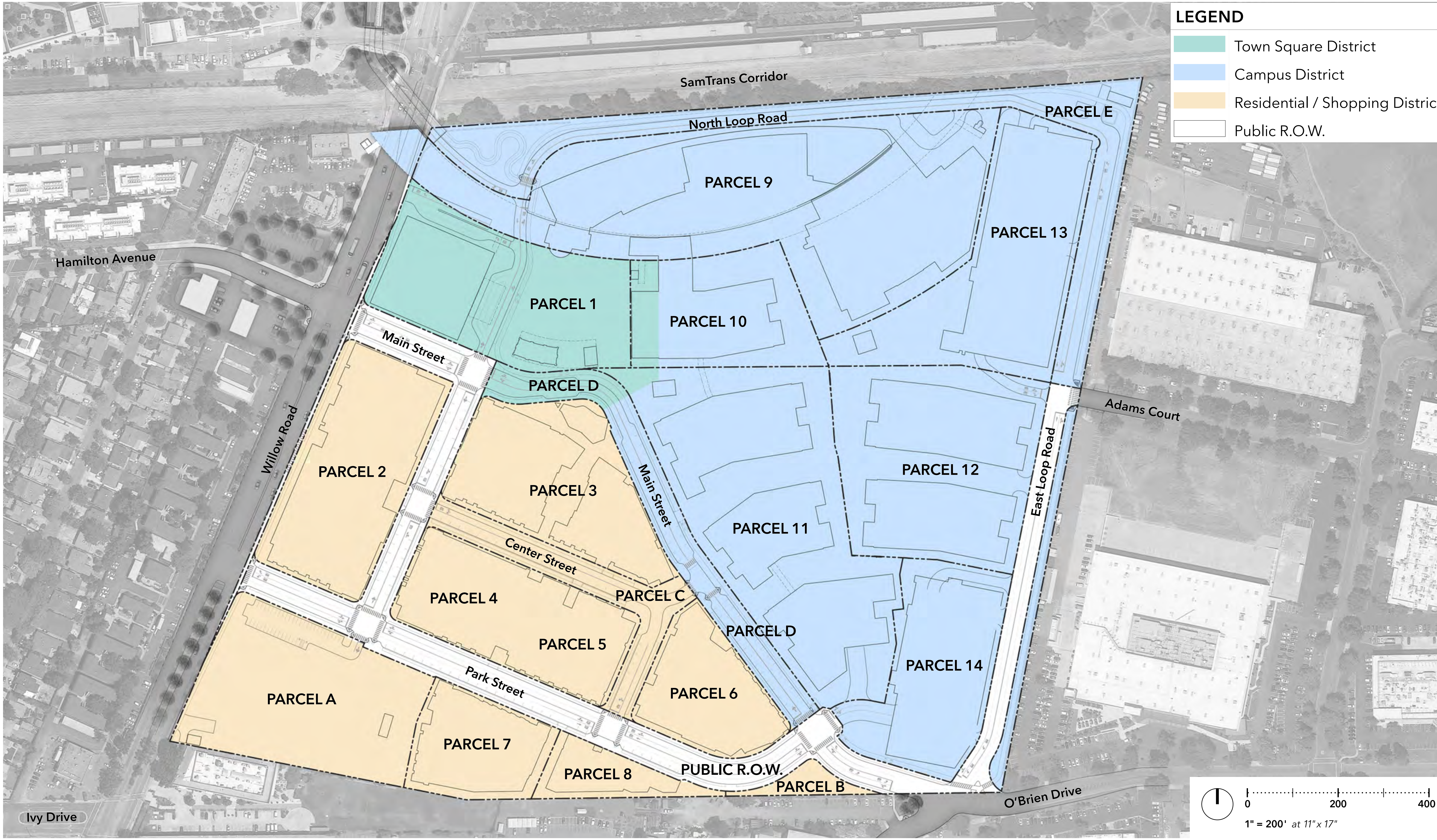
Yes, currently the office campus (6 offices + 2 garages) is on track to have enough solar PV to offset this gas usage. We are estimating producing approx. 3.5M kWh/year from solar PV.

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 ANALYSIS

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