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STANFORD 2018 GENERAL USE PERMIT: GHG TECHNICAL REPORT

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

°C	Degree Celsius
AB	Assembly Bill
ABAG	Association of Bay Area Governments
AEP	Association of Environmental Professionals
ARB	California Air Resources Board
ARRA	American Recovery and Reinvestment Act
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BAU	Business-As-Usual
Bay Area Basin	San Francisco Bay Area Basin
BMP	Best Management Practice
CAFE	Corporate Average Fuel Economy
CalEEMod®	California Emission Estimator Model
CAP	Criteria Air Pollutant
CAT	Climate Action Team
CEC	California Energy Commission
CEF	Central Energy Facility
CEQA	California Environmental Quality Act
CF_4	Perfluoromethane
CFC	Chlorinated Fluorocarbon
CH_4	Methane
CNRA	California Natural Resources Agency
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
CY	Cubic Yards
DOT	Department of Transportation
EDGAR	Emissions Database for Global Atmospheric Research
EIR	Environmental Impact Report
EISA	Energy Independence and Security Act
EMFAC	EMission FACtor Model

GHG	Greenhouse Gas
GT	Billion Metric Tons
GUP	General Use Permit
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
Lb	Pound
LCFS	Low Carbon Fuel Standard
LFG	Landfill Gas
MMT	Million Metric Tons
mpg	Miles Per Gallon
MPO	Metropolitan Planning Organization
MRR	Mandatory Reporting Rule
MT	Metric Tons
MTC	Metropolitan Transportation Commission
MWh	Megawatt-Hour
N_2O	Nitrous Oxide
NCDC	National Clean Diesel Campaign
NHTSA	National Highway Traffic Safety Administration
OPC	California Ocean Protection Council
OFFROAD	Missions Inventory Program Model
OPR	Office of Planning and Research
PGE	Pacific Gas and Electric
ppb	Parts Per Billion
ppm	Parts Per Million
PSD	Prevention of Significant Deterioration
PSSI	Peninsula Sanitary Service, Inc.
Ramboll	Ramboll Environ US Corporation
RFS	Renewable Fuel Standard
RPS	Renewables Portfolio Standard
RTAC	Regional Targets Advisory Committee
RTP	Regional Transportation Plan
SB	Senate Bill

SCS	Sustainable Communities Strategy
SEM	Sustainability and Energy Management
SESI	Stanford Energy System Innovations
SF_6	Sulfur Hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
WCI	Western Regional Climate Action Initiative
WECC	Western Electricity Coordinating Council
ZEV	Zero-Emission Vehicle
ZNE	Zero Net Energy

1. INTRODUCTION

Please note that this report replaces the Greenhouse Gas Technical Report dated April 13, 2017. This updated report incorporates updates to the traffic data that result in minor changes to mobile emissions.

1.1 Project Description

Stanford University's contiguous lands occupy over 8,000 acres, with 4,017 of those acres in unincorporated Santa Clara County. The development of the Stanford land in unincorporated Santa Clara County currently is subject to conditions of approval in the 2000 General Use Permit (GUP). The 2000 GUP authorized the development of 2.035 million square feet of net new academic space and 3,018 net new housing units. In March 2016 the Santa Clara County Planning Commission authorized an additional 1,450 housing units. As of December 2015, 769,354 square feet of academic buildings remain to be built under the 2000 GUP. Stanford is proposing a 2018 GUP that would authorize 2.275 million net new academic space and 3,150 net new housing units. Stanford estimates that the new development authorized by the proposed 2018 GUP would occur between 2018 and 2035.

1.2 Emissions Inventory Years

This report evaluates the greenhouse gas (GHG) emissions inventories associated with the buildings and energy sources for existing conditions and the development proposed for the 2018 GUP (the "Project"). Inventories presented here represent calendar years 2014 and 2015, annualized emissions expected in Fall 2018, emissions expected in Fall 2020 including occupancy of the Escondido Village Graduate Residences, and the emissions inventory for the completion of the development proposed for the 2018 GUP, anticipated to occur by Fall 2035.

1.2.1 Study Area Boundaries

Stanford anticipates that the 2018 GUP will continue to cover all of its lands in unincorporated Santa Clara County. However, the GUP does not apply to land uses within those areas that are permitted as of right. The single-family and two-family residences in the faculty/staff subdivision are permitted as of right, and therefore are not included in the study area for this report. In addition, Stanford does not propose development under the 2018 GUP in areas zoned for medium-density faculty and staff housing (i.e., the Peter Coutts, Pearce Mitchell, and Olmsted Terrace housing areas). Nor does Stanford propose development outside the Academic Growth Boundary, including on the Stanford Golf Course. Therefore, these areas similarly are not included in the study area boundary for this GHG Technical Report.

The study area boundary includes all of the Academic Campus and Campus Open Space lands, including the Stanford Driving Range, which Stanford proposes to designate as Academic Campus rather than medium-density residential. Thirty-eight faculty and staff housing units are included in the study area in the Searsville and Olmsted staff rental subdivisions. The study area within which the emissions are analyzed are shown in **Figure 1-2**.

1.2.2 Existing Conditions Analysis Years

This document contains the evaluation of three analysis years to represent existing conditions. A more complete description of the existing condition years and the recent history of Stanford's emissions profile is provided in Section 3.2. The scenario years are:

1. 2014, which represents the state of the campus energy systems at the Stanford campus prior to the implementation of the Stanford Energy System Innovations (SESI), and also includes the operations of the Valero Service Station. This period uses data from 2014. A major feature of SESI was the replacement of the steam-based heating system with a hot-water based heating system, and replacement of the cogeneration plant with a new more efficient Central Energy Facility (CEF). A fuller description of the SESI and a comparison of the old and new CEF is provided in Section 3.2. The 2014 information is provided to aid in understanding the degree to which historic emissions have been reduced.
2. 2015, which represents the state of the campus energy systems after SESI. This period uses data from 2015. Natural gas and electricity usage is based on July – December 2015, after SESI is implemented. This scenario also reflects year 2015 emission factors.
3. Fall 2018, which represents the conditions that are expected to exist immediately prior to commencement of operations under the proposed 2018 GUP. This includes buildings that would be expected to be permitted and occupied during implementation of the 2000 GUP, and also reflects emission factors consistent with 2018. The Fall 2018 scenario assumes that the Escondido Village Graduate Residences Project is under construction, but not yet occupied and operational.
4. Fall 2020, which represents the conditions expected to exist after complete buildout of the 2000 GUP, including the operations from the Escondido Village Graduate Residences, and the same academic square footage as the Fall 2018 scenario. This scenario reflects emission factors consistent with 2020.

1.2.3 Project Analysis Year

This document evaluates the emissions inventory for complete buildout of the 2018 GUP (i.e., the Project). Because California has adopted a regulatory goal for reductions in GHG emissions by 2030, the Project emissions inventory is based on adopted regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming the total operational activity from complete buildout and operation of the 2018 GUP in 2030. This scenario is called "Fall 2035" because it consists of the full Project operations expected by 2035; however, if 2035 emission factors were used instead of 2030 emission factors, then total GHG emissions would be even lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. This report also includes an estimate of Project emissions in Fall 2035 that incorporates intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. The additional scenario is labeled "Fall 2035 With RPS Projection".

2. GHG SCIENTIFIC BACKGROUND AND REGULATORY OVERVIEW

2.1 GHG Scientific Background

There is international scientific consensus that anthropogenic emissions of greenhouse gases (GHGs)[1] have and will continue to contribute to changes in the global climate. Although there is uncertainty concerning the magnitude, rate, and ultimate effects of this change, it is generally accepted that climate change will result in a number of substantial adverse environmental impacts.

Climate change is the cumulative effect of all natural and anthropogenic sources of GHGs on a global scale. The GHG emissions from an individual project, even a very large development project, would not individually generate sufficient GHG emissions to measurably influence global climate change.[2,3] Consideration of a project's climate change impact, therefore, is essentially an analysis of a project's contribution to a cumulatively significant global impact through its emission of GHGs. While it is possible to examine the quantity of GHGs that would be emitted from individual project sources, it is not currently possible to link these GHGs emitted from a specific source or location to particular global climate changes.

The State of California, through Assembly Bill (AB) 32, Senate Bill (SB) 32, Executive Order S-3-05, and Executive Order B-30-15 has set state-wide targets for the reduction of GHG emissions. The goal of AB 32, Executive Order S-3-05, and Executive Order B-30-15 is to reduce future GHG emissions in a state that is expected to experience rapid growth in population and economic output.

2.1.1 Global Setting

This section describes the status of global science on climate change and the scientific consensus regarding the role of anthropogenic GHG emissions in contributing to climate change and global warming. This section also describes global-scale estimates of GHG trends and projected effects on climate.

2.1.1.1 Global Climate Change

Global warming and global climate change are both terms that describe changes in the earth's climate. Global climate change is a broad term used to describe any worldwide, long-term change in the earth's climate. This change could be, for example, an increase or decrease in temperatures, the start or end of an ice age, or a shift in precipitation patterns. The term global warming is more specific than global climate change and refers to a general increase in temperatures across the earth. Though global warming is characterized by rising temperatures, it can cause other climatic changes, such as a shift in the frequency and

[1] For the purposes of this analysis, the term "GHGs" refers to carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride, those gases regulated under California AB 32 and the Kyoto Protocol of the United Nations Framework Convention on Climate Change. Although the State of California also declared nitrogen trifluoride a GHG, there is no nitrogen trifluoride associated with this project. Therefore, nitrogen trifluoride will not be further considered.

[2] Alternative Approaches to Analyzing GHG Emissions and Global Climate Change in CEQA Documents. Accessed July 8, 2016. http://www.placer.ca.gov/Departments/CommunityDevelopment/EnvCoordSvcs/EIR/Homewood/drafteir/~/media/cdr/ECS/EIR/Homewood/ClimateChange/1_AEP2007.ashx

[3] Technical Advisory. CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review. June 19. Accessed July 8, 2016. http://opr.ca.gov/docs/june08-ceqa.pdf

intensity of rainfall or hurricanes. Global warming does not necessarily imply that all locations will be warmer. Some specific, unique locations may be cooler even though the world, on average, is warmer. All of these changes fit under the umbrella of global climate change.[4]

While global warming can be caused by natural processes, there is a general scientific consensus that most current global warming is the result of human activity on the planet.[5] This human-made, or anthropogenic, warming is primarily caused by increased emissions of GHGs that keep the earth's surface warm. This is called "the greenhouse effect." The greenhouse effect and the role that GHGs play in it are described below.

2.1.1.2 The Greenhouse Effect

Greenhouses allow sunlight to enter, and then they capture some of the heat generated by the sunlight. Similarly, the earth's atmosphere acts like a greenhouse by retaining some of the heat that is generated by the sun. When solar radiation from the sun reaches the earth, much of it penetrates the atmosphere to ultimately reach the earth's surface; this solar radiation is absorbed by the earth's surface and then re-emitted as heat in the form of infrared radiation.[6] The warming potential of GHGs does not come from the absorption of solar radiation but from the absorption of infrared radiation. When the infrared radiation is absorbed by the molecules of GHGs, it is re-radiated in all directions. A portion of the infrared radiation is emitted back toward the surface of the earth, in effect "trapping" the heat in the atmosphere.[7] This phenomenon is referred to as the "greenhouse effect."

The earth's greenhouse effect has existed far longer than humans have and has played a key role in the development of life. Concentrations of major GHGs, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor, have been naturally present for millennia at relatively stable levels in the atmosphere, maintaining hospitable temperatures on the surface of the earth. Without these GHGs, the earth's temperature would be too cold for life to exist.

In the absence of major industrial human activity, natural processes have maintained atmospheric concentrations of GHGs, and, therefore, global temperatures at constant levels over the last several centuries.[8] As human industrial activity has increased, atmospheric concentrations of certain GHGs have grown dramatically. Concentrations of CO_2 and CH_4 over the past 10,000 years has increased, particularly dramatically since the Industrial Revolution. As the concentrations of GHGs increase due to human activity, more infrared

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[4] Other definitions of "greenhouse effect" and "global warming" can be found on Merriam-Webster online at http://www.m-w.com/. A definition for "climate change" can be found at http://dictionary.reference.com, which uses Webster's New Millennium™ Dictionary of English, Preview Edition (v 0.9.6). (Websites accessed July 8, 2016.)

[5] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

[6] All light, be it visible, ultraviolet, or infrared, carries energy.

[7] Infrared radiation is characterized by longer wavelengths than solar radiation. GHGs reflect radiation with longer wavelengths. As a result, instead of escaping back into space, GHGs reflect much infrared radiation (i.e., heat) back to the earth.

[8] Examples of natural processes include the addition of GHGs to the atmosphere from respiration, fires, and decomposition of organic matter. The removal of GHGs is mainly from plant and algae growth and absorption by the ocean.

radiation is reflected back toward the earth, subsequently heating the surface of the earth to higher temperatures. This is the process that is described as human-induced global warming.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) began releasing components of its Fifth Assessment Report,[9] providing a comprehensive assessment of climate change science. The Fifth Assessment Report states that there is a scientific consensus that the global increases in GHGs since 1750 are mainly due to human activities such as fossil fuel use, land use change (e.g., deforestation), and agriculture. In addition, the report states that it is likely that these changes in GHG concentrations have contributed to global warming. Confidence levels of claims in this report have increased since the release of the Third and Fourth Assessment Reports due to the large number of simulations run and the broad range of available climate models.[10]

2.1.1.3 GHGs and GHG Emission Sources

The term "greenhouse gases" includes gases that are emitted from natural processes, such as forest fires, and anaerobic degradation, as well as man-made fossil fuel combustion, such as CO_2, CH_4, N_2O, and water vapor, as well as gases that are only human-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfur hexafluoride (SF_6). These last three families of gases, while not naturally present in the atmosphere, have properties similar to the naturally occurring GHGs that also cause them to trap infrared radiation when they are present in the atmosphere, thus making them GHGs. These six gases comprise the major GHGs that are recognized by the Kyoto Protocol (water is not included).[11] A seventh gas, nitrogen trifluoride, was also recognized by the California Air Resources Board (ARB) as a GHG.[12] There are other GHGs that are not recognized by the Kyoto Protocol or ARB, due to either the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the Kyoto Protocol or ARB because there is not an obvious correlation between atmospheric water vapor concentrations and specific human activities. Atmospheric water vapor appears to act in a positive feedback manner; higher temperatures lead to higher atmospheric water vapor concentrations, which in turn cause more global warming.[13]

The effect each GHG has on global warming is a combination of the volume of its emissions and its global warming potential (GWP). GWP indicates, on a pound (lb)-for-pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent than CO_2, with GWPs of 25 and 298,[14] respectively. However, these GHGs are nowhere near as potent as

[9] IPCC Fifth Assessment Report. Climate Change 2014: Working Groups I, II, and III Reports. Accessed July 14, 2016. http://www.ipcc.ch/report/ar5/syr/

[10] IPCC Third Assessment Report. Accessed July 14, 2016. https://www.ipcc.ch/ipccreports/tar/

[11] The Kyoto Protocol sets legally binding targets and timetables for cutting the GHG emissions of industrialized countries. The U.S. has not approved the Kyoto Protocol.

[12] Senate Bill 104, which directs ARB to regulate nitrogen trifluoride and possibly other gases found to be at least as harmful as CO_2 was signed into law by Governor Schwarzenegger in October 2009.

[13] Third Assessment Report. Accessed July 9, 2016. https://www.ipcc.ch/ipccreports/tar/

[14] These GWPs are from the IPCC's Fourth Assessment Report.

synthetic chemicals such as SF_6 and perfluoromethane (CF_4), which have GWPs of 22,800 and 7,390, respectively, compared to a GWP of 1 for CO_2.[15]

GHG emissions are typically measured in terms of mass of carbon dioxide equivalent (CO_2e). CO_2e is calculated as the product of the mass of a given GHG and its specific GWP.

The most important GHG in human-induced global warming is CO_2. While many gases have much higher GWPs than the simple GHGs, CO_2 is emitted in such vastly higher quantities that it accounts for 85% of the GWP of all GHGs emitted by the United States (US).[16] Fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles, has led to substantial increases in CO_2 emissions and thus substantial increases in atmospheric CO_2 concentrations. In 2005, atmospheric CO_2 concentrations were about 379 parts per million (ppm), over 35% higher than the pre-industrial concentrations of about 280 ppm.[17]. In addition to the sheer increase in the volume of its emissions, CO_2 is a major factor in human-induced global warming because of its lifespan in the atmosphere of 50 to 200 years.

Concentrations of the second most prominent GHG, CH_4, have also increased due to human activities such as rice production, degradation of waste in landfills, cattle farming, and natural gas mining. In 2005, atmospheric levels of CH_4 were more than double pre-industrial levels, up to 1,774 parts per billion (ppb) as compared to 715 ppb.[18] CH_4 has a relatively short atmospheric lifespan of only 12 years but has a higher GWP than CO_2.

N_2O concentrations increased from about 270 ppb in pre-industrial times to about 319 ppb by 2005.[19] Most of this increase can be attributed to agricultural practices (such as soil and manure management), as well as fossil-fuel combustion and the production of some acids. N_2O's 120-year atmospheric lifespan increases its role in global warming.

Besides CO_2, CH_4, and N_2O, there are several gases and categories of gases that were not present in the atmosphere in pre-industrial times but now exist and contribute to warming. These include CFCs, used often as refrigerants, and their more stratospheric-ozone-friendly replacements, HFCs. Fully fluorinated species, such as SF_6 and CF_4, are present in the atmosphere in relatively small concentrations but have extremely long life spans of 50,000 and 3,200 years each, making them potent GHGs.

2.1.1.4 Current and Projected Climatic Impacts of Global Warming

A strong indication that anthropogenic global warming is currently taking place is the fact that the top ten warmest years since 1880 occurred after 1998, with 2014 as the hottest year on record. Furthermore, a warming of about 0.2 degree Celsius (°C) per decade is projected by currently accepted models.

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[15] Fourth Assessment Report.

[16] USEPA. 2016. Inventory of U.S. GHG Emissions and Sinks: 1990-2014. Accessed July 8, 2016. https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

[17] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[18] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[19] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

There is scientific consensus that global climate change will increase the frequency of heat extremes, heat waves, and heavy precipitation events. Other likely direct effects include an increase in the areas affected by drought and by floods, an increase in tropical cyclone activity, a rise in sea level, and recession of polar ice caps. The impacts of global warming have already been demonstrated by substantial ice loss in the Arctic.[20,21] Scenarios for 2100 modeled in the IPCC's Fifth Assessment Report include the following:[22]

Temperature Increase by 2100

- Low Emissions Scenario: 1.1°C to 2.6°C
- High Emissions Scenario: 2.5°C to 7.8°C

Sea Level Rise by 2100

- Low Emissions Scenario: 0.26 to 0.55 meters (range)
- High Emissions Scenario: 0.45 to 0.82 meters (range)

2.1.2 United States Setting

Total US GHG emissions were approximately 6.9 billion metric tons (GT) CO_2e in 2014, 6.8 GT CO_2e in 2013, and 6.6 GT CO_2e in 2012.[23] Dividing this value by the 2014 U.S. population yields per capita emissions of approximately 21.6 metric tons (MT) CO_2e per person.[24] US emissions have increased by an annual average rate of 0.4% since 1990. Approximately 77% of the CO_2e emissions in the US are comprised of CO_2 emissions from energy-related fossil fuel combustion.[25]

According to the Emissions Database for Global Atmospheric Research (EDGAR), global GHG emission totaled approximately 53.9 GT CO_2e in 2012.[26] The top 10 emitting countries in 2012 were as follows:

- China – 12.5 GT CO_2e
- United States – 6.3 GT CO_2e[27]

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[20] *Summary for Policymakers.* In: *Climate Change 2007: The Physical Science Basis.* Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[21] IPCC. 2007c. Summary for Policymakers. In: Climate Change 2007: Impacts, Adaption and Vulnerability. Accessed July 8, 2016. http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4_wg2_full_report.pdf

[22] Future GHG emissions are the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change. Their future evolution is highly uncertain. Scenarios are alternative images of how the future might unfold and are an appropriate tool with which to analyze how driving forces may influence future emission outcomes and to assess the associated uncertainties. They assist in climate change analysis, including climate modeling and the assessment of impacts, adaptation, and mitigation. The possibility that any single emissions path will occur as described in scenarios is highly uncertain. More information on the IPCC's selection of scenarios is available at, http://www.ipcc.ch/ipccreports/sres/emission/index.htm accessed July 8, 2016.

[23] USEPA. 2016. Inventory of US GHG Emissions and Sinks 1990-2014. Accessed June 30, 2016. https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf.

[24] US Census Population. Accessed June 30, 2016.http://www.census.gov/topics/population.html .

[25] State Energy CO_2 Emissions. Access July 1, 2016. https://www.epa.gov/statelocalclimate/state-energy-co2-emissions.

[26] GHG (CO_2, CH_4, N_2O, F gases) emission time series 1990-2012 per region/country. Emission Database for Global Atmospheric Research. Accessed June 30, 2016. http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts1990-2012&sort=des9.

- India – 3.0 GT CO_2e
- Brazil – 3.0 GT CO_2e
- Russian Federation – 2.8 GT CO_2e
- Japan – 1.5 GT CO_2e
- Canada – 1.0 GT CO_2e
- Germany – 0.95 GT CO_2e
- The Democratic Republic of Congo – 0.80 GT CO_2e
- Indonesia – 0.78 GT CO_2e

In 2012, CO_2e emissions from industrialized countries reporting their inventories to the United Nations Framework Convention on Climate Change (UNFCCC) were as follows:[28]

- United States – 6.5 GT CO_2e
- European Union (27 members) – 4.5 GT CO_2e
- Russian Federation – 2.3 GT CO_2e
- Japan – 1.3 GT CO_2e
- Canada – 0.70 GT CO_2e

2.1.3 California Setting

In 2014, California emitted approximately 442 million metric tons (MMT) CO_2e, or about 7% of the total US emissions, whereas California represents over 12% of the US population.

In 2013, the largest source of GHG emissions in California (approximately 38%) was the transportation sector.[29] High GWP gases[30] accounted for approximately 4% of the CO_2e emissions in 2011.[31] California's 2014 per-capita GHG emissions were 11.4 MT CO_2e per person[32]. Since 2001, California's per-capita GHG emissions have trended downward despite an increase in population. An overall decrease in gross GHG emissions since 2008 has also contributed to the decrease in per-capita GHG emissions.[33]

In 2012, emissions from facilities required to report their GHG inventories to ARB under the California Mandatory Reporting Rule (MRR) rose following a three-year decline. Emissions from these facilities remained constant the following year. Emissions were 110.0, 123.3, and 123.2 MMT CO_2e for 2011, 2012, and 2013, respectively.[34] ARB forecasts that California's

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[27] Slight difference between USEPA value and EDGAR value may be due to differences in sources and methodology used by the two organizations.

[28] *Time Series Annex I: GHG Total Excluding Land Use, Land-Use Change and Forestry.* Accessed June 30, 2016. http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3841.php

[29] Emissions Trends: Mandatory GHG Emissions Reporting. January. Accessed July 1, 2016. http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2008-2013-ghg-summary-2015-06-30.pdf.

[30] Such as HFCs and PFCs.

[31] California GHG Emission Inventory. Accessed July 1, 2016. http://www.arb.ca.gov/cc/inventory/data/data.htm.

[32] US Census QuickFacts. Accessed July 1, 2016. http://www.census.gov/quickfacts/

[33] Emissions Trends: Mandatory GHG Emissions Reporting. January. Accessed July 1, 2016..http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2008-2013-ghg-summary-2015-06-30.pdf

[34] California GHG Emission Inventory. Accessed July 1, 2016. http://www.arb.ca.gov/cc/inventory/data/data.htm

GHG emissions will reach approximately 509 MMT CO_2e by 2020 if no further measures are taken to mitigate or decrease emissions.[35]

2.1.4 Bay Area Setting

The Bay Area Air Quality Management District (BAAQMD) published an updated inventory of GHG emissions in the San Francisco Bay Area Air Basin (Bay Area Basin) in January 2015 based on a 2011 inventory year. Total GHG emissions within the Bay Area Basin in 2011 were estimated as 86.6 MMT CO_2e. Fossil fuel consumption in the transportation sector and the industrial/commercial sector were the two largest sources of the Bay Area Basin's GHG emissions in 2011, contributing, respectively, 39.7% and 35.7% of GHG emissions in the Bay Area Basin. These sectors were followed by electricity/co-generation (14.0%), residential fuel usage (7.7%), off-road equipment (1.5%), and agriculture/farming (1.5%).

To reduce future GHG emissions, BAAQMD published the California Environmental Quality Act (CEQA) Guidelines, which were updated in May of 2012.[36] BAAQMD CEQA Guidelines suggest adopting a climate action plan that includes both a GHG emission inventory and a forecast of future emissions. In accordance with the 2010 BAAQMD CEQA Guidelines, the BAAQMD has created a forecast of GHG emissions through 2020 by applying sector-specific growth factors to the baseline year emissions. The BAAQMD GHG Plan Level Guidance document identifies specific growth metrics and data sources for the various sectors including residential, commercial, industrial, transportation, waste, water treatment, and agriculture. The BAAQMD projects that GHG emissions will increase to approximately 94.8 MMT CO_2e per year by 2029 if current trends continue without mitigation.[37]

2.1.5 Santa Clara County Setting

In 2015, BAAQMD prepared GHG inventories for each of the nine Bay Area Counties.[38] In this report, annual GHG emissions of Santa Clara County for basis year 2011 were listed as 16.0 MMT CO_2e.

2.1.6 Stanford University Setting

In 2007, Stanford University formed its Sustainability and Energy Management (SEM) program. Stanford reported that in 2014, campus operations produced approximately 209,000 $MTCO_2e$.[39] On-site power generation accounts for 58% of these emissions. 12% of the total is attributable to vehicles used to commute to campus. 11% of GHG emissions are attributable to power generation for Stanford Hospital. Stanford aims to increase

[35] GHG Inventory. Accessed July 1, 2016. 2020 Emissions Forecast. Accessed July 8, 2016. http://www.arb.ca.gov/cc/inventory/data/forecast.htm.

[36] BAAQMD GHG Plan Level Guidance. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en.

[37] Source Inventory of Bay Area GHG Emissions: Base Year 2011. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf

[38] Source Inventory of Bay Area GHG Emissions: Base Year 2011. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf

[39] The primary differences between the Stanford SEM's 2014 inventory and the inventory presented in this GHG Technical Report are different boundaries accounted for in the two inventories and that Stanford SEM's inventory does not account for GHG emissions from vehicular activity from workers and visitors.

sustainability by conserving energy in existing buildings, incorporating efficiency in new building designs, and seeking out more sustainable sources of energy.[40]

2.1.7 Climate Change Effects

The California Natural Resources Agency (CNRA) prepared the Climate Adaptation Strategy in 2009, which discusses the impacts of climate change on California.[41] The Climate Adaptation Strategy identifies different areas of focus for decision makers, listed below, and aims to safeguard California by reducing climate risks. This document was updated in July 2014 as Safeguarding California: Reducing Climate Risk, which discusses examples of progress made since 2009.[42] Notable advances in the 2014 update include the creation of the Cal-Adapt tool for visualization of local climate impacts, the publication of the 2012 California Climate Adaptation Planning Guide for local and regional governments, and the 2013 Climate Change Consortium for Specialty Crops for agricultural resilience.

The Climate Adaptation Strategy was developed as a result of the November 2008 Executive Order S-13-08, which called for State agencies to plan for sea level rise and other climate impacts, and coordinated these plans in California's first strategy.

2.1.7.1 Changing Temperatures

The CNRA described new projections by Massachusetts Institute of Technology modelers predicting a median probability of surface warming of 5.2°C by the year 2100, which is much higher than previous modeling completed in 2003.[43] Researchers modeled temperature changes specifically related to California.[44] The model predicted greater temperature increases in summer than in winter and larger increases inland than in coastal areas.

2.1.7.2 Tipping Elements

The CNRA emphasized "tipping elements," which bring about "abrupt changes that could push natural systems past thresholds beyond which they could not recover." According to the CNRA, there are five main events (see Table 2-1-1) that could bring about abrupt environmental changes. Each of these five has a particular tipping temperature at which the event is likely to occur. The consequence of crossing each threshold could cause a 7- to 12-meter rise in sea level over the course of several centuries.

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[40] Stanford Sustainability and Energy Management. Accessed July 1, 2016. https://sustainable.stanford.edu/sites/default/files/resource-attachments/E_C_Plan_2015.pdf

[41] 2009 California Climate Adaptation Strategy. Accessed July 1, 2016. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

[42] 2014 Safeguarding California: Reducing Climate Risk. An update to the 2009 California Climate Adaptation Strategy. Final Version. Accessed July 1, 2016. http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf

[43] Chandler, David, 2009. Climate Change Odds Much Worse Than Thought: New Analysis Shows Warming Could Be Double Previous Estimates. MIT News Office, May 19. Accessed July 8, 2016. http://news.mit.edu/2009/roulette-0519

[44] Moser, S., G. Franco, S. Pittiglio, W. Chou, W. and D. Cayan. 2008. The Future is Now: An Update on Climate Change Science Impacts and Response Options for California. 2008 Climate Change Impacts Assessment Project - Second Biennial Science Report to the California Climate Action Team, CEC-500-2008-071, Sacramento, CA.

Table 2-1-1 Tipping Elements That Could Trigger Abrupt Environmental Changes

Additional Warming (°F)	Environmental Change	Length of Time for Change to Complete
1-3	Rapid Arctic sea ice melt	10 years
2-4	Irreversible melting of the Greenland Ice Sheet	300 years or more
5-9	Irreversible melting of the West Antarctic Ice Sheet	300 years or more
5-7	Amazon forest die-back	None given
6-11	Intensification of El Niño Southern Oscillation cycles	None given

Notes:

°F = degrees Fahrenheit

Source:

CNRA. 2009. California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

2.1.7.3 Extreme Natural Events

In addition, the CNRA listed extreme natural events are likely to occur, including higher nighttime temperatures and longer, more frequent heat waves overall; a 12–35% decrease in precipitation levels by mid- to late-21st century; increased evaporation and faster incidences of snowmelt that will increase drought conditions; and more precipitation in the form of rain as compared to snow that will decrease water storage in California during the dry season and increase flood events during the wet season.[45]

2.1.7.4 Precipitation Changes

The CNRA also stated that climate change will intensify California's "Mediterranean climate pattern," with the majority of annual precipitation occurring between November and March and drier conditions during the summer.[46] This will increase droughts and floods and will affect river systems. One of the ways to quantify potential impacts related to river systems was by calculating a rise in water temperature and its effects on fisheries resources.[47]

2.1.7.5 Sea Level Rise

The CNRA stated that sea level rise can cause damage to coastal communities and loss of land, which according to a study published by the University of California-Berkeley Department of Agricultural and Resource Economics, could reach tens of billions of dollars

[45] Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment. PIER Research Report, CEC-500-2009-014, Sacramento, CA, California Energy Commission.

[46] Scenarios of Climate Change in California: An Overview (White Paper, CEC-500-2005-203-SF). Sacramento, CA: CCCC, February. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF.

[47] Exposure to High Temperature Influences the Behavior, Physiology, and Survival of Sockeye Salmon During Spawning Migration. Canadian Journal of Zoology. 86(2): pp. 127-140.

per year in direct costs and trillions of dollars of assets in collateral risk.[48] Current calculations of sea level rise from 1900 to 2000 estimate approximately 7 inches along the California coast.[49] Further, up to 55 inches of sea level rise globally by the end of the 21st century is predicted under the "business as usual" model.[50]

2.1.7.6 Water Supply Issues

California Health and Safety Code Section 38501(a) recognizes that climate change "poses a serious threat to the economic well-being, public health, natural resources, and the environment of California," and notes that "the potential adverse impacts of [climate change] include…reduction in the quality and supply of water to the state from the Sierra snowpack." As most of the state, including the San Francisco Peninsula, depends on surface water supplies originating in the Sierra Nevada, this water supply reduction is a concern.

Most of the scientific models addressing climate change show that the primary effect on California's climate would be a reduced snow pack and a shift in stream-flow seasonality. A higher percentage of the winter precipitation in the mountains would likely fall as rain rather than as snow in some locations, reducing the overall snowpack. Further, as temperatures rise, snowmelt is expected to occur earlier in the year, resulting in peak runoff that would likely come a month or so earlier. The end result would be that the state may not have sufficient surface storage to capture the resulting early runoff, and so, absent construction of additional water storage projects, a portion of the current supplies would be lost to the oceans, rather than be available for use in the state's water delivery systems.

2.1.7.7 Low Sea Ice Levels

The CNRA stated that substantial sea ice melting from Greenland and the West Antarctic Ice Sheet has the potential to further raise sea levels. The sea ice extent in the Western Nordic Seas (i.e., Greenland, Norway, and Iceland Seas) is at the lowest level observed in the last 800 years. The implication is that a substantial reduction in sea ice in the Arctic sea promotes alterations in atmospheric circulation and precipitation patterns that extend to the mid-latitudes (e.g., the California coast). Additionally, it was reported that the variations in sea ice extent are correlated with changes in sea surface temperatures and atmospheric and ocean heat transport from the North Atlantic.[51]

The West Antarctic Ice Sheet is a marine-based ice sheet with edges that flow into floating ice shelves. Both the main sheet and the surrounding shelves have been showing signs of shrinking and collapsing due to global warming. Researchers have tracked the fate of at least

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[48] California Climate Risk and Response. Berkeley, CA: University of California-Berkeley, Department of Agricultural and Resource Economics. http://next10.org/sites/next10.huang.radicaldesigns.org/files/California_Climate_Risk_and_Response.pdf

[49] The Future is Now: An Update on Climate Change Science Impacts and Response Options for California. 2008 Climate Change Impacts Assessment Project - Second Biennial Science Report to the California Climate Action Team, CEC-500-2008-071, Sacramento, CA.

[50] Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment. PIER Research Report, CEC-500-2009-014, Sacramento, CA, California Energy Commission. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

[51] Fauria, M., A. Grinsted, S. Helama, J. Moore, M. Timonen, T. Martma, E. Isaksson, and E. Eronen. 2009. Unprecedented Low Twentieth Century Winter Sea Ice Extent in the Western Nordic Seas Since A.D. 1200. Climate Dynamics, June 12.

nine shelves that have receded or collapsed around the Antarctic Peninsula in the past 50 years.[52]

2.1.7.8 Ocean Chemistry

The CNRA also noted that an emerging effect from climate change may be acidification of the ocean. Acidification will affect the ability of hard-shelled invertebrates to create their skeletal structures.[53] The implications of this change are major losses to shellfish industries and shifts in food resources for ocean fisheries. The primary contributing factors were cited as the increasing level of CO_2 and weather pattern shifts. Increases in atmospheric CO_2 levels result in increased uptake of CO_2 by the oceans, which result in decreased pH (acidification). Weather pattern shifts change the amount of calcium carbonate being delivered by rivers from sources stored in rocks, which further exacerbates the ability of invertebrates to form calcified shells.[54]

One of the main contributing factors to CO_2, outside of human influences, is melting permafrost. When permafrost thaws, it releases CO_2 and CH_4 trapped in the soil or beneath lakes into the atmosphere. Scientists are now estimating that there is more than twice the total amount of carbon stored in permafrost as there is in atmospheric CO_2, and that microbial decomposition of organic carbon in permafrost "could amount to roughly half [of the CO_2 emissions] resulting from global land-use change during this century".[55,56]

2.1.7.9 Socio-Economic Issues

Global temperature increases may have significant negative impacts on ecosystems, natural resources, and human health. Ecosystem structure and biodiversity will be compromised by temperature increases and associated climatic and hydrological disturbances.[57] The availability and quality of potable water resources may be compromised by increased salinization of ground water due to sea level rise, decreased supply in semi-arid and arid locations, and poorer water quality arising from increased water temperatures and more frequent floods and droughts.[58] These impacts on freshwater systems, in addition to the effects of increased drought and flood frequencies, may reduce crop productivity and food supply.

In addition to compromising food and water resources, climatic changes associated with global warming can affect human health and welfare through other means. Warmer

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[52] Doyle, A. 2009. Antarctic Ice Shelf Set To Collapse Due To Warming. Roche, A. (ed) In Reuters UK.Thomas Reuters. http://uk.reuters.com/articlePrint?articleId=UKTRE50I4G520090119.

[53] Risien, J. (ed.). 2009. West Coast Regional Marine Research and Information Needs. Corvallis, Oregon: Oregon Sea Grant. ORESU-Q-09-001.

[54] Griffith, E.M., A. Paytan, K. Caldeira, T. D. Bullen, and E. Thomas. 2008. A Dynamic Marine Calcium Cycle During the Past 28 Million Years. Science. December 12.

[55] Schuur, E.A.G., J. Bockheim, J.G. Canadell, E. Euskirchen, C.B. Field, S.V. Goryachkin, S. Hagemann, P. Kuhry, P.M. Lafleur, H. Lee, G. Mazhitova, F.E. Nelson, A. Rinke, V.E. Romanovshy, N. Shiklomanov, C. Tarnocai, S. Venevsky, J.G. Vogel, and S.A. Zomov. 2008. Vulnerability of Permafrost Carbon to Climate Change: Implications for the Global Carbon Cycle. BioScience. 58(8), pp. 701-714.

[56] ScienceDaily. 2008. Thawing Permafrost Likely To Boost Global Warming, New Assessment Concludes, September 2. http://www.sciencedaily.com/releases/2008/09/080901084854.htm.

[57] IPCC. 2007. *IPCC Fourth Assessment Report: Climate Change 2007: Working Groups I, II, and III Reports*. http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

[58] IPCC. 2008. Technical Paper VI: Climate Change and Water. http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf.

temperatures can lead to more ground-level ozone, a pollutant that causes eye irritation and respiratory problems. Ranges of infectious diseases will likely increase, and some areas will face greater incidences of illness and mortality associated with increased flooding and drought events.

In its 2014 Working Group II Report, the IPCC provided an assessment of the impacts of climate change on natural, managed, and human systems, as well as the capacity of these systems to adapt to these impacts. The IPCC states that, although some people will gain and some will lose because of global climate change, the "magnitude and severity of negative impacts are projected to increasingly outweigh the positive impacts" globally over the 21st century.[59]

California in particular is an area that could be negatively affected by global warming. Global warming could alter the seasonal pattern of snow accumulation and snowmelt that serve as primary sources for California's drinking water and irrigation water supplies. The scientific community projects extensions in the periods of high forest fire risk. Climatic changes would also affect agriculture, a major California industry, which could result in economic losses. For example, the heat wave in July 2006 is estimated to have cost the California dairy industry in excess of $1 billion.[60]

2.2 Regulatory Overview

2.2.1 International Provisions

The Kyoto Protocol, adopted on December 11, 1997, is an international agreement that is linked to the UNFCCC.[61] It sets targets and timetables for 36 industrialized countries and the European community for reducing GHG emissions. The targets amount to an average of 5% reduction against 1990 levels over the 5-year period from 2008 to 2012.

Negotiations after Kyoto have continued in an attempt to address the period after the first "commitment period" of the Kyoto Protocol concluded at the end of 2012. In Durban, South Africa, in 2011, parties to the protocol agreed in principle to negotiate a new comprehensive and legally binding climate agreement by 2015 and to enter it into force for all parties from 2020. In 2012, the Doha Amendment to the Kyoto Protocol was adopted for a second commitment period from 2013 to 2020. However, the Doha Amendment has not yet entered into force.

The Paris Agreement, developed at COP21 in December 2015, is an international agreement among parties in the UNFCCC. The central aim of the Paris Agreement is to maintain the global temperature rise in the 21st century below 2 degrees Celsius above pre-industrial levels. Furthermore, the Paris Agreement provides for increased transparency, requires all Parties to maintain and communicate "nationally determined contributions" that they intend to achieve, and aims to erect financial and technology frameworks for reaching the climate goals it puts forth. The agreement addresses a range of areas necessary to combat climate

[59] IPCC. 2014. *IPCC Fifth Assessment Report: Climate Change 2014: Impacts, Adaptation and Vulnerability*. http://ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf.

[60] Environment News Service. 2006. California Heat Wave Costs Agriculture Industry Billions. August 4. http://www.ens-newswire.com/ens/aug2006/2006-08-04-09.html#anchor4.

[61] UNFCCC. 2013. Time Series Annex I: GHG Total Excluding Land Use, Land-Use Change and Forestry. http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3841.php.

change, including a long-term temperature goal, global peaking of GHG emissions, mitigation, and a "global stocktake" every five years.

2.2.2 Federal Provisions

Although the US is not a party to the Kyoto Protocol, in 2002, President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the US economy by 18% by 2012.[62] The goal did not establish binding reduction mandates. Rather, the US Environmental Protection Agency (USEPA) began to administer a variety of voluntary programs and partnerships with industries that produce and use synthetic gases to reduce emissions of particularly potent GHGs.

In 2015, the US State Department submitted the nation's GHG emissions reduction target to the UNFCCC. The submission, referred to as Intended Nationally Determined Contribution, is a formal statement of the US target to reduce the nation's emissions by 26 to 28 percent below 2005 levels by 2025.

The emissions reduction target is the culmination of a process that examined opportunities under existing regulatory authorities to reduce GHG emissions in 2025 from all sources in all economic sectors. Several US laws, as well as existing and proposed regulations, are relevant to the implementation of the US target, including the Clean Air Act (42 U.S.C. § 7401 et seq.), the Energy Policy Act (42 U.S.C. § 13201 et seq.), and the Energy Independence and Security Act (42 U.S.C. § 17001 et seq).[63]

2.2.2.1 US Supreme Court Ruling in Massachusetts et al. v. Environmental Protection Agency

The Bush Administration's approach to addressing climate change was challenged in *Massachusetts et al. v. Environmental Protection Agency*, 549 US 497.[64] In this decision, the U.S. Supreme Court held that the USEPA was authorized by the Clean Air Act to regulate CO_2 emissions from new motor vehicles. The court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances in which the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change.

2.2.2.2 Endangerment Finding

On December 7, 2009, the USEPA Administrator issued an "endangerment finding" and a "cause or contribute finding" under Section 202(a) of the Clean Air Act, concluding that GHGs threaten the public health and welfare of current and future generations and that motor vehicles contribute to GHG pollution.

These findings do not impose any requirements on industry or other entities. However, this action was a prerequisite to finalizing the USEPA's proposed GHG emissions standards for

[62] NOAA. 2002. President Announces Clear Skies and Global Climate Change Initiative, February. http://georgewbush-whitehouse.archives.gov/news/releases/2002/02/20020214-5.html.

[63] The White House, FACT SHEET: U.S. Reports its 2025 Emissions Target to the UNFCCC (May 2015). https://www.whitehouse.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc

[64] Massachusetts et al. vs. Environmental Protection Agency. 2007. 549 U.S. 497

light-duty vehicles[65,66] and providing the basis for adopting new national regulations to mandate GHG emission reductions under the federal Clean Air Act.

2.2.2.3 USEPA Rulemaking

The following sections summarize the USEPA's recent regulatory activities with respect to various types of GHG sources.

Stationary Sources

This section describes USEPA's recent regulatory activities with respect to stationary sources, which are sources of pollutants that do not move from one location. Boilers and emergency generators at Stanford University are stationary sources. Other examples of stationary sources include power plants, gas stations, and incinerators.

Mandatory Reporting Rule

Congress passed "The Consolidated Appropriations Act of 2008" (HR 2764) in December 2007, requiring reporting of GHG data and other relevant information from large emission sources and suppliers in the United States. The rule is referred to as 40 CFR Part 98 – GHG Reporting Program. The stated purpose of the rule is to collect accurate and timely GHG data to inform future policy decisions. Facilities that emit 25,000 MT of GHGs or more per year are required to submit annual reports to the USEPA. Suppliers of certain products that result in GHG emissions if released and facilities that inject CO_2 underground for geologic sequestration are also subject to the rule.

This program is expected to cover approximately 85% of the nation's GHG emissions and applies to roughly 10,000 facilities. The USEPA's new reporting system will provide a better understanding of GHG sources and will assist the development of policies and programs to reduce emissions. The data will also allow the reporters to track their own emissions, compare themselves to similar facilities, and aid in identifying cost-effective methods to reduce GHG emissions in the future.

Tailoring Rule

In May 2010, the USEPA issued the "Tailoring Rule" establishing permitting requirements for GHG emissions under the Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs. A determination of the Best Available Control Technology (BACT) for GHGs is a requirement established by the program in the same manner as it is done for any other PSD regulated pollutant. The Tailoring Rule sets thresholds for GHG emissions that define when permits under the PSD and Title V Operating Permit programs are required for new and existing industrial facilities. This rule generally establishes that first-time new construction projects that emit GHG emissions of at least 100,000 tons per year and modifications at existing facilities that increase GHG emissions by at least 75,000 tons per year are subject to PSD. The rule also establishes that facilities that emit or have the potential to emit at least 100,000 tons per year CO_2e will be subject to Title V permitting requirements. Each new source or modified emission unit subject to PSD is required to undergo a BACT review.

[65] USEPA. 2009. Recovery: EPA Gets Involved. Accessed July 8, 2016. http://www.epa.gov/recovery

[66] USEPA and DOT. 2010. *Light-Duty Vehicle GHG Emission Standards and Corporate Average Fuel Economy Standards*. Final Rule. 75 Fed. Reg. 25324-25728.

Climate Action Plan

In June 2013, President Barack Obama issued a Climate Action Plan to reduce carbon pollution. The Climate Action Plan established a multi-faceted approach to reduce carbon pollution, ranging from calling for carbon pollution standards for new and existing power plants, to new federal funding for renewables, to directing the development of new efficiency standards for appliances and federal buildings, among other measures.

Mobile Sources

This section describes the USEPA's recent regulatory activities with respect to mobile sources, which include vehicles that operate on roads and highways as well as non-road vehicles, engines, and equipment. Examples of mobile sources include cars, trucks, construction equipment, lawn mowers, railroad locomotives, ships, and airplanes.

Corporate Average Fuel Economy

First enacted by Congress in 1975 as part of the 1975 Energy Policy Conservation Act in response to the 1973-1974 oil crises, Corporate Average Fuel Economy (CAFE) standards seek to reduce energy consumption by increasing the fuel economy of passenger cars and light-duty trucks. The CAFE regulation requires each car manufacturer to meet a standard for the sales-weighted fuel economy for the entire fleet of vehicles sold in the US in each model year. Fuel economy, expressed in miles per gallon (mpg), is defined as the average distance traveled by an automobile (in miles) per gallon of gasoline or equivalent amount of other fuel. The National Highway Traffic Safety Administration (NHTSA) of the US Department of Transportation (DOT) administers the CAFE program, and the USEPA provides the fuel economy data. NHTSA sets fuel economy standards for passenger cars and light-duty trucks sold in the US while the USEPA calculates the average fuel economy for each manufacturer.

USEPA and NHTSA Joint Rulemaking for Vehicle Standards

In response to a *U.S. Presidential Memorandum Regarding Fuel Efficiency Standards* dated May 21, 2010, the USEPA and NHTSA are taking coordinated steps to enable the production of a new generation of clean vehicles, through reduced GHG emissions and improved fuel efficiency from on-road vehicles and engines. In April 2010, the USEPA and NHTSA issued a Final Rulemaking establishing new federal GHG and fuel economy standards for model years 2012 to 2016 passenger cars, light-duty trucks, and medium-duty passenger vehicles. The agencies extended the national program of harmonized GHG and fuel economy standards to model years 2017 through 2025 in a joint Final Rulemaking issued on August 28, 2012. These standards are projected to achieve a fleet-wide average CO_2 emission level of 163 grams per mile in model year 2025. (This would be equivalent, on a mpg-equivalent basis, to 54.5 mpg if all of the CO_2 emissions reductions were achieved with fuel economy technology.)

In addition, on August 9, 2011, the USEPA and NHTSA finalized regulations to reduce GHG emissions and improve fuel efficiency of medium- and heavy-duty vehicles, including large pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses. The regulations incorporate all on-road vehicles rated at a gross vehicle weight at or above 8,500 lbs, and the engines that power them. Under the regulations, fuel economy will be improved and GHG emissions will be reduced in model years 2014-2018.

In August 2016, the USEPA and NHTSA adopted the next phase (Phase 2) of the fuel economy and GHG standards for medium- and heavy-duty trucks, which apply to vehicles

with model year 2018 and later. [67] In response to the USEPA's adoption of the Phase 2 standards, ARB staff plan to bring a proposed California Phase 2 program before its Board in 2017.[68]

2.2.2.4 Additional Federal GHG Rules and Policies

In addition to the rules and regulations developed with respect to stationary and mobile sources, discussed above, various other federal developments have occurred that aim to reduce GHGs from other sources, including land use activities.

Energy Independence and Security Act

On December 19, 2007, President Bush signed the Energy Independence and Security Act (EISA) of 2007. Among other key measures, the EISA would do the following, which would aid in the reduction of national GHG emissions:

1. Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.
1. Set a target of 35 mpg for the combined fleet of cars and light trucks by model year 2020, and direct NHTSA to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.
2. Prescribe or revise standards affecting regional efficiency for heating and cooling products, procedures for new or amended standards, energy conservation, energy efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Additional provisions of the EISA address energy savings in government and public institutions, promotion of research for alternative energy, additional research in carbon capture, international energy programs, and the creation of "green jobs."

American Recovery and Reinvestment Act

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act (ARRA) of 2009. ARRA was passed in response to the economic crisis of the late 2000s, with the primary purpose of maintaining existing jobs and creating new jobs. Among the secondary objectives of ARRA was investment in "green" energy programs, including funding the following through grants, loans, or other means: private companies developing renewable energy technologies; local and state governments implementing energy efficiency and clean energy programs; research in renewable energy, biofuels, and carbon capture; and development of high efficiency or electric vehicles.[69,70]

Renewable Fuel Standards (RFS1 and RFS2)

Created under the Energy Policy Act of 2005, the RFS program established the first renewable fuel volume mandate in the United States. The original RFS program (RFS1) required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. Under the

[67] USEPA. Available at: https://www3.epa.gov/otaq/climate/documents/420f16044.pdf.

[68] CARB, CA Phase 2 GHG webpage: http://www.arb.ca.gov/msprog/onroad/caphase2ghg/caphase2ghg.htm. Accessed: September 2016.

[69] The Recovery Act. 2009. Accessed July 9, 2016. https://www.whitehouse.gov/recovery/about

[70] USEPA. 2009. Recovery: EPA Gets Involved. Accessed July 8, 2016. https://archive.epa.gov/recovery/web/html/

EISA of 2007, the RFS program was expanded to include diesel and to increase the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022. In addition, the updated version of EISA required the USEPA to apply lifecycle GHG performance threshold standards to ensure that each category of renewable fuel emits fewer GHGs than the petroleum fuel it replaces.

In January 2011, the USEPA established the volume requirements and associated percentage standards that applied in calendar year 2011 for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel (RFS2). The final percentage standard sets 8% of renewable fuel per total volume. The rule also announced the 2011 price for cellulosic biofuel waiver credits ($1.13 per credit) and the USEPA's assessment of the aggregate compliance provision for domestic feedstocks. The regulation increased the volume of fuel required to be blended into transportation fuel from 12.2 billion gallons in 2009 to 74 billion gallons by 2022; this includes 16.0 billion gallons for cellulosic biofuel, at least 1 billion gallons for biomass-based diesel fuel, 21.0 billion gallons for advanced biofuel, and 36.0 billion gallons for renewable fuel.

2.2.2.5 Voluntary Programs

The following voluntary programs developed by the USEPA provide opportunities for industry, the USEPA, and other organizations in both the public and private sectors to work together to reduce GHG emissions.[71]

Center for Corporate Climate Leadership

The USEPA's Center for Corporate Climate Leadership serves as a resource center for all companies looking to expand their work in the area of GHG measurement and management.

Green Power Partnership

The Green Power Partnership is a voluntary partnership between the USEPA and organizations that are interested in using green power, which is electricity produced from a subset of renewable resources, such as solar, wind, geothermal, biomass, and low-impact hydropower.

National Clean Diesel Campaign

The USEPAs National Clean Diesel Campaign (NCDC) promotes diesel emission reduction strategies. The NCDC works to reduce the pollution emitted from diesel engines across the country through the implementation of varied control strategies by working with manufacturers, fleet operators, air quality professionals, environmental and community organizations, and state and local officials to reduce diesel emissions. NCDC activities include developing new emissions standards for locomotive and marine diesel engines; and promoting the reduction of emissions for existing diesel engines, including using cleaner fuels, retrofitting and repairing existing fleets, and reducing idling, among others.

State and Local Climate and Energy Program

The USEPA also administers the State and Local Climate and Energy Program, which provides technical assistance, analytic tools, and outreach support to state, local, and tribal governments.[72]

[71] USEPA. Voluntary Energy and Climate Programs. Accessed July 8, 2016. http://www.epa.gov/climatechange/EPAactivities/voluntaryprograms.html.

2.2.3 Multi-State Area Provisions

The Western Regional Climate Action Initiative (WCI) was established in 2007 by the governors of five US states (Arizona, California, New Mexico, Oregon, and Washington) as a partnership to implement a regional, economy-wide cap-and-trade system to reduce global warming pollution. By the end of 2008, the partnership had expanded to include Montana, Utah, and four Canadian provinces (British Columbia, Manitoba, Ontario, and Quebec).

The WCI partners set a goal of reducing the region's GHG emissions from the electricity, industrial, and transportation sectors to 15% below 2005 levels by 2020. By December 2011, California and Quebec had adopted cap-and-trade regulations based on WCI recommendations, while the rest of the partner states declined to actively implement a cap-and-trade program. The partnership was then streamlined to include only California and the four Canadian provinces actively implementing or considering cap-and-trade programs. In May 2013, ARB adopted a final rule linking California's and Quebec's cap-and-trade programs (as of January 1, 2014) for the purpose of allowing the two entities to mutually recognize each other's compliance instruments. In October 2013, California and Quebec entered into an agreement to integrate and harmonize their cap-and-trade programs. California is also working closely with British Colombia, Ontario, and Manitoba through the WCI to develop harmonized cap-and-trade programs.

2.2.4 California Provisions

California has adopted various administrative initiatives and also enacted a variety of legislation relating to climate change, much of which sets aggressive goals for GHG emissions reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents prepared under CEQA. In particular, the amendments to the CEQA Guidelines do not require or suggest specific methodologies for performing an assessment of thresholds of significance, and do not specify GHG reduction mitigation measures. Instead, the CEQA Guidelines amendments continue to rely on lead agencies to choose methodologies and make significance determinations based on substantial evidence, as discussed in further detail below.[73] Consequently, no State agency has promulgated binding regulations for analyzing GHG emissions, determining their significance, or mitigating any significant effects in CEQA documents.

The discussion below provides a brief overview of ARB and Office of Planning and Research (OPR) documents and of the primary legislation that relates to climate change and that may affect the emissions associated with the Project. It begins with an overview of the primary regulatory acts that have driven GHG regulation in California, which underlie many of the GHG rules and regulations that have been developed.

2.2.4.1 Executive Order S-3-05 (State-Wide GHG Targets for 2010, 2020, and 2050)

California Executive Order S-03-05 (June 1, 2005) establishes the goal of reducing GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by

[72] USEPA. State and Local Climate and Energy Program. November. Accessed July 8, 2016. https://www.epa.gov/statelocalclimate

[73] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/FINAL_Text_of_Proposed_Amendemts.pdf

2050. Although the 2020 target is the core of AB 32 and has effectively been incorporated into AB 32, the 2050 target remains the goal of the Executive Order only.[74]

2.2.4.2 Executive Order B-30-15 (State-Wide GHG Targets for 2030)

In April 2015, Governor Brown signed Executive Order B-30-15, which established the following GHG emission reduction goal for California: by 2030, reduce GHG emissions to 40 percent below 1990 levels. This Executive Order also directed all state agencies with jurisdiction over GHG-emitting sources to implement measures designed to achieve the new interim 2030 goal, as well as the pre-existing, long-term 2050 goal identified in Executive Order S-3-05 (see discussion above). Additionally, the Executive Order directed ARB to update its Scoping Plan (see discussion below) to address the 2030 goal. Therefore, in the coming months, ARB is expected to develop statewide inventory projection data for 2030, as well as commence its efforts to identify reduction strategies capable of securing emission reductions that allow for achievement of the Executive Order's new interim goal.

In the last legislative session, the Legislature adopted SB 32 to enact the Executive Order's 2030 goal.

2.2.4.3 Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006 (AB 32) was signed into law in September 2006 after considerable study and expert testimony before the Legislature.[75] The law instructed ARB to develop and enforce regulations for the reporting and verification of state-wide GHG emissions. The bill directed ARB to set a state-wide GHG emission limit based on 1990 levels, to be achieved by 2020. The bill set a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of the bill is the requirement that state-wide GHG emissions be reduced to 1990 levels by 2020. Based on ARB's calculation of 1990 baseline emissions levels, California must reduce GHG emissions by approximately 28.5% below "business-as-usual" (BAU) predictions for 2020 to achieve this goal.

In June 2011, ARB revised its "BAU" GHG emission estimate for 2020 in order to account for the recent economic downturn in its emission projections.[76] The estimate presented in the Scoping Plan (596 MMT CO_2e) was based on pre-recession, 2007 data from the Integrated Energy Policy Report. ARB has updated the projected "BAU" 2020 GHG emissions to 545 MMT CO_2e.

AB 32 requires ARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. Key AB 32 milestones for ARB's actions include the following:

- *June 30, 2007: Identification of discrete early action GHG emissions reduction measures.* On June 21, 2007, ARB satisfied this requirement by approving three

[74] On November 6, 2013, the BAAQMD Board passed a resolution adopting the 2050 target of 80 percent below 1990 levels. Details of this resolution are described in the "Regional Provisions" section of this "Regulatory Setting" section.

[75] ARB. Assembly Bill 32 Overview. 2006a. Accessed July 22, 2016. http://www.arb.ca.gov/cc/ab32/ab32.htm

[76] ARB. Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/Supplement_to_SP_FED.pdf

early action measures.[77] These were later supplemented with six other discrete early action measures.[78]

- *January 1, 2008: Identification of the 1990 baseline GHG emissions level and approval of a state-wide limit equivalent to that level and adoption of reporting and verification requirements concerning GHG emissions.* On December 6, 2007, ARB approved a state-wide limit on GHG emissions levels for the year 2020 consistent with the determined 1990 baseline.[79]
- *January 1, 2009: Adoption of a scoping plan for achieving GHG emission reductions.* On December 11, 2008, ARB adopted its *Climate Change Scoping Plan: A Framework for Change* (Scoping Plan), discussed in more detail below.[80]
- *January 1, 2010: Adoption and enforcement of regulations to implement the "discrete" actions.* Several early action measures have been adopted and became effective on January 1, 2010.[81],[82]
- *January 1, 2011: Adoption of GHG emissions limits and reduction measures by regulation.* On October 28, 2010, ARB released its proposed cap-and-trade regulations, which would cover sources of approximately 85% of California's GHG emissions.[83] ARB's Board ordered ARB's Executive Director to prepare a final regulatory package for cap-and-trade on December 16, 2010.[84]
- January 1, 2012: GHG emissions limits and reduction measures adopted in 2011 become enforceable.
- November 14, 2012: First quarterly auction of GHG emissions allowances was held, as part of the cap-and-trade program.
- January 1, 2013: Cap-and-trade program begins with a GHG emissions cap that will decline over time.
- September 17, 2013: First carbon offset credits are issued as part of the cap-and-trade program.[85]

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[77] ARB. Summary of Board Meeting: Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. Sacramento, CA, June 21.

[78] ARB. Summary of Board Meeting: Public Meeting to Consider Approval of Additions to Reduce GHG Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. Sacramento, CA, October 25.

[79] ARB. California GHG Inventory (millions of metric tons of CO2 equivalent) by IPCC Category. Sacramento, CA, November. http://www.arb.ca.gov/cc/inventory/archive/tables/ghg_inventory_ipcc_90-04_all_2007-11-19.pdf

[80] ARB. 2008. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[81] ARB. Summary of Board Meeting: Consideration of Recommendations for Discrete Early Actions for Climate Change Mitigation in California. Sacramento, CA, June 21.

[82] ARB. Summary of Board Meeting: Public Meeting to Consider Approval of Additions to Reduce GHG Emissions under the California Global Warming Solutions Act of 2006 and to Discuss Concepts for Promoting and Recognizing Voluntary Early Actions. Sacramento, CA, October 25.

[83] ARB. Proposed Regulation to Implement California Cap-and-Trade Program. Sacramento, CA, October 28.

[84] ARB. California Cap-and-Trade Program. Final Resolution. Sacramento, CA. http://www.arb.ca.gov/regact/2010/capandtrade10/res1042.pdf

[85] ARB. 2014. Assembly Bill 32 Overview. Accessed August 31, 2016. https://www.arb.ca.gov/cc/ab32/ab32.htm

- May 22, 2014: Approval of the First Update to the Climate Change Scoping Plan. The First Update to the Climate Change Scoping Plan defines the ARB's climate change priorities for the next five years.
- April 29, 2015: AB 32 Scoping Plan updated to reflect the GHG emissions reduction target for 2030, which was established with Executive Order B-30-15.[86]

2008 Scoping Plan

As noted above, on December 11, 2008, ARB adopted the 2008 Scoping Plan to establish an overall framework for the measures that will be adopted to reduce California's GHG emissions. ARB determined that achieving the 1990 emission level would require a reduction of GHG emissions of approximately 28.5% below what would otherwise occur in 2020 in the absence of new laws and regulations (referred to as "BAU"). The Scoping Plan evaluates opportunities for sector-specific reductions, integrates all ARB and Climate Action Team early actions and additional GHG reduction measures by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program. Many of these measures and regulations became effective on January 1, 2012. The key elements of the Scoping Plan[87] include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a state-wide renewables energy mix of 33% by 2020;
- Developing a California cap-and-trade program that links with other WCI partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions;
- Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard (LCFS); and
- Creating targeted fees, including a public goods charge on water use, fees on high GWP gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation.

In 2009, a coalition of environmental groups brought a challenge to the Scoping Plan alleging that it violated AB 32 and that the environmental review document (called a "Functional Equivalent Document") violated CEQA by failing to appropriately analyze alternatives to the proposed cap-and-trade program. On May 20, 2011, the San Francisco Superior Court entered a final judgment ordering that ARB take no further action with respect to cap-and-trade rulemaking until it complied with CEQA.[88] ARB appealed the decision on May 23, 2011.

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[86] ARB. 2016. AB 32 Scoping Plan. Accessed August 31, 2016. https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm

[87] ARB. 2009. Initial Climate Change Scoping Plan. Sacramento, CA, December. Accessed July 9, 2016. http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm

[88] ARB, et al., v. Association of Irritated Residents, et al., 2011. http://www.crpe-ej.org/crpe/images/stories/7.25.11_Petition_for_Review_FINAL_with_Exhibits_smaller_version.pdf

The portions of the Scoping Plan that do not relate to cap-and-trade remained valid during the litigation. While the appeal was pending, ARB prepared a supplement to the Functional Equivalent Document that included the analysis that the trial court had determined was inadequate under CEQA. ARB certified the supplement to the Functional Equivalent Document and readopted the Scoping Plan on August 24, 2011[89]. On June 19, 2012, the California First District Court of Appeal upheld the Scoping Plan and affirmed ARB's approval of the Scoping Plan as in compliance with AB 32.[90]

In connection with the preparation of the supplement to the Functional Equivalent Document, ARB released revised estimates of the expected 2020 emissions reductions in consideration of the economic recession and the availability of updated information from development of measure-specific regulations. Incorporation of revised estimates in consideration of the economic recession reduced the projected 2020 emissions from 596 MMT CO_2e to 545 MMT CO_2e.[91] Under this scenario, achieving the 1990 emissions level would require a reduction of GHG emissions of 118 MMT CO_2e, or 21.7% (down from 28.5%), from 2020 "BAU" emissions levels. The 2020 AB 32 baseline was also updated to account for measures incorporated into the inventory, including Pavley (vehicle model years 2009-2016) and the Renewables Portfolio Standard (RPS) (12% to 20%). Inclusion of these measures further reduced the 2020 baseline to 507 MMT CO_2e. As a result, based on both the economic recession and the availability of updated information from the development of measure-specific regulations, achieving the 1990 emission level would now require a reduction of GHG emissions of 80 MMT CO_2e, or a reduction of approximately 16% (down from 28.5%) to achieve in 2020 emissions levels in the "BAU" or "No Action Taken" condition.[92]

The Scoping Plan identifies over 70 measures for reducing GHG emissions in sectors including transportation, electricity and natural gas, water, green buildings, industry, recycling and waste, and agriculture. Many of these measures incorporate laws, policies, and measures that are not solely driven by the AB 32 directive, including ship electrification (shorepower), high speed rail, RPS, and the Goods Movement Emission Reduction Plan. Regulatory development for other measures is ongoing. Of these measures, 44 were identified as Early Action Measures, which were adopted by ARB and made enforceable in 2010. These measures included regulations affecting landfills, motor vehicle fuels, refrigerants in cars, port operations, and many other sources.

The Scoping Plan notes that local governments are "essential partners" in the effort to reduce GHG emissions, and that they have "broad influence and, in some cases, exclusive jurisdiction" over activities that contribute to GHG emissions. The Scoping Plan encourages local governments to adopt goals for reducing municipal GHG emissions and move toward adoption of a goal for reducing community emissions. These targets should parallel the State's commitment to reduce GHG emissions by approximately 15% of current levels by 2020. The Scoping Plan also observes that "[l]ocal governments have the ability to directly influence both the siting and design of new residential and commercial developments in a

[89] ARB. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf .

[90] Association of Irritated Residents, et al., v. California Air Resources Board, et al, 2012. 206 Cal. App. 4th 1487.

[91] ARB. Status of Scoping Plan Recommended Measures. July. http://www.arb.ca.gov/cc/scopingplan/status_of_scoping_plan_measures.pdf.

[92] ARB. 2011. Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. http://www.arb.ca.gov/cc/scopingplan/document/final_supplement_to_sp_fed.pdf

way that reduces GHGs associated with vehicle travel, as well as energy, water, and waste" and that "[i]ncreasing low-carbon travel choices (public transit, carpooling, walking and biking) combined with land use patterns and infrastructure that support these low-carbon modes of travel, can decrease average vehicle trip lengths by bringing more people closer to more destinations."[93] It also notes that regional targets would be set and achieved on a regional basis through the Senate Bill (SB) 375 implementation process, which "maintains regions' flexibility." SB 375 is discussed below.

2014 First Update to the Scoping Plan

In 2014, ARB adopted the *First Update to the Climate Change Scoping Plan: Building on the Framework* (2014 First Update).[94] The stated purpose of the 2014 First Update is to "highlight[…] California's success to date in reducing its GHG emissions and lay[…] the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050."[95] The First Update found that California is on track to meet the 2020 emissions reduction mandate established by AB 32, and noted that California could reduce emissions further by 2030 to levels squarely in line with those needed to stay on track to reduce emissions to 80 percent below 1990 levels by 2050 if the State realizes the expected benefits of existing policy goals.[96]

In conjunction with the 2014 First Update, ARB identified "six key focus areas comprising major components of the State's economy to evaluate and describe the larger transformative actions that will be needed to meet the State's more expansive emission reduction needs by 2050."[97] Those six areas are: (1) energy; (2) transportation (vehicles/equipment, sustainable communities, housing, fuels, and infrastructure); (3) agriculture; (4) water; (5) waste management; and (6) natural and working lands. The First Update identifies key recommended actions for each sector that will facilitate achievement of the 2050 reduction target.

Based on ARB's research efforts, it has a "strong sense of the mix of technologies needed to reduce emissions through 2050."[98] Those technologies include energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and the rapid market penetration of efficient and clean energy technologies.

As part of the 2014 First Update, ARB recalculated the State's 1990 emissions level using more recent GWPs identified by the IPCC. Using the recalculated 1990 emissions level and the revised 2020 emissions level projection identified in the 2011 Final Supplement, ARB determined that achieving the 1990 emissions level by 2020 would require a reduction in

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[93] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[94] Health & Safety Code Section 38561(h) requires CARB to update the Scoping Plan every five years.

[95] ARB, 2014. First Update to the Climate Change Scoping Plan: Building on the Framework (May 2014). http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf

[96] ARB, 2013. First Update to the Climate Change Scoping Plan: Building on the Framework (May 2014). http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf

[97] ARB, 2013. First Update to the Climate Change Scoping Plan: Building on the Framework (May 2014). http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf

[98] ARB, 2013. First Update to the Climate Change Scoping Plan: Building on the Framework (May 2014). http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf

GHG emissions of approximately 15.3 percent (instead of 28.5 percent or 16 percent) from the "BAU" conditions.

The 2014 First Update included a strong recommendation from ARB for setting a mid-term statewide GHG emissions reduction target. ARB specifically recommended that the mid-term target be consistent with: (i) the United States' pledge to reduce emissions 42 percent below 2005 levels (which translates to a 35-percent reduction from 1990 levels in California); and (ii) the long-term policy goal of reducing emissions to 80 percent below 1990 levels by 2050.

The 2014 First Update discussed new residential and commercial building energy efficiency improvements, specifically identifying progress towards zero net energy buildings as an element of meeting mid-term and long-term GHG reduction goals. The First Update expressed ARB's commitment to working with the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) to facilitate further achievements in building energy efficiency.

Proposed 2030 Target Scoping Plan

Currently, ARB is moving forward with the development of a second update to the 2008 Scoping Plan. This update is expected to address Executive Order B-30-15, and specifically Governor Brown's statewide GHG emissions reduction target for 2030, as discussed below. In January 2017, ARB released its proposed 2017 Climate Change Scoping Plan Update.[99] The Proposed Plan draft includes the following major elements for reaching the 2030 Target:

1. SB 350

   This concept includes enhancements to existing programs and implementation of SB 350, with a target of achieving 50 percent RPS and a doubling of energy efficiency savings in natural gas and electricity end uses statewide by 2030.

2. Mobile Source Strategy

   The proposed plan will increase the stringency of the Low Carbon Fuel Standard, target 4.2 million zero-emission vehicles on the road by 2030, promote medium-and heavy-duty vehicle GHG reductions, continue to reduce vehicle miles traveled (VMT), and implement the CA Sustainable Freight Action Plan.

3. Post 2020 Cap and Trade Program

   ARB proposes to continue the existing Cap-and-Trade Program after 2020 with declining caps.

4. Refinery Sector Measure

   This concept would reduce GHG emissions by 20 percent in the refinery sector statewide.

5. Short-Lived Climate Pollutant Reduction Strategy

   This plan will reduce emissions of methane, hydrofluorocarbons, and black carbon.

The Proposed Plan also addresses how CEQA can be used to further the statewide goals of GHG reduction. The Proposed Plan recommends GHG reduction goals that can apply to plan- or project-level analyses to be incorporated into environmental documentation in support of

[99] ARB. 2017. The 2017 Climate Change Scoping Plan Update. January 20. Available at https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

CEQA. The Proposed Plan states a GHG target in the form of MT CO_2e per capita is "appropriate for the plan level (city, county, subregional, or regional level), but not for specific individual projects, because ARB's metric includes all emission sectors in the State." Project-level goals may be supported by local governments or lead agencies and include potential strategies such as tiering from a geographically specific GHG reduction plan, comparing to service population emissions targets, implementing all feasible mitigation measures, achieving zero net GHG emissions, or emitting less than bright-line numerical thresholds. Service population emission targets are used to assess significance for this Project.

ARB is currently soliciting comments on the Proposed Plan and will be conducting additional workshops through mid 2017.

California Mandatory Reporting Rule

ARB adopted the California Mandatory Reporting Rule in December 2007 (CCR Title 17, Subchapter 10, Article 2). In December 2010, ARB adopted proposed revisions to support a California GHG cap-and-trade program and to harmonize with the Federal Rule. The revised rule, in effect starting January 1, 2012, eliminates many of the differences between the federal and California rules, though some remain. Additional modifications and clarifications were made to the rule in 2012, 2013, and 2014.

The California MRR requires the reporting of GHG emissions from essentially the same source categories specified in the USEPA MRR, but with some differences. Most of the differences in the rules are related to ensuring that all sources subject to the California cap-and-trade regulations will also be subject to the California rule, and that GHG emissions reporting for those sources will meet the requirements of the cap-and-trade program. Additionally, California requires that emission reports be verified by a third party, and that sources emitting less than the federal reporting threshold but more than the California reporting threshold are subject to abbreviated reporting requirements.

Cap-and-Trade Program

The California Global Warming Solutions Act of 2006 (AB 32) allowed, but did not require, ARB to include among the mechanisms intended to reduce GHG emissions a “system of market-based declining annual aggregate emission limits.” The legislation required ARB to develop a Scoping Plan to describe the various mechanisms that would be used. In turn, the Scoping Plan, approved by ARB on December 11, 2008, directed ARB staff to develop, among other programs, a cap-and-trade mechanism that would apply a declining aggregate cap on GHG emissions[100] and provide a flexible compliance system using tradable instruments.

On October 20, 2011, ARB adopted the final cap-and-trade regulation (CCR Title 17, Subchapter 10, Article 5). The program started on January 1, 2012, and will proceed in “compliance phases,” the first of which began on January 1, 2013. In the first phase, the program applies to electric utilities, importers of electricity, and specified industries, including refineries. Approximately 350 electric utilities and approximately 600 industrial facilities were included in the initial phase of the program. In 2015, importers and

[100] The cap-and-trade regulation applies to the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

distributors of fossil fuels were added to the program in the second phase. The program imposes a "cap" on the total GHG emissions from covered entities in the state, and the quantity of emissions allowed under the cap decreases each year, ultimately reaching the goal of returning state-wide GHG emissions to 1990 levels by 2020. (The quantity of allowed emissions actually increases between 2014 and 2015, but that is to account for the addition of the fuel importers and distributors and additional electricity importers to the program; the net effect is to reduce overall GHG emissions.)

To encourage emission sources to emit less as the cap decreases, "allowances," or permission to emit GHGs, are made available in decreasing quantities. Allowances are both freely allocated and auctioned off. The amount of freely given allowances decreases over time, and the severity of the decrease varies by industrial sector, with those thought to be less vulnerable to out-of-state competition receiving fewer allowances more quickly. Similarly, the amount of allowances available for purchase at auction decreases. The intent is to make reducing GHG emissions more financially attractive as the number of available allowances decreases, making each allowance more costly.

On May 8, 2013, ARB adopted proposed amendments to the California GHG emissions cap-and-trade program in Resolution 13-7. These amendments would add security to the market system and help staff implement the cap-and-trade program, as well as link the California cap-and-trade program with that of the Canadian province Quebec.[101] Additional minor modifications were made to the regulation in 2013 and 2014.

Co-Pollutant Benefits

Implementation of the cap-and-trade program will also reduce state-wide emissions of criteria and toxic air pollutants. Because GHG emissions are largely the result of fuel combustion, as the cap decreases and state-wide combustion decreases, criteria and toxic air pollutants associated with combustion will also decrease state-wide. ARB also evaluated the potential for localized impacts from short-term increases in construction and operational emissions at facilities modifying operations in response to cap-and-trade compliance obligations. ARB's analysis indicated that localized impacts are unlikely due to existing local and state air quality regulations; however, where there is potential for significant impact from a proposed project, it would be addressed by local permitting agencies and CEQA lead agencies through the permitting and CEQA processes in which mitigation measures are evaluated.

2.2.4.4 Senate Bill 32

Enacted in 2016, Senate Bill (SB) 32 (Pavley, 2016) codifies the 2030 emissions reduction goal of Executive Order B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030.

SB 32 was coupled with a companion bill: AB 197 (Garcia, 2016). Designed to improve the transparency of CARB's regulatory and policy-oriented processes, AB 197 created the Joint Legislative Committee on Climate Change Policies, a committee with the responsibility to ascertain facts and make recommendations to the Legislature concerning statewide programs, policies and investments related to climate change. AB 197 also requires CARB to make certain GHG emissions inventory data publicly available on its web site; consider the

[101] State of California. 2013. Amendments to California Cap-and-Trade Program – Linkage. https://www.arb.ca.gov/regact/2012/capandtrade12/res13-7.pdf

social costs of GHG emissions when adopting rules and regulations designed to achieve GHG emission reductions; and, include specified information in all Scoping Plan updates for the emission reduction measures contained therein.

2.2.4.5 Regulation of Energy-Related Sources

Renewables Portfolio Standard (SB 1078, SB 107, SB X1-2, and SB 350)

Established in 2002 under SB 1078,[102] and accelerated in 2006 under SB 107[103] and again in 2011 under SB X1-2,[104] California's RPS requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 33% of total retail sales by 2020. The 33-percent standard is consistent with the RPS goal established in the 2008 Scoping Plan.[105] As interim measures, RPS requires 20% of retail sales to be sourced from renewable energy by 2013, and 25% by 2016. Initially, the RPS provisions applied to investor-owned utilities, community choice aggregators, and electric service providers. SB X1-2 added, for the first time, publicly owned utilities to the entities subject to RPS.[106] The expected growth in RPS to meet the standards in effect in 2008 is not reflected in the "BAU" calculation in the 2008 Scoping Plan, discussed above. In other words, the 2008 Scoping Plan's BAU 2020 does not take credit for implementation of RPS that occurred after its adoption.[107] SB 350 further increases the RPS goals for 50% renewables by 2030.

GHG Emissions Standard for Baseload Generation (SB 1368)

SB 1368 (September 29, 2006) prohibits any retail seller of electricity in California from entering into a long-term financial commitment for baseload generation if the GHG emissions are higher than those from a combined-cycle natural gas power plant.[108] This performance standard applies to electricity generated out-of-state as well as in the state, and to publicly owned as well as investor-owned electric utilities.

2.2.4.6 Regulation of Mobile Sources

Senate Bill 375 (Land Use Planning)

SB 375 provides for a new planning process to coordinate land use planning, regional transportation plans, and funding priorities in order to help California meet the GHG reduction goals established in AB 32.[109] SB 375 requires Metropolitan Planning Organizations (MPOs) including the Association of Bay Area Governments (ABAG) to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans (RTPs) that will achieve GHG emission reduction targets set by ARB, primarily by reducing VMT from light-duty vehicles through development of more compact, complete, and efficient communities.

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[102] State of California. Senate Bill 1078 (2001-2002 Reg. Session) Stats. 2002, ch 516.

[103] State of California. Senate Bill 1368 (2005-2006 Reg. Session) Stats. 2006, ch. 598.

[104] State of California. Ass'n of Irritated Residents v. California Air Resources Board (Super. Ct. San Francisco County, March 18, 2011, No. CPF-09-509562).

[105] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

[106] State of California. Ass'n of Irritated Residents v. California Air Resources Board (Super. Ct. San Francisco County, March 18, 2011, No. CPF-09-509562).

[107] ARB. Climate Change Scoping Plan. Sacramento, CA, December. http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

[108] State of California. 2006b. Senate Bill 1368 (2005-2006 Reg. Session) Stats. 2006, ch. 598.

[109] State of California. 2008. Senate Bill 375. 2008, ch. 728.

SB 375 also required ARB to appoint a Regional Targets Advisory Committee (RTAC) to recommend factors for ARB to consider and methodologies for it to use in setting GHG emission reduction targets (Regional Targets) for each region. On September 29, 2009, the RTAC released its recommendations to ARB, who, on September 23, 2010, adopted Regional Targets applying to the years 2020 and 2035.[110] In 2011, ARB adopted Regional Targets of 7% for 2020 and 15% for 2035 for the area under ABAG's jurisdiction, which includes Stanford University. On July 18, 2013, the Metropolitan Transportation Commission (MTC) and ABAG approved the final Plan Bay Area, which includes the Bay Area region's first SCS as well as a new 2040 RTP and establishes the strategies for meeting the Bay Area's Regional Targets.[111]

The SCS for the San Francisco Bay Area is discussed in the "Regional Provisions" section below.

Mobile Source Reductions (Pavley) (AB 1493)

AB 1493 required ARB to adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light-duty trucks of model years 2009 through 2016[112]. The bill required the California Climate Action Registry to develop and adopt protocols for the reporting and certification of GHG emissions reductions from mobile sources for use by ARB in granting emission reduction credits. The bill authorizes ARB to grant emission reduction credits for reductions of GHG emissions prior to the date of the enforcement of regulations, using model year 2000 as the baseline for reduction.

In 2004, ARB applied to the USEPA for a waiver under the federal Clean Air Act to authorize implementation of these regulations. The waiver request was formally denied by the USEPA in December 2007 after California filed suit to prompt federal action. In January 2008, the State Attorney General filed a new lawsuit against the USEPA for denying California's request for a waiver to regulate and limit GHG emissions from these vehicles. In January 2009, President Obama issued a directive to the USEPA to reconsider California's request for a waiver. On June 30, 2009, the USEPA granted the waiver to California for its GHG emission standards for motor vehicles. As part of this waiver, the USEPA specified the following provision: ARB may not hold a manufacturer liable or responsible for any non-compliance caused by emission debits generated by a manufacturer for the 2009 model year. ARB has adopted a new approach to passenger vehicles – cars and light trucks – by combining the control of smog-causing pollutants and GHG emissions into a single coordinated package of standards. The new approach also includes efforts to support and accelerate the numbers of plug-in hybrids and zero-emission vehicles in California.

Low Carbon Fuel Standard

Executive Order S-1-07, as issued by former Governor Schwarzenegger, called for a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by CARB by 2020.[113] In response, ARB approved the LCFS regulations

[110] ARB. Sustainable Communities. 2010. Accessed July 22, 2016. http://www.arb.ca.gov/cc/sb375/sb375.htm

[111] Metropolitan Transportation Commission. 2013. Plan Bay Area. Accessed October 14, 2013. http://www.mtc.ca.gov/planning/plant_bay_area/

[112] State of California. 2002a. Assembly Bill 1493 (2001-2002 Reg. Session) Stats. 2002, ch. 200.

[113] Carbon intensity is a measure of the GHG emissions associated with the various production, distribution and use steps in the "lifecycle" of a transportation fuel.

in 2009, which became fully effective in April 2010. Thereafter, a lawsuit was filed challenging ARB's adoption of the regulations; and, in 2013, a court order was issued compelling ARB to remedy substantive and procedural defects of the LCFS adoption process under CEQA.[114] However, the court allowed implementation of the LCFS to continue pending correction of the identified defects. In September 2015, CARB re-adopted the LCFS regulations.

Clean Cars

In January 2012, ARB approved the Advanced Clean Cars Program, which established an emissions control program for cars and light-duty trucks (such as SUVs, pickup trucks, and minivans) of model years 2017-2025. When the program is fully implemented, new vehicles will emit 75% less smog-forming pollutants than the average new car sold today, and GHG emissions will be reduced by nearly 35%. The program also requires car manufacturers to offer for sale an increasing number of zero-emission vehicles (ZEVs) each year, including battery electric, fuel cell, and plug-in hybrid electric vehicles.

In December 2012, ARB adopted regulations allowing car manufacturers to comply with California's GHG emissions requirements for model years 2017-2025 through compliance with the USEPA GHG requirements for those same model years.[115]

2.2.4.7 CEQA Guidelines Amendments (SB 97)

The 2009 CEQA Guidelines amendments adopted pursuant to SB 97 state in Section 15064.4(a) that lead agencies should "make a good faith effort, to the extent possible on scientific and factual data, to describe, calculate or estimate" GHG emissions. The CEQA Guidelines amendments note that an agency may identify emissions either by selecting a "model or methodology" to quantify the emissions or by relying on "qualitative analysis or other performance based standards." [116] Section 15064.4(b) provides that the lead agency should consider the following when assessing the significance of impacts from GHG emissions on the environment:

- The extent a project may increase or reduce GHG emissions as compared to the environmental setting.
- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
- The extent to which the project complies with regulations or requirements adopted to implement a state-wide, regional, or local plan for the reduction or mitigation of GHG emissions[117].

In addition, Section 15064.7(c) of the CEQA Guidelines amendments specifies "[w]hen adopting thresholds of significance, a lead agency may consider thresholds of significance

[114] *POET, LLC v. CARB* (2013) 217 Cal.App.4th 1214.

[115] ARB. Lev III and ZEV Regulation Amendments For Federal Compliance Option, December 31. Accessed July 8, 2016. http://www.arb.ca.gov/regact/2012/leviiidtc12/leviiidtc12.htm

[116] CNRA. Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of GHG Emissions Pursuant to SB97. http://resources.ca.gov/ceqa/docs/Final_Statement_of_Reasons.pdf

[117] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

previously adopted or recommended by other public agencies, or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence"[118]. Similarly, the revision to Appendix G, Environmental Checklist Form, which is often used as a basis for lead agencies' selection of significance thresholds, does not prescribe specific thresholds. Rather, Appendix G asks whether the project would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment? or
2. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs?

This indicates that the determination of what is a significant effect on the environment should be left to the lead agency.

Accordingly, the CEQA Guidelines amendments do not prescribe specific methodologies for performing an assessment, do not establish specific thresholds of significance, and do not mandate specific mitigation measures. Rather, the CEQA Amendments emphasize the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA.[119]

The CEQA Guidelines amendments indicate that lead agencies should consider all feasible means, supported by substantial evidence and subject to monitoring and reporting, of mitigating the significant effects of GHG emissions. These potential mitigation measures, set forth in Section 15126.4(c), may include (1) measures in an existing plan or mitigation program for the reduction of GHG emissions that are required as part of the lead agency's decision; (2) reductions in GHG emissions resulting from a project through implementation of project design features; (3) off-site measures, including offsets, to mitigate a project's emissions; and (4) carbon sequestration measures.[120]

Among other things, the California Natural Resources Agency (CNRA) noted in its Public Notice for these changes that impacts of GHG emissions should focus on the cumulative impact on climate change. The Public Notice states:

> While the Proposed Amendments do not foreclose the possibility that a single project may result in GHG emissions with a direct impact on the environment, the evidence before [CNRA] indicates that in most cases, the impact will be cumulative. Therefore, the Proposed Amendments emphasize that the analysis of GHG emissions should center on whether a project's incremental contribution of GHG emissions is cumulatively considerable.[121]

Thus the CEQA Guidelines amendments continue to make clear that the significance of GHG emissions is most appropriately considered on a cumulative level.

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[118] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[119] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[120] CNRA. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

[121] CNRA. Notice of Public Hearings and Notice of Proposed Amendment of Regulations Implementing the California Environmental Quality Act.. http://resources.ca.gov/ceqa/docs/Notice_of_Proposed_Action.pdf

As described in the Final Statement of Reasoning[122] for the 2009 CEQA Guidelines amendments, the CEQA Guidelines specifically do not address lifecycle emission for two reasons. First, there are different interpretations of the meaning of "lifecycle" amongst lead agencies, which could lead to confusion on how to evaluate the contribution of lifecycle emissions to a project. Furthermore, requiring an analysis of lifecycle emissions may be inconsistent with CEQA, as the emissions may be outside the scope of the "indirect emissions" that are evaluated with a project

2.2.4.8 Senate Bill 743 (Updates to CEQA Guidelines)

Public Resources Code Section 21099(c)(1), as codified through enactment of SB 743, was enacted with the intent to change the focus of transportation analyses conducted under CEQA. SB 743 reflects a legislative policy to balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of GHG emissions. SB 743 requires the OPR to establish "alternative metrics to the metrics used for traffic levels of service for transportation impacts outside transit priority areas." [123] Under SB 743, the new metrics- or significance criteria- must promote the reduction of GHG emissions, the development of multimodal transportation networks, and a diversity of land uses. SB 743 dictates that once the CEQA Guidelines are amended to include new thresholds, automobile delay, as described by level of service or similar measures of vehicular capacity or congestion, shall no longer be considered a significant impact under CEQA in all locations in which the new thresholds are applied. The Legislature gave OPR the option of applying the new thresholds only to transit priority areas, or more broadly to areas throughout the State. OPR has proposed to apply the new thresholds throughout the State.

In January 2016, OPR issued its *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA* (Revised SB 743 Proposal). Included in the Revised SB 743 Proposal is proposed new CEQA Guidelines Section 15064.3 and related revisions to Appendix G. Under the proposed new Guidelines, the analysis of transportation impacts in the CEQA context would shift from a levels of service metric to a vehicle miles traveled (VMT) metric. In proposing the new approach, OPR noted the relationship between VMT and GHG emissions. If adopted as issued by OPR in January 2016, application of the new CEQA Guidelines would be mandatory when assessing CEQA transportation impacts two years after adoption, which is anticipated in late 2016/2017.

2.2.4.9 Building Energy Efficiency Standards

Title 24, Part 6 of the California Code of Regulations regulates the design of building shells and building components. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. Through SB 350, also known as the Clean Energy and Pollution Reduction Act of 2015, Section 25943 of the Public Resources Code was amended to implement a comprehensive program that will achieve energy efficiency in existing residential and nonresidential structures that will fall

[122] CNRA. 2009a. Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing Analysis and Mitigation of GHG Emissions Pursuant to SB97. http://resources.ca.gov/ceqa/docs/Final_Statement_of_Reasons.pdf

[123] California Legislative Information. 2013. SB-743 Environmental quality: transit oriented infill projects, judicial review streamlining for environmental leadership development projects, and entertainment and sports center in the City of Sacramento. Accessed July 14, 2016 http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB743

significantly below the standards described in Title 24 of the California Code of Regulations. The comprehensive program includes energy efficiency improvements, a broad range of energy assessments, energy ratings, financing options, and other measures.

The CEC adopted the 2013 Building Energy Efficiency Standards (2013 Building Standards), effective July 1, 2014. The 2013 Building Standards are 25 percent more efficient than previous standards for residential construction and 30 percent more efficient for nonresidential construction, and require better windows, insulation, lighting, ventilation systems, and other features that further reduce energy consumption in homes and businesses.

The CEC also has adopted the 2016 Building Energy Efficiency Standards (2016 Building Standards), effective January 1, 2017. For purposes of single-family residences, the 2016 Building Standards result in about 19 percent less electricity use and 27 percent less natural gas use for heating, cooling, ventilation, and water heating than the 2013 Building Standards. For multi-family residences, the 2016 Building Standards result in about 12 percent less electricity use and 48 percent less natural gas use for heating, cooling, ventilation, and water heating than the 2013 Building Standards. The electricity and natural gas use is expected to be less than five percent different between the 2016 Building Standards and the 2013 Building Standards for non-residential building types, such as office, light industrial, and suburban retail buildings.

In addition to the CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24) is commonly referred to as CALGreen, and establishes voluntary and mandatory standards pertaining to the planning and design of sustainable site development, energy efficiency, water conservation, material conservation, and interior air quality. CALGreen is periodically amended, and was most recently amended in 2013 and became effective on January 1, 2014, with a supplement thereto recently becoming effective on July 1, 2015.

The California Public Utilities Commission, CEC, and CARB also have a shared, established goal of achieving zero net energy (ZNE) for new construction in California. The key policy timelines include: (1) all new residential construction in California will be ZNE by 2020, and (2) all new commercial construction in California will be ZNE by 2030. The ZNE goal generally means that new buildings must use a combination of improved efficiency and distributed renewable energy generation to meet 100 percent of their annual energy need; as specifically defined by the CEC:

> "A ZNE Code Building is one where the net of the amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single 'project' seeking development entitlements and building code permits, measured using the [CEC]'s Time Dependent Valuation metric. A ZNE Code Building meets an Energy Use Intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings."[124]

[124] CEC. 2013 Integrated Energy Policy Report (2013), p. 36.

Through Executive Order B-18-12, passed in April 2012, all State agencies and departments were required to reduce GHG emissions by 10% by 2015 and 20% by 2020, compared to 2010 levels. The key policy timelines include: (1) 50% of new State buildings and major renovations are required to be ZNE by 2020, with all new buildings and major renovations required to be ZNE by 2025, (2) grid-based energy purchases for State-owned buildings must be reduced by at least 20% by 2018, compared to 2003 levels, (3) new or renovated State buildings larger than 10,000 square feet will obtain a LEED certification of silver or higher, (4) State agencies must reduce overall water usage at their facilities by 10% by 2015 and 20% by 2020, compared to 2010 levels, and a number of other measures to promote green building practices and increase energy and water efficiency.

2.2.4.10 Executive Order B-16-12 (Transportation GHG Reduction Target)

On March 23, 2012, Governor Edmund Brown signed Executive Order B-16-12, which ordered State agencies to support and promote the rapid commercialization of ZEVs. Executive Order B-16-12 called upon ARB, CEC, Public Utilities Commission, and other relevant agencies to cooperate with the Plug-In Vehicle Collaborative and the California Fuel Cell Partnership to increase State manufacturing, private sector investment, and State research of zero-emission vehicles.

Furthermore, Executive Order B-16-12 set targets for State ZEV infrastructure to be able to support one million vehicles by 2020; 1.5 million zero-emission vehicles to be on the road, displacing 1.5 billion gallons of petroleum fuels, by 2025; and an 80% reduction of GHG emissions from the transportation sector by 2050, compared to 1990 levels. At least 10 percent of California state fleet purchases of light-duty vehicles must by zero-emission by 2015, and at least 25 percent of fleet purchases of light-duty vehicles must be zero-emission by 2020.

2.2.4.11 Senate Bill 391 (California Transportation Plan)

Also known as the California Transportation Plan, SB 391 denoted that the DOT will take into account a wide variety of measures, including the use of alternative fuels, new vehicle technology, tailpipe emissions reductions, and the expansion of public transit, bicycling, and walking. Finally, SB 391 requires that the DOT update the California Transportation Plan by December 31, 2015, and every five years thereafter. The California Transportation Plan was updated in 2015.[125]

2.2.4.12 Other State GHG Regulatory Activities

ARB Executive Order S-13-08

On November 14, 2008, Governor Arnold Schwarzenegger signed Executive Order S-13-08, which called on State agencies to develop a strategy for identification of and preparation for expected climate change impacts in California. The resulting *2009 California Climate Adaptation Strategy* report was developed by the CNRA in coordination with the (CAT). The report presents the best available science relevant to climate impacts in California and proposes a set of recommendations for California decision-makers to assess vulnerability and promote resiliency in order to reduce California's vulnerability to climate change. Guidance regarding adaptation strategies is general in nature and emphasizes incorporation of

[125] California Department of Transportation. California Transportation Plan 2040. Accessed August 31, 2016. http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/index.shtml

strategies into existing planning policies and processes. An update to the CAS report is planned for release as a draft for public comment by the end of 2013.[126]

In addition to requiring the CAT to create a Climate Adaptation Strategy, Executive Order S-13-08 ordered the creation of a comprehensive Sea Level Rise Assessment Report. The report, published in June 2012, indicates that the sea level along most of California's coast is expected to rise about 1 meter over the next century and is likely to increase the risk of damage in the form of flooding, coastal erosion, and wetland loss due to storm surges and high waves. The sea level increase is slightly higher than projected for global sea levels.[127], [128]

Executive Order S-13-08 also called for the California Ocean Protection Council (OPC) to work with the other CAT State agencies to develop interim guidance for assessing the potential impacts of sea level rise due to climate change in California. In coordination with National Academy of Sciences efforts, the OPC drafted interim guidance recommending that State agencies consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess project vulnerability, reduce expected risks, and increase resiliency to sea level rise. The draft resolution and interim guidance document is consistent with the Ocean Protection Act (Division 26.5, Public Resource Code Section 35615(a)(1)), which specifically directs the OPC to coordinate activities of State agencies to improve the effectiveness of State efforts to protect ocean resources.[129]

Other Potentially Applicable Regulations or Policies

Senate Bill X7 7 (Water Conservation Act of 2009)

The Water Conservation Act of 2009 sets an overall goal of reducing per-capita urban water use by 20% by December 31, 2020. The state is required to make incremental progress toward this goal by reducing per-capita water use by at least 10% by December 31, 2015. Reduction in water consumption directly reduces the necessary energy and the associated emissions to convene, treat, and distribute the water; it also reduces emissions from wastewater treatment.

The Department of Water Resources adopted a regulation on February 16, 2011 that sets forth criteria and methods for exclusion of industrial process water from the calculation of gross water use for purposes of urban water management planning. The regulation would apply to all urban retail water suppliers required to submit an Urban Water Management Plan, as set forth in the Water Code, Division 6, Part 2.6, Sections 10617 and 10620.

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[126] State of California. Climate Change Portal: California Climate Adaptation Strategy. Accessed July 8, 2016. http://www.climatechange.ca.gov/adaptation/strategy/index.html

[127] NRC. 2016. National Research Council of the National Academies: Committee on Sea Level Rise in California, Oregon, and Washington; Board on Earth Sciences and Resources and Ocean Studies Board; Division of Earth and Life Studies. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, June. http://www.nap.edu/read/13389/chapter/1

[128] Office of News and Public Information (ONPI). Office of News and Public Information of the National Academies. California Sea Level Projected to Rise a Higher Rate than Global Average; Slower Rate for Oregon, Washington, But Major Earthquake Could Cause Sudden Rise, June 22. http://www8.nationalacademies.org/onpinews/newsitem.aspx?recordid=13389

[129] Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT). 2010. State of California Sea-Level Rise Interim Guidance Document, October. http://www.opc.ca.gov/webmaster/ftp/project_pages/Climate/SLR_Guidance_Document.pdf

Senate Bill 471 Water, Energy, and Reduction of GHG Emissions: Planning

AB 32 designated the ARB as the agency that would manage the GHG Reduction Fund. Senate Bill 471, introduced in February 2015 and amended in August 2015, denotes that GHG emissions reductions associated with water treatment are eligible for funding from the GHG Reduction Fund. SB 471 requires the State Energy Resources Conservation and Development Commission, State Water Resources Control Board, State Air Resources Board, Public Utilities Commission, and Department of Water Resources to cooperate in conducting a study on water-related energy use in California.

2.2.5 Regional Provisions

2.2.5.1 BAAQMD Regional Climate Protection Strategy Resolution

On November 6, 2013, the BAAQMD Board passed a resolution adopting a regional target of achieving 80% below 1990 levels of GHG emissions by 2050. This reduction goal matches that of Executive Order S-3-05, described earlier. In addition, the resolution commits the BAAQMD to develop a regional climate protection strategy, including a Bay Area climate protection work program that will be included as an element of the BAAQMD's 2016 Clean Air Plan.[130] A draft of the 2016 Clean Air Plan, including the regional climate protection strategy, was released in July 2016, and a proposed final draft is scheduled to be released in November 2016.

2.2.5.2 ABAG/MTC Sustainable Communities Strategy (SB 375)

As discussed above, SB 375 is intended to help achieve AB 32's goals by coordinating land use and transportation planning, along with funding priorities. SB 375 requires each MPO in California to develop a SCS as part of its RTP that will achieve the GHG reduction targets required by AB 32. As described above, the MTC and the ABAG developed an SCS for the San Francisco Bay Area and incorporated it and a new RTP into a "Plan Bay Area." Plan Bay Area included Stanford as an employment center in its employment analysis.

[130] BAAQMD. Air District Board passes climate protection resolution. November 6. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/Files/Communications%20and%20Outreach/Publications/News%20Releases/2013/climateres_131106.ashx?la=en

3. GHG EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions GHG emission inventories, which include construction and operational emissions. GHG operational emissions sources within the study area at Stanford University include: electricity use, natural gas use, mobile sources, emergency generator use, solid waste, and water supply and wastewater. Full details on the calculation methodology for the existing conditions and project inventories are provided in **Appendix A**.

3.1 Units of measurement: Tonnes of CO_2 and CO_2e

As discussed in Section 2.1, the term "GHGs" includes gases from fossil fuel use that contribute to the global greenhouse effect, such as CO_2, CH_4, and N_2O, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as HFCs and CFCs. Water, although a GHG, is not typically evaluated, as water vapor is ubiquitous and typically considered in the context of global feedback loops rather than as an emission from a single project. GHG emissions are typically measured in terms of mass of CO_2e. CO_2e are calculated as the product of the mass of a given GHG and its specific GWP, as described in Section 2.1.[131] 100-year GWPs of 25 and 298, corresponding to the Forth Assessment Report, were used for CH_4 and N_2O, respectively, for this analysis. In many sections of this report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

CalEEMod® 2013.2.2 uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. However, the GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been incorporated in these calculations instead, as the Fourth Assessment Report is the basis of the GWPs in the 2016 California GHG inventory.[132] The IPCC also released a Fifth Assessment Report in 2014, which updates the GWPs to 265 and 28 for N_2O and CH_4, respectively.[133] The vast majority of emissions from this Project are CO_2. As a result, small changes in global warming potential for methane and nitrous oxide between the various scientific updates provided by the IPCC have a minimal impact on the overall GHG emissions from the Project.

In this report, a tonne refers to MT (1,000 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

3.2 Existing Conditions Inventories Description

There are four existing conditions scenario years presented in this report:

[131] CalEEMod® 2013.2.2, the primary tool used to develop the emissions inventory uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. The GWPs in the IPCC Fourth Assessment Report have of 298 for N_2O and 25 for CH_4 have been manually incorporated to CalEEMod® output.

[132] CARB. 2016. California Greenhouse Gas Emission Inventory – 2016 Edition. Available at: https://www.arb.ca.gov/cc/inventory/data/data.htm. Accessed: September 2016.

[133] IPCC. 2014. Climate Change 2014 – Synthesis Report. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf.

- 2014
- 2015
- Fall 2018
- Fall 2020

The Fall 2018 scenario year presented in this technical report represents the conditions expected to exist at commencement of the proposed 2018 GUP. This includes additional buildings that would be expected to be permitted under the 2000 GUP, but does not include the occupancy of the new Escondido Village Graduate Residences. This scenario also takes into account changes in the motor vehicle fleet anticipated in 2018. For example, mobile sources are expected to have lower emissions in 2018 based on existing regulatory standards. Also importantly, Fall 2018 reflects Stanford's existing commitment to acquire electricity from a solar farm in Kern County and to build new solar systems on Stanford's campus. The Kern County solar farm will be a 68-megawatt peak solar plant generating 159,000 megawatt-hours per year (MWh/year). In addition, several Stanford building complexes feature solar panels, including the Science and Engineering Quad and the Knight Management Center. Installation began in May 2016 on rooftop panels for an additional 16 campus buildings to provide an additional 5 MW, which will generate up to 7,300 MWh/year. These two solar systems are expected to provide up to 53 percent of Stanford's total electricity use.

The 2014 and 2015 scenarios demonstrate the effects of the recently completed changes at Stanford that have significantly changed its emissions profile. Previously, in 2014, Stanford produced electricity, steam and chilled water at its on-campus Cardinal cogeneration plant and its prior Central Energy Facility (old CEF). These facilities employed what was previously considered a state-of-the-art process of generating electricity through a gas-fired plant, and using the steam (a by-product of electricity generation) to heat campus buildings. Stanford used onsite chillers to create cold water to cool the buildings. In addition, the old CEF provided process steam for use in kitchens and laboratories. Excess electricity produced by the old CEF that was not used by Stanford was sold back to Pacific Gas & Electric Company (PG&E). Emitting equipment for the old CEF was comprised of four boilers, a gas turbine, duct burners, and three emergency generators. The old CEF (including the Cardinal Cogeneration plant) was decommissioned in April 2015.

In 2015, Stanford completed a groundbreaking overhaul of it campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations-- or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water-based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

The new CEF includes the following equipment:

- three hot water generators,
- two emergency generators,

- electric-powered chillers (non-emitting), and
- thermal energy storage tanks (non-emitting).

The hot water generators supply hot water for building heating and primarily run on natural gas, with the additional capability to run on diesel fuel in emergencies. The emergency generators run on diesel fuel.

Unlike the old CEF, the new CEF does not provide electricity to the campus. Instead, Stanford currently procures electricity via Direct Access from the grid through an Electricity Service Provider.

In addition to the change in emissions profiles due to the SESI, there are also changes in 2015 due to two other types of emissions sources:

- Stanford installed a steam processing plant that provides process steam for sterilization purposes (e.g., for laboratory autoclaves). This is referred to as "Replacement Process Steam."[134]
- Stanford installed individual boilers in a few campus locations to provide steam for heating at a few campus buildings that will not be converted from steam to hot water within a reasonably foreseeable timeframe. This category of sources is referred to as the "Individual Replacement Boilers."

Both pre-SESI (2014) and post-SESI (2015) inventories are provided here to provide context for the Fall 2018 inventory. 2014 represents the historic campus emissions prior to SESI. 2015 represents the current campus emissions after SESI. The 2015 emissions inventory was used to develop the Fall 2018 inventory by incorporating assumptions on additional campus growth under the existing 2000 GUP in certain categories, such as an increase in academic square footage and residential beds. The Fall 2020 emissions inventory represents the same conditions as Fall 2018 but with the addition of 2,020 net new beds for Escondido Village Graduate Residences, and reflects year 2020 emission factors. A comparison of the 2014, 2015, Fall 2018, and Fall 2020 inventories is provided in Table 3-2-1, illustrating the effect of SESI (between 2014 and 2015), the remaining growth of the campus under the 2000 GUP with the exception of the Escondido Village Graduate Residences, and the impact of increased electricity generation from the solar farm (Fall 2018), and the impact of the additional Escondido Village Graduate Residences (Fall 2020).

3.3 Project Inventory Description

This GHG Technical Report evaluates the emissions inventory for the Project - the complete buildout of the 2018 GUP. The Fall 2020 emissions inventory was scaled up to develop the Project inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds. Because California has adopted goals for reducing GHGs by 2030, the Project emissions inventory is based on adopted regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming the total operational activity from complete buildout and operation of the 2018

[134] Stanford implemented an energy-efficiency program to convert campus buildings from steam to hot water for building heating. As part of this program, the steam produced at the old CEF was converted to hot water at regional heat exchange stations. While the new CEF replaces the heating and cooling functions served by the old CEF, it does not produce steam. Accordingly, other sources were needed to meet the remaining campus demands for steam (i.e., process steam for sterilization, steam for use in kitchens).

GUP in 2030. This scenario is called "Fall 2035" because it consists of the full Project operations which are expected by 2035; however, if 2035 emission factors were used instead of 2030, the total GHG emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. This report also includes an estimate of Project emissions in Fall 2035 that incorporates intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. The additional scenario is labeled “Fall 2035 With RPS Projection”. A comparison of the Project inventory, and the additional Fall 2035 scenario, to the existing conditions inventories is presented in **Table 3-2-1.**

3.4 Construction Emissions: Existing Conditions and 2035 Project

This section describes the estimation of GHG emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual construction and demolition for all existing conditions and Project inventory years. Detailed information on the construction emissions calculations is provided in **Appendix A**, and the detailed emission inventory from the CalEEMod® output files is included in **Appendix B**. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

GHG emissions from these construction phases are largely attributable to fuel use from off-road construction equipment and vendor vehicles. GHG emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section. VMT, trips, and emissions for the construction on-road vehicles are shown for informational purposes as separate line items in the operational mobile emissions tables.

Ramboll Environ used California Emissions Estimate Model (CalEEMod®) version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 sqft,demolition of 50,306 sqft of buildings, and excavation of 62,062 cubic yards (CY) of soil per year, with the default start and end dates of the phases moved such that all construction occurs within one year while maintaining total default number of equipment-hours. Emissions are shown in **Table 3-2-1**.

3.4.1 Vegetation Changes

Permanent vegetation changes that occur as a result of land use development constitute a one-time change in the carbon sequestration capacity of a project site. In this case, no construction is proposed in open space areas, and redevelopment will primarily occur in the core campus and parking lots and will be landscaped with trees. This will result in an overall

negligible change in carbon sequestration once the vegetation reaches a steady state (i.e., new vegetation replaces dying vegetation). Consequently, vegetation change results in a negligible change in GHG emissions for this GUP.

3.5 Indirect GHG Emissions from Electricity Use

Indirect GHG emissions, which occur when electricity is used, are typically due to electricity generation from offsite power plant locations. Electrical power is supplied to the study area by PGE, through the direct access program, and from the on-site Cardinal Cogen Plant (for the 2014 inventory only).

To estimate emissions, the electricity usage is multiplied by the emission intensity factors for the GHGs. Emission intensity factors are GHG emission rates from a given source in terms of the amount of GHG released (lbs) per MWh of energy produced.

Stanford purchases "direct access" electricity for a portion of its operations. This program allows for a choice of energy services provider rather than solely purchasing electricity from the utility company.[135] The default intensity for the direct access electricity in the 2014 and 2015 inventories are based on the USEPA eGRID most recent (2014v2) values for the Western Electricity Coordinating Council (WECC) California electricity region for the electricity supplier mix specified by Stanford's Office of Sustainability for each inventory year.[136] A more specific electricity intensity factor was not available for Stanford's 2014 direct access provider, Constellation Energy. In addition, the Stanford Office of Sustainability provided the PGE intensity for the commercially supplied PGE electricity. Intensity factors for Fall 2018 campus electricity are adjusted based on Stanford's commitment to operate the Stanford Solar Generating Station that will provide half of campus electricity by renewable sources by 2017;[137] renewable sources are assumed to have an electricity intensity of zero. The electricity intensity factors for the Fall 2018 inventories are based on a linear interpolation to meet the State's requirement for 33 percent renewables by 2020. The 2020 electricity intensity factors are estimated incorporating the State's requirement for 33 percent renewables by 2020. The electricity intensity factors for Project emissions are based on the assumption the PGE and WECC California achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources in 2030.[138] The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050. This is consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan[139], and results in in 57.5% of electricity from renewables by 2035. The default electricity intensity for CH_4 and N_2O were obtained from CalEEMod® Appendix D value for PGE and were conservatively not adjusted for future

[135] PGE. 2016. Electricity – Direct Access. Available at: http://www.pge.com/b2b/retailenergysuppliers/espresourcecenter/directaccessfaqs/. Accessed: July 2016.

[136] USEPA. 2017. eGRID2014v2. Available at: https://www.epa.gov/energy/egrid-2014-summary-tables. Accessed: April 2017

[137] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: July 2016.

[138] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

[139] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

inventory years. A summary of the electricity intensity factors used in the analysis are shown in **Table 3-5-1**.

3.6 Operational Emissions: Existing Conditions and 2035 Project

3.6.1 Electricity

Locations on campus acquire electricity from several providers. These are summarized in **Table 3-6-1** for 2014.

For the 2014 inventory, electricity usage for the 2014 calendar year was provided by Stanford for PGE Commercial customers, direct access customers, imports to campus, imports to the old CEF, and commercial non-Stanford accounts. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using CalEEMod® assumptions. GHG emissions associated with Cardinal Cogen were derived directly from a 2014 BAAQMD emissions inventory, multiplied by the percentage associated with electricity production for the Stanford Campus and CEF (35%). Cardinal Cogen emissions associated with electricity sales to PGE (18%) and chilled water and steam sold to the hospital (13%) are not accounted for in this inventory. Cardinal Cogen emissions associated with chilled water and steam sold to the campus (34%) are included in the Natural Gas subcategory described later in this report. The breakdown of Cardinal Cogen emissions was provided by the Stanford Office of Sustainability.

Similarly, for the 2015 inventory, electricity usage for July through December 2015 for PGE Commercial customers, direct access customers, campus usage, and the new CEF was provided by Stanford. The July – December usage was doubled to account for an entire year. The entire 2015 calendar year was not used because the new CEF was brought online in April 2015. Thus, doubling the July – December usage is assumed to be representative of a year's worth of electricity usage. It was assumed that the electricity usage for non-Stanford commercial customers would not change from the 2014 inventory. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was again estimated using CalEEMod® assumptions.

The Fall 2018 inventory is based on the 2015 inventory with certain subcategories of electricity usage increased. The electricity usage for the campus and new CEF was increased by 8% to account for the increase in academic square footage by Fall 2018. It was assumed that the electricity usage for PGE Commercial customers and direct access customers would not increase by 2018. Electricity usage for 2014 for non-Stanford commercial customers was provided by Stanford and was not scaled as it was assumed that electricity consumption for this category would not change significantly. Electricity usage for faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions was estimated using CalEEMod® assumptions.

The Fall 2020 inventory is based on the Fall 2018 inventory with additional electricity consumption calculated for the new Escondido Village graduate residences. This annual electricity use is based on the CalEEMod® default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017).

For the Fall 2035 and Fall 2035 with RPS Projection inventories, electricity emissions are based on Fall 2020 usage estimates scaled up to account for development by 2035. Electricity usage from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual electricity use is based

on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

For 2014, PGE emission factors from CPUC corresponding to 2014 were applied to PGE Commercial customers and the Searsville Block and Olmsted Staff Rental subdivisions. The eGRID 'current' (2014v2)[140] emission factor for WECC California was used for direct access customers, imports to Campus, and imports to the old CEF. An emission factor derived from Cardinal Cogen was used for non-Stanford commercial customers.

For 2015, PGE emission factors from the CPUC corresponding to 2014 were applied to PGE Commercial customers, the Searsville Block and Olmsted Staff Rental subdivisions, and non-Stanford commercial customers. The eGRID 'current' (2014v2)[141] emission factor for WECC California was used for direct access customers, campus usage, and imports to the new CEF.

For Fall 2018, PGE emission factors projected from 2014 to 2018 were applied to PGE Commercial customers, the Searsville Block and Olmsted Staff Rental subdivisions, and Commercial Non-Stanford electricity usage. The eGRID 'current' (2014v2)[142] emission factor for WECC California was adjusted toward RPS goals and used for direct access customers. Then, the direct access emission factor was modified to take into account Stanford's commitment to procure approximately 159,000 MWh/year of electricity from its Kern County solar farm and an additional 7,300 MWh/year from on-campus rooftop solar installations. This modified emission factor was applied to the campus and new CEF consumption category.

For Fall 2020, the electricity intensity factors for Project emissions are based on the assumption that PGE and WECC California achieve the State's goal of acquiring 33 percent of energy from renewable sources and that the Stanford Solar Farm and on-site solar generation continue to produce additional renewable electricity.

For Fall 2035, the electricity intensity factors for Project emissions are based on the assumption the PGE and WECC achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources and that the Stanford Solar Farm and on-site solar generation continue to produce renewable electricity.[143]

For the Fall 2035 with RPS Projection scenario, the electricity intensity factors are based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels,

[140] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[141] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[142] https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf

[143] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

assuming the State will similarly achieve 80% RPS by 2050[144] and that the Stanford Solar Farm and on-site solar generation continue to produce renewable electricity.

Electricity consumption, intensity factors, and emissions are summarized in **Tables 3-6-2, 3-6-3, 3-6-4, 3-6-5**, **3-6-6a, and 3-6-6b.** The derivation of the Project electricity intensity factors is shown in **Table 3-5-1.**

3.6.2 Natural Gas

GHG emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating) and industrial usage (i.e., powering the old CEF for the 2014 inventory and powering the new CEF and Replacement Process Steam Plant for the 2015 and Fall 2018 inventories).

For 2014 and 2015 inventories, student residential and commercial natural gas usage is provided through PGE consumption data. Natural gas usage for private faculty/staff housing is estimated based on averages for the climate zone. Natural gas usage of the old CEF (2014 inventory) and the new CEF and Replacement Process Steam Plant (2015 inventory) are provided by Stanford.

For the Fall 2018 inventory, natural gas combustion emissions are based on 2015 natural gas consumption data provided by Stanford for residential and commercial categories, scaled up to account for development by 2018; natural gas consumption estimated for the faculty/staff housing in 2018; and natural gas consumption data by Stanford for 2015 for the new CEF and Replacement Process Steam Plant scaled up to account for development under the 2000 GUP by 2018.

For the Fall 2020 inventory, natural gas combustion emissions are based on the Fall 2018 natural gas consumption data described above. Additional residential natural gas consumption is estimated for the new Escondido Village Graduate Residences.

For the 2035 inventory, natural gas combustion emissions are based on Fall 2020 natural gas consumption estimates scaled up to account for development by 2035. The majority of PGE Residential accounts are student housing so the increase in consumption is scaled up by the increase in number of beds from Fall 2020 to 2035. Commercial accounts, hot water generators that are part of the CEF, and the replacement process steam plant natural gas consumption is scaled up by the increase in academic square feet from Fall 2020 to 2035. Natural gas consumption from 550 new faculty/staff high density homes to be constructed within the study boundary by 2035 was also added to the inventory. The annual natural gas use is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Natural gas use for the other scaled categories is assumed to scale linearly, meaning efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) from the Federal Mandatory GHG Reporting Regulation (40 CFR 98).

[144] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Natural gas consumption, emission factors, and emissions for all scenario years are summarized in **Tables 3-6-7, 3-6-8, 3-6-9, 3-6-10, 3-6-11**, and **3-6-12.**

3.6.3 Mobile Sources

GHG emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. Mobile source emissions include running exhaust emissions and starting exhaust tailpipe emissions. Running exhaust is dependent on VMT. Starting exhaust is dependent on the number of starts or trips that a vehicle makes. EMFAC2014 was used to calculate the emission factors for each type of fleet in the relevant operational year. Assumptions and calculations used to determine these values are described in detail in **Appendix C**.

For 2014 and 2015, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. The on-road Campus Fleet can be categorized into the Bonair Fueling Station Fleet, the Peninsula Sanitation Services, Inc (PSSI)Fleet, the Marguerite Bus/Shuttle Fleet, and the Public Safety Fleet. Stanford provided activity data in the form of fuel usage totals for the Bonair Fueling Station Fleet and the PSSI Fleet, and VMT for the Marguerite Bus/Shuttle Fleet a portion of the PSSI fleet, and the Public Safety Fleet. Activity data (fuel consumption) for the off-road Campus Fleet and golf course fleets (Siebel Varsity Golf Training Complex and Red Barn)[145] was provided by Stanford. Activity data (number of trips and VMT) for visitors and childcare facilities were calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

For Fall 2018, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, visitors, and vendors corresponding to 2015 were scaled up based on academic square footage and number of residents. The 10 oldest vehicles from the Marguerite fleet will be assumed to be electric by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%.

For Fall 2020, the same methodology, traffic data, and assumptions are used as that for the Fall 2018 inventory, except that the worker and resident VMT have been updated per **Fehr & Peers Appendix B2** to incorporate changes due to the new Escondido Village Graduate Residences.

For 2035, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. On-road Campus Fleet emissions incorporate the Stanford commitments that all Marguerite buses will be electric 2035 and 70% of Bonair vehicles will be replaced by electric vehicles by 2035. Activity data (number of trips and VMT) for visitors and childcare facilities was calculated by Ramboll Environ based on

[145] Although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary.

Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

The GHG emission factors for the mobile sources mentioned above were generated with the most recent approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation, emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year. Full calculation details can be found in **Appendix A**.

Emissions for all scenario years are summarized in **Tables, 3-6-13, 3-6-14, 3-6-15**, **3-6-16**, and **3-6-17.**

3.6.4 Emergency Generators

Stanford currently has 90 emergency generators installed on campus. GHG emissions are from diesel combustion resulting from their operation for testing and maintenance and for emergency operation. Activity data (hours of operation, including some emergency usage) for the emergency generators is provided by Stanford for 2014 and 2015. Activity data was scaled up from the 2015 inventory based on increased academic square footage of 8% to develop the Fall 2018 inventory. The Fall 2020 inventory is assumed to be the same as the Fall 2018 inventory. For 2035, activity data from Fall 2018/2020 was scaled up based on the increase in academic square footage from full buildout of the 2000 GUP to full buildout of the 2018 GUP. A representative GHG emission factor (in grams per horsepower per hour) was derived for emergency generators based on a default fuel consumption rate. Full calculation details are provided in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-6-18** and **3-6-19.**

3.6.5 Waste

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 emission estimates for 2014 and 2015 inventories are based on Stanford actual disposal and diversion rates for those years, with waste from faculty/staff housing outside the study area removed. GHG emission estimates for the Fall 2018 inventory are based on Stanford actual disposal and diversion rates across campus in 2015, scaled up by 8% to account for the increase in academic square footage. Stanford waste is sent to Newby Island Landfill, which contains a landfill gas (LFG) collection and destruction system. The GHG emissions were calculated using methods from CalEEMod® assuming LFG collection.

Fall 2020 is based on the Fall 2018 waste total with additional waste estimated for the new Escondido Village Graduate Residences. Waste generated by the new residents is based on the CalEEMod® default for mid-rise apartments. The diversion rate is assumed to remain the same as the 2015 rate.

For 2035, waste generation is assumed to linearly increase from Fall 2020 based on the increase in academic square footage expected from full buildout of the 2000 GUP to full buildout of the 2018 GUP. Waste associated with the new faculty/staff housing is added based on the 2015 per-house waste disposal rates. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The

diversion rate is assumed to remain constant from the 2015 rate, even though diversion rate statewide is expected to increase by 2035.

GHG emissions associated with non-landfill diverted waste streams are not considered, because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions when operated effectively.[146] These 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.[147] Biogenic CO_2 emissions were not included when ARB analyzed the GHG emissions inventory under AB 32. Therefore, they are not included in the emissions inventory.

Emissions are summarized in **Tables 3-6-20, 3-6-21**, **3-6-22**, **3-6-23**, and **3-6-24.**

3.6.6 Water Use and Emissions

Indirect GHG emissions result from the production of electricity used to convey, treat, and distribute water and 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. Stanford potable water is sourced from the San Francisco Public Utilities Commission. Non-potable water comes from groundwater and lake water. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

GHG emissions associated with water use for 2014 and 2015 are based on actual data for domestic water use and wastewater generation for the campus in 2014 and 2015, respectively. For the Fall 2018 inventory, water usage and wastewater generation values are based 2015 data, plus a 12% increase in total consumption from the April 2017 Stanford Water Supply Assessment (WSA) Report to adjust for Fall 2018. For the Fall 2020 inventory, additional water use is added on a per-bed basis for the new Escondido Village Graduate Residences based on the consumption in the WSA. Emissions from electricity from lake water pumping is already captured under campus electricity. Wastewater quantities are derived by summing monthly sewer water records. Ramboll Environ used CalEEMod® default assumptions for average embodied energy in water for Santa Clara County, which are based on a study commissioned by the CEC.[148,149] This study published recommended electricity intensities for the supply and conveyance, treatment and distribution of water, as well as treatment of wastewater, for Northern and Southern California. These factors account for the energy embodied in water use and were used to calculate emissions for the campus. Lacking more detailed information about the wastewater treatment type at the Palo Alto Water Treatment Plant, CalEEMod® defaults for Santa Clara County have been used to represent a conservative emissions calculation; if the actual wastewater treatment process does not contain anaerobic facultative lagoons or septic tanks, emissions would decrease. The PGE electricity emission factor is used to estimate GHG emissions per kilowatt-hour, since it is assumed that the electricity from the conveyance, treatment, and distribution comes from PGE.

[146] ARB. 2010. Local Government Operations Protocol. Chapter 9.4.

[147] This inventory represents scope 1 and 2 emission categories. A life-cycle analysis of waste diversion would be a scope 3 inventory. CARB's Local Government Operations Protocol Version 1.1 (May 2010) clearly states that scope 3 emissions should not be combined with scope 1 and 2 emissions.

[148] Embodied energy refers to the amount of energy that was used in delivering water to the specific land use.

[149] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

Fall 2035 water use rates are from the April 2017 Stanford Water Supply Assessment, which were based on pre-drought water use rates per undergraduate and graduate bed, academic building square foot, and faculty and staff residence. Consistent with the existing inventories, total water consumption is lower in the GHG Report than in the Water Supply Assessment, because the WSA includes water use from the 899 faculty and staff houses not included in the study area. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use.

Emissions are shown in **Tables 3-6-25**, **3-6-26, 3-6-27, 3-6-28, 3-6-29a,** and **3-6-29b**.

3.6.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression for 2014, 2015, Fall 2018, Fall 2020, and Fall 2035. Emissions are shown in **Table 3-2-1**.

4. GHG INVENTORIES IN CONTEXT

This section compares the three existing conditions inventories and the Project inventory.

4.1 2014 Inventory

The site emitted approximately 222,069 $MTCO_2e$ in 2014 (see **Table 3-2-1**). The dominant emissions sources were the Cardinal Cogen and transportation, which contributed 67% and 25% of the total inventory, respectively.

4.2 2015 Inventory

The site emitted approximately 166,924 $MTCO_2e$ in 2015 (see **Table 3-2-1**). The dominant emissions sources were electricity imported to campus and transportation, which contributed 45% and 33% of the total inventory, respectively. The reduction in emissions compared to 2014 primarily is due to completion of the SESI.

4.3 Fall 2018 Inventory

The site is expected to emit approximately 125,672 $MTCO_2e$ in the inventory year Fall 2018 prior to commencement of the proposed 2018 GUP (see **Table 3-2-1)**. The dominant emissions sources were transportation and electricity imported to campus, which contributed 42% and 27% of the total inventory, respectively. The reduction in emissions compared to 2015 primarily is due to operation of the Stanford Solar Generating Station.

4.4 Fall 2020 Inventory

The site is expected to emit approximately 124,525 $MTCO_2e$ in the inventory year 2020 (see **Table 3-2-1)**. The dominant emissions sources were transportation and electricity imported to campus, which contributed 43% and 27% of the total inventory, respectively. The slight decrease in emissions compared to Fall 2018 is due to the addition of the Escondido Village Graduate Residences that reduces graduate student mobile trips coupled with a decrease in electricity and mobile emission factors.

4.5 Fall 2035 Inventory

The site is expected to emit approximately 125,412 $MTCO_2e$ per year in Fall 2035 (see **Table 3-2-1)**. The dominant emissions sources are almost evenly transportation, electricity imported to campus, and natural gas which contributed 34%, 30%, and 30% of the total inventory, respectively.

4.6 Fall 2035 with RPS Projection Inventory

Emissions for a second Fall 2035 scenario ("Fall 2035 with RPS Projection") are calculated to represent a reasonable estimate of 2035 Project emissions as the electricity grid continues to incorporate additional renewables after 2030. The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[150] This linear trajectory would require 57.5 percent of electricity to come from renewable sources in 2035. As shown in **Table 3-2-1**, the site is expected to

[150] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

emit approximately 119,875 $MTCO_2e$ per year in Fall 2035 after incorporating the 2035 RPS projection.

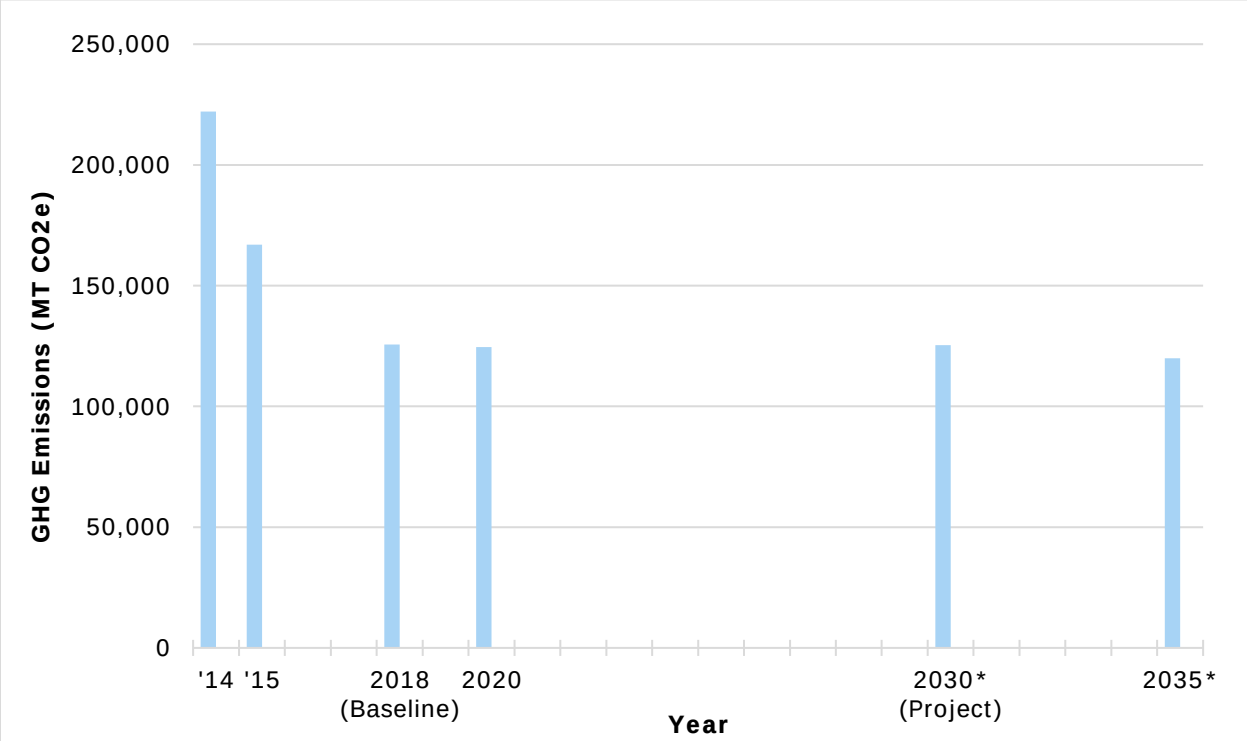
4.7 Summary

A category-by-category comparison of emissions between the three existing conditions inventories and the Project inventory is shown in **Table 3-2-1.** Even with growth in population and building square footage, total mass emissions of GHGs decrease significantly from 2014 to 2015 to Fall 2018 and remain stable from Fall 2018 to Fall 2020 and through Fall 2035. The decrease from 2014 to 2015 is due to the changes in electricity and gas consumption due to SESI, and continued decreases through Fall 2018 and Fall 2020 are due to the Stanford Solar Generating Station and the cleaner PGE electricity. The relatively stability of emissions from Fall 2020 to Fall 2035 is primarily due to a larger campus with a higher population offset by cleaner electricity and cleaner mobile vehicles. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the electricity intensity factor, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. As shown in the Fall 2035 with RPS Projection scenario, incorporating a reasonable estimate of the electricity intensity factor in 2035 further decreases GHG emissions. The Project would not result in a net increase in campus-wide GHG emissions from the baseline year of 2018 through full build out of the 2018 General Use Permit in 2035.

Table 4-7. Stanford GHG Emissions

Inventory Year	GHG Emissions (MT)
2014	222,069
2015	166,924
Fall 2018 (Baseline)	125,672
Fall 2020	124,525
Fall 2035 (Project)*	125,412
Fall 2035 (Project) with RPS Projection	119,875

Figure 4-5. Stanford GHG Emissions



*As described in Section 1.2.3, the Fall 2035 Project inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

5. SIGNIFICANCE STANDARDS AND IMPACT ASSESSMENT

5.1 Standards of Significance

5.1.1 CEQA Guidelines Appendix G Thresholds

As described in Section 2.2, the 2009 amendments to the state CEQA Guidelines do not establish specific thresholds of significance for GHG impacts. Rather, Section 15064.4 of the CEQA Guidelines emphasizes the lead agency's discretion to determine the appropriate methodologies and thresholds of significance consistent with the manner in which other impact areas are handled in CEQA.[151] Appendix G of the CEQA Guidelines, the Environmental Checklist Form, is often used as a basis for lead agencies' selection of significance thresholds, but it does not prescribe specific thresholds. Rather, Appendix G suggests evaluating whether a project would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant adverse impact on the environment; or
3. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Guidelines section 15064.4(b) states that in evaluating the significance of impacts from GHG emissions, the lead agency should consider the following factors, among others:

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.
- Whether the project emissions exceed a thresholds of significance that the lead agency determines applies to the project.
- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of GHG emissions.

Here, there is no applicable plan, policy, or regulation enacted or adopted for unincorporated Santa Clara County that meets the standards set forth in Guidelines section 15064.4(b).

Further, while this GHG Technical Report presents GHG emissions at full Project build-out compared to GHG emissions under existing conditions, the quantity of emissions standing alone does not mean that the project's GHG emissions would be cumulatively considerable. The global nature of climate change and the absence of scientific and factual information on the significance of particular amounts of GHG emissions make the change insufficient to support a significance determination. In *Center for Biological Diversity v. Department of Fish & Wildlife,* 62 Cal. 4th 204 (2015), the California Supreme recognized that an individual project's emissions will most likely not have any appreciable impact on the global problem by themselves, but they will contribute to the significant cumulative impact caused by GHG emissions from other sources around the globe. The question therefore becomes whether the

[151] CNRA. 2009. Revised Text of Proposed Guideline Amendments. Sacramento, CA. http://resources.ca.gov/ceqa/docs/FINAL_Text_of_Proposed_Amendemts.pdf

project's incremental addition of GHGs is cumulatively considerable in light of the global problem, and thus significant. The Supreme Court acknowledged that the fact that emissions are global rather than local gives rise to an argument that a certain amount of GHG emissions "is as inevitable as population growth." The Court stated "Under this view, a significance criterion framed in terms of efficiency is superior to a simple numerical threshold because CEQA is not intended as a population control measure."

This GHG Technical Report uses the BAAQMD CEQA Guidelines service population metric to assess the significance of the project's contribution to cumulative global GHG emissions. The BAAQMD service population metric is an efficiency-based metric that the BAAQMD developed to assess whether a land use project would further the emission reduction goals for 2020 articulated by the State Legislature in AB 32. To extend the analysis beyond 2020, Ramboll Environ has adjusted the BAAQMD's service population metric to assess whether the Project would meet the State's newly enacted, more stringent, 2030 GHG emissions reduction goal, and Ramboll Environ has further adjusted the service population metric to identify the additional reductions that would be required by 2035 to achieve a trajectory toward the 2050 goals announced in the Governor's Executive Order.

In addition, this GHG Technical Report includes a qualitative discussion of the Project's consistency with AB 32, the ARB Scoping Plan, the region's Sustainable Communities Strategy/Regional Transportation Plan (Plan Bay Area), Executive Order S-3-05, Executive Order B-16-12, and SB 32. In *Cleveland National Forest Foundation v. San Diego Association of Governments* (Cal. Supreme Court Case S223603, Filed July 13, 2017), the California Supreme Court held that the lead agency did not abuse its discretion in declining to adopt the 2050 goal in Executive Order S-3-05 as its significance criterion for assessing greenhouse gas emissions. There, the Court explained the EIR did not obscure the existence or contextual significance of the Executive Order's 2050 emissions target; the EIR made clear that the 2050 target is part of the regulatory setting in which the plan at issue would operate; and the EIR straightforwardly mentioned the 2050 target in the course of explaining why the lead agency chose not to use the target as a measure of significance. The EIR explained that it is uncertain what role regional land use and transportation strategies can or should play in achieving the EO's 2050 emissions reductions target. Because it remains uncertain as to what plans and policies the State will adopt to achieve the 2050 goal, this analysis similarly declines to adopt the 2050 goal as a significance criterion. However, because the goal is based on sound science, this analysis discusses the goal and assesses whether the project emissions would be consistent with the trajectory needed to achieve the goal.

5.1.2 BAAQMD Significance Threshold

The BAAQMD presents its thresholds of significance along with methods for evaluating compliance in its guidance document entitled California Environmental Quality Act Air Quality Guidelines (updated May 2011).[152,153]

[152] BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. Accessed December 1, 2013. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20CEQA%20Guidelines_May%202011_5_3_11.ashx.

[153] On March 5, 2012 the Alameda County Superior Court issued a judgment, in California Building Industry Association v. Bay Area Air Quality Management District, finding that the BAAQMD had failed to comply with CEQA when it adopted its significance thresholds in 2010. The Court ruled that the adoption of the significance thresholds (including new significance thresholds for TACs and fine particulate matter or $PM_{2.5}$) is considered a

With respect to Project operations, BAAQMD's guidelines establish three potential analysis criteria for land use development projects:

- Compliance with a qualified Climate Action Plan, with a goal consistent with AB 32,
- A mass emissions threshold of 1,100 MT of CO2e per year, or
- A GHG efficiency threshold of 4.6 MT of CO2e per service population (project jobs + project residents).

BAAQMD thresholds are based on the AB 32 GHG reduction goals and a "gap analysis" that attributes an appropriate share of GHG emissions reductions to new land use development projects in BAAQMD's jurisdiction. The efficiency threshold (4.6 MT of CO_2e per service population) was calculated by dividing the AB 32 GHG reduction target for land use development emissions in California by the estimated 2020 population and employment level.[154] BAAQMD thresholds are tied directly to AB 32 and statewide emissions reduction goals for 2020.

SB 32 addresses GHG emissions reductions through 2030. Long-term goals for 2030 and 2050 also have been articulated in EO B-30-15 and EO S-3-05, respectively.

Achieving SB 32 and the Executive Orders' 2050 GHG emissions reduction goals will require systemic changes in how energy is produced and consumed through all sectors of the economy (as discussed in greater detail in the impact analysis below). Because the mix of technologies, strategies, and policy choices the state will ultimately choose to implement to achieve the 2030 and 2050 goals is not readily ascertainable at this time, any accounting of future GHG emissions from an individual development project cannot yet reflect the scope and scale of reductions that may occur as the state transitions toward new regulations designed to achieve the new long-term goals. Furthermore, in absence of a state plan to achieve these long-term goals, it is difficult to identify the "fair share" of reductions to be applied at the local or project level.

The Association of Environmental Professionals (AEP) Climate Change Committee recommended in a 2015 white paper that CEQA analyses for multiple-phase projects with post-2020 development not only "consider consistency with the 2020/AB 32-based framework but

"project" under CEQA, and, thus, the BAAQMD should have prepared the required CEQA review and documentation. The court issued a writ of mandate ordering the BAAQMD to set aside the 2010 significance thresholds and cease dissemination of them until the BAAQMD had complied with CEQA. On August 13, 2013, the California First District Court of Appeal reversed the Superior Court's decision, ruling that adoption of CEQA significance thresholds does not constitute a "project" under CEQA. The CBIA then sought review of this decision in the California Supreme Court, which narrowed the scope of review to the question: under what circumstances does CEQA require an analysis of how existing environmental conditions will impact future residents or receptors of a proposed project? On December 17, 2015, the California Supreme Court held that CEQA does not generally require an agency to consider the effects of existing environmental conditions on a proposed project's future users or residents. On August 16, 2016, the California First District Court of Appeal concluded that a local agency might permissibly apply the thresholds for existing environmental conditions to an environmental review conducted for its own project under CEQA, even though the thresholds cannot be used to require an environmental impact report or the implementation of mitigating measures for a privately initiated project based solely on the impact the existing environment will have on future users or occupants of a project.
Because the vacation of the proposed significance thresholds did not affect their validity from a scientific perspective and the BAAQMD's thresholds are supported by substantial evidence, and because the County of Santa Clara does not have alternative numeric thresholds for evaluating air quality impacts under CEQA, the thresholds from the BAAQMD CEQA Guidelines will be used in this analysis.

[154] BAAQMD. 2010. Proposed Thresholds of Significance. May.

also analyze the consequences of post-2020 GHG emissions in terms of their impacts on the reduction trajectory from 2020 toward 2050."[155] AEP further recommends that the "significance determination…should be based on consistency with substantial progress along a post-2020 trajectory."[156] The AEP white paper is advisory only and is not binding guidance or an adopted set of CEQA thresholds. The Project would continue to generate operational GHG emissions in future years; thus, a post-2020 discussion is warranted.

Consistent with general scientific understanding that there will be a need for deeper reductions in GHG emissions in the post-2020 period, this report evaluates operational GHG emissions by using three different metrics:

- Existing conditions emissions in Fall 2018 and Fall 2020 are compared to BAAQMD's threshold of 4.6 MT of CO_2e per service population. The detailed derivation is shown in **Table 5-1-1**. The degree to which existing emissions are below the BAAQMD threshold for 2020 and the trajectory of the Project emissions toward the 2030 threshold (identified below) can be used to assess the Project's near-term GHG emissions. Emissions in excess of BAAQMD's thresholds could impede attainment of statewide GHG reduction targets for 2020 established under AB 32. BAAQMD used the global warming potentials from the Second Assessment Report (SAR) to establish this threshold. However, if the GWPs from Assessment Report 4 were used, the metric would still be 4.6 MT of CO_2e per service population, due to negligible impacts of the GWPs on the GHG emissions inventory.
- Project emissions at full Project buildout in 2035 (Fall 2035) are compared to a 2030 threshold of 2.7 MT of CO_2e per service population. The 2030 threshold was calculated for 2030 and based on the GHG reduction goal established under SB 32 and EO B-30-15 (40 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels adjusted for the AR4 global warming potentials for consistency with the rest of the inventory and the projected 2030 statewide population and employment levels). The detailed derivation is shown in **Table 5-1-2**. Emissions in excess of the 2030 threshold of 2.7 MT of CO_2e per service population could impede attainment of statewide GHG reduction targets for 2030 established under SB 32. The 2030 assessment conservatively assumes full Project build-out by 2030, with 2030 emission factors.
- Project emissions (Fall 2035 and Fall 2035 with RPS Projection) are also compared to a 2035 threshold of 2.1 MT of CO2e per service population. The 2035 threshold was calculated for 2035 and based on a linear projection toward 2050 reduction targets (2035 emissions would be 50% below 1990 emissions levels, and using the projected 2035 statewide population and employment levels). The detailed derivation is shown in **Table 5-1-3**.

Table 5-1-4 summarizes the operational GHG thresholds and the "substantial progress" efficiency metric considered in this GHG Technical Report.

[155] Association of Environmental Professionals. 2015. Beyond 2020: The Challenge of GHG Reduction Planning by Local Governments. Draft. March 16.

[156] Association of Environmental Professionals. 2015. Beyond 2020: The Challenge of GHG Reduction Planning by Local Governments. Draft. March 16.

Table 5-1-4: Operational GHG Thresholds / Substantial Progress Efficiency Metrics

Analysis Condition	Threshold / Metric	Basis
2018 and 2020 Existing Conditions and Trajectory Toward Fully Build-out Project Conditions	4.6 MT of CO_2e per service population	BAAQMD-adopted threshold based on AB32
Full Project Conditions	2.7 MT of CO_2e per service population	SB 32 (40 percent reduction below 1990 levels)[a]
Full Project Conditions	2.1 MT of CO_2e per service population	EO S-3-05 (linear projection towards 2050 reduction target of 80 percent reduction below 1990 levels is equivalent to 50 percent reduction below 1990 levels by 2035)[b]

Notes:
[a] Calculation of 2.7 MT of CO_2e is based on state land use sector emissions being 40 percent below 1990 levels, combined with the forecast population and employment levels at full buildout of the proposed Project. Comparison with this metric can only be done by incorporating enacted statewide reductions in electricity GHG intensity and improvements in transportation efficiency.
[b] Calculation of 2.1 MT of CO_2e is based on state land use sector emissions being 50 percent below 1990 levels by 2035, combined with the forecast population and employment levels at full buildout of the proposed Project. This is a linear interpolation of the 2030 goal (40 percent below 1990 levels) and the 2050 goal (80 percent below 1990 levels). Comparison with this metric can only be done by incorporating enacted statewide reductions in electricity GHG intensity and improvements in transportation efficiency. The Fall 2035 Project emissions inventory conservatively uses 2030 anticipated electricity GHG intensity and mobile emission factors. The Fall 2035 With RPS Project emissions inventory incorporates anticipated electricity GHG intensity in 2035.

5.2 Environmental Analysis

Impact GHG-1: The Project Would Not Generate Greenhouse Gas Emissions, either Directly or Indirectly, that Would Make A Cumulatively Considerable Contribution to Global Climate Change (Less than Significant)

As described in Section 5.1.2, Project emissions are compared to service population thresholds based on BAAQMD CEQA Guidelines and adjustments to the BAAQMD thresholds to incorporate the State's 2030 emissions reduction goals. The service population derivation for each inventory year is shown in **Table 5-2-1.**

Table 5-2-1: Service Population Derivation

Inventory	Number of People[1]			
	Workers	Residents	Workers Who Are Residents	Service Population[2]

2014	38,851	12,592	11,468	51,443
2015	38,851	12,592	11,468	51,443
Fall 2018 (Baseline)	40,240	13,028	11,928	53,268
Fall 2020	40,240	15,250	13,948	55,490
Fall 2035 (Project)	49,428	19,353	17,116	68,781
Fall 2035 (Project) with RPS Projection	49,428	19,353	17,116	68,781

Notes:
[1.] Number of people is shown in Fehr & Peers VMT Appendix.
[2.] Service population is defined as the sum of the residential population and the workers, as shown in Table 6 of May 2011 BAAQMD CEQA Guidelines [CEQA Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. BAAQMD. 2011]. If a resident works on-site, that person is counted as both a resident and a worker.

Stanford's Fall 2018 existing emissions service population efficiency metric is estimated to be 2.4 MT of CO_2e per service population. That efficiency ratio is well below the BAAQMD CEQA Guidelines' significance threshold of 4.6 MT of CO_2e per service population. Under the BAAQMD CEQA Guidelines' threshold, the Project would not result in a cumulatively considerable contribution to global climate change.

Stanford's Fall 2020 existing emissions service population efficiency metric is estimated to be 2.2 MT of CO_2e per service population. That efficiency ratio is well below the BAAQMD CEQA Guidelines' significance threshold of 4.6 MT of CO_2e per service population. Under the BAAQMD CEQA Guidelines' threshold, the Project would not result in a cumulatively considerable contribution to global climate change.

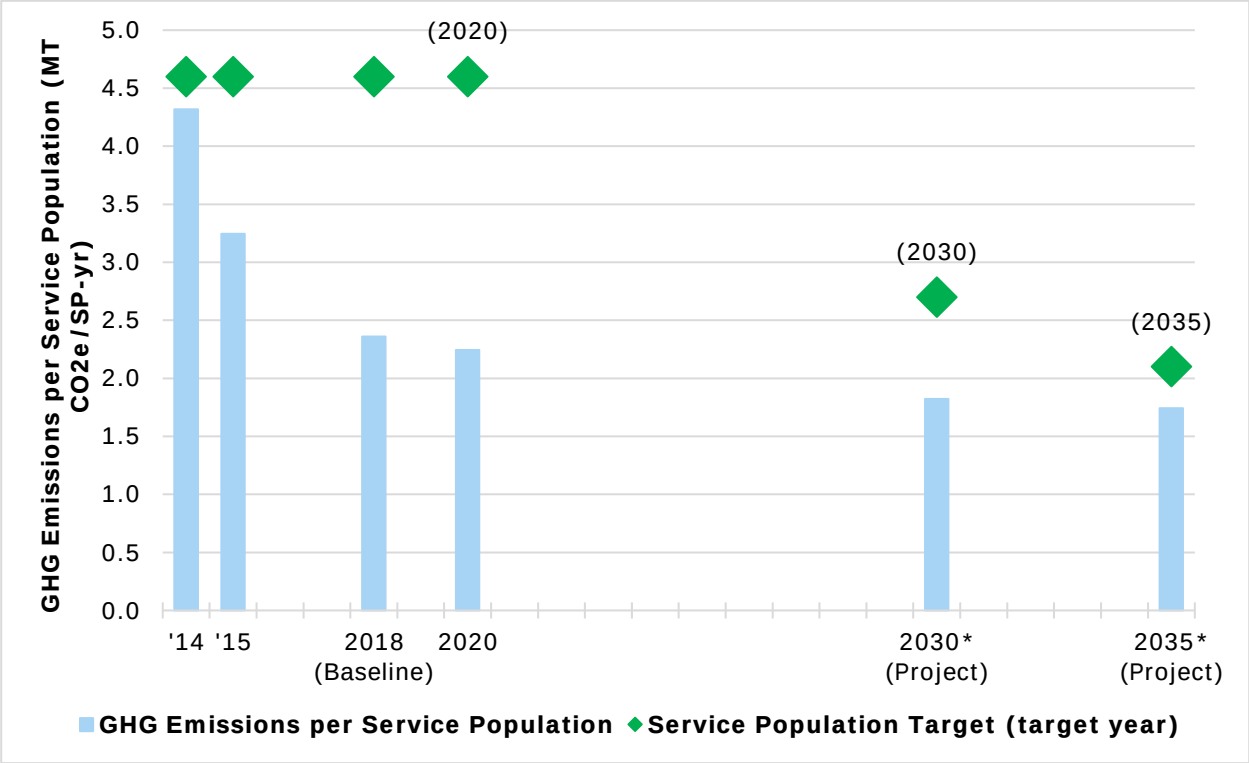
As described in Section 5.1.2, Project emissions are also compared to a 2030 threshold of 2.7 MT of CO_2e per service population and a 2035 threshold of 2.1 MT of CO_2e per service population that are derived from the BAAQMD methodology. The Project's efficiency metric is estimated to be 1.8 MT of CO_2e per service population in 2030. Under these long-term thresholds, the Project would not result in a cumulatively considerable contribution to global climate change.

The Project emissions inventory is based on adopted 2030 regulatory measures (e.g., RPS) and emission factors (e.g., EMFAC2014 mobile factors), assuming complete buildout of the 2018 GUP. If 2035 emission factors were developed, the total GHG emissions would be even lower than in 2030. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions.

As another point of comparison, the Fall 2035 with RPS Projection inventory was also prepared to represent Project emissions in Fall 2035, incorporating intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035. This inventory results in an efficiency metric of 1.7 MT of CO_2e per service population, which is below the 2.1 MT of CO_2e per service population derived from the BAAQMD methodology for year 2035. This comparison is still conservative since other factors such as 2035 mobile emissions factors are not incorporated in the inventory.

Considering the downward trend of the Project's service efficiency CO_2e metric and less than significant impacts in 2018, 2020, 2030 and 2035, it can be reasoned that levels would continue to decrease into 2050. The service population efficiency metrics and Project comparisons are shown in **Figure 5-2**.

Figure 5-2. GHG Service Population Efficiency Metrics



* As described in Section 1.2.3, the Fall 2035 Project inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

<u>Impact GHG-2</u>: The Project Would Be Consistent with AB 32, the ARB Scoping Plan, the Region's Sustainable Communities Strategy / Regional Transportation Plan (Plan Bay Area), Executive Order S-3-05, Executive Order B-16-12, and SB 32. (Less than Significant)

The Project has been evaluated for consistency with the following plans, policies, and regulations:

- AB 32 (California Global Warming Solutions Act of 2006), including:
  - ARB Scoping Plan

- Plan Bay Area
- Executive Order S-3-05
- Executive Order B-30-15
- SB 32

Each plan, policy, and regulation is described in detail in Section 5.1.2, above. A discussion of Project consistency with each plan, policy, and regulation is presented below.

AB 32

The heart of the California Global Warming Solutions Act of 2006 (AB 32) is the requirement for statewide GHG emissions to be reduced to 1990 levels by 2020. The Project would be consistent with this mandate based on the BAAQMD service population metric, as described in the preceding impact analysis. AB 32 also required the adoption of discrete Early Action Items[157] which resulted in the development of the Low Carbon Fuel Standard, among other things. Further, AB 32 required the development of a Scoping Plan for achieving the necessary GHG reductions in a technologically and economically feasible manner, the adoption of a mandatory GHG emissions reporting regulation, and the establishment of a market-based declining emission limit program (i.e., the cap-and-trade program). Each of these programs is discussed below.

CARB Scoping Plan

The AB 32 Scoping Plan identifies over 70 measures for reducing greenhouse gas emissions to 1990 levels by 2020. Specific measures discussed in the Scoping Plan that are relevant to the Project include the Renewables Portfolio Standard (RPS) and Advanced Clean Cars program.

The RPS requires retail sellers of electricity to achieve 33% renewable energy sources by 2020. While Stanford is not a regulated entity under the RPS, the electricity that Stanford purchases from those suppliers reflects the use of renewable sources as required to comply with the RPS.

In 2015, under the Stanford Energy Systems Innovations (SESI), Stanford transformed its campus-wide energy system, replacing a 100% fossil fuel-based cogeneration power plant with grid-sourced electricity and an advanced heat recovery system. This transformation resulted in large reductions of GHG emissions, fossil fuel use, and campus-wide water use. The new Central Energy Facility (CEF) combines conversion of the heat supply of all buildings from steam to hot water, and an innovative heat recovery loop that captures nearly two-thirds of waste heat generated by the campus cooling system to produce hot water for the heating system. By Fall 2018, Stanford will procure approximately 159,000 MWh/year of electricity from its Kern County Solar Generating Station and an additional 7,300 MWh/year from on-campus rooftop solar installations. These solar installations will be providing half of the campus's electricity demand. In combination with the renewable sources that utilities

[157] CARB. 2007. Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration. Available online at: https://www.arb.ca.gov/cc/ccea/meetings/ea_final_report.pdf

must use to comply with the RPS, the total percentage of Stanford's electricity that will come from renewable sources will be over 65 percent.

The Advanced Clean Cars Program applies to vehicle manufacturers. While Stanford is not a regulated entity under this regulation, the vehicles used by Stanford employees, residents, and contractors will reflect the GHG emission limits required by the regulation. Implementation of these regulations, combined with the LCFS will reduce the campus's vehicular GHG emissions on a per service population basis. Additional emissions reductions will result from a fully electric vehicle of Marguerite shuttles by 2030.

Mandatory Greenhouse Gas Emissions Reporting Regulations

The State of California and federal mandatory GHG emissions reporting regulations require facilities exceeding a specified threshold of GHG emissions to report their emissions inventory. Both regulations require reporting of emissions from stationary combustion. This does not include non-stationary combustion sources such as from vehicle travel and trucking or indirect emissions from water and electricity usage. Further, the California regulation requires emissions reports to be verified by a third party if emissions exceed 25,000 MT CO_2e. Stanford submits its emissions inventory reports to ARB. Because Stanford does not directly emit more than 25,000 MT CO_2e annually, third-party verification, California Cap-and-Trade, and Federal reporting requirements do not apply.

Plan Bay Area

SB 375, the Sustainable Communities and Climate Protection Act of 2008, supports the State's climate action goals to reduce GHG emissions through coordinated transportation and land use planning. SB 375 required ARB to establish GHG emission reduction targets (Regional Targets) for each metropolitan planning region. On September 23, 2010, ARB adopted Regional Targets applying to the years 2020 and 2035.[158] In 2011, ARB adopted Regional Targets of 7% for 2020 and 15% for 2035 for the area under ABAG's jurisdiction, which includes Stanford University.

SB 375 requires Metropolitan Planning Organizations (MPO) including the Association of Bay Area Governments (ABAG) to incorporate a "sustainable communities strategy" (SCS) in their regional transportation plans (RTPs) that will achieve the GHG emission Reduction Targets set by ARB, primarily by reducing vehicle miles traveled (VMT) from light-duty vehicles through development of more compact, complete, and efficient communities.

Review of maps produced by MTC showing the 2040 growth projections under the RTP and SCS indicates increases in both residents and workers at Stanford. Therefore, the proposed Project is consistent with the SCS in terms of proposing additional residences and academic square footage in locations where the SCS specifies development. In addition, the VMT Technical Report prepared by Fehr & Peers indicates that the proposed Project would generate VMT per worker and VMT per resident rates that are more than 15% below the regional averages.

Stanford's low VMT is largely due to its close proximity to transit and its aggressive Travel Demand Management (TDM) programs. In 2003, the drive alone rate for Stanford commuters (workers and off campus students) was 72 percent. As the TDM programs have expanded, the drive alone rate of Stanford commuters has decreased to around 50 percent.

[158] ARB. Sustainable Communities. 2010. Accessed July 22, 2016. http://www.arb.ca.gov/cc/sb375/sb375.htm

This decrease in solo drivers directly reduces the number of vehicle trips to the campus and vehicle miles traveled.

Executive Order B-30-15 and SB 32

In April 2015, Governor Brown signed Executive Order B-30-15, which established the following GHG emission reduction goal for California: by 2030, reduce GHG emissions to 40 percent below 1990 levels. This Executive Order also directed all state agencies with jurisdiction over GHG-emitting sources to implement measures designed to achieve the new interim 2030 goal, as well as the pre-existing, long-term 2050 goal identified in Executive Order S-3-05 (see discussion below). Additionally, the Executive Order directed CARB to update its Scoping Plan to address the 2030 goal. SB 32 codifies the 2030 emissions reduction goal of Executive Order B-30-15 requiring CARB to ensure that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030.

The Project's 2030 emissions total represents the emissions inventory for the Project at full build-out. As explained in the preceding impact analysis, the Project emissions would be beneath the 2030 Service Population target that Ramboll Environ calculated for 2030 based on the GHG reduction goal established under SB 32 and EO B-30-15 (40 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels and the projected 2030 statewide population and employment levels). Several regulatory requirements reduce the Project's emissions and help ensure that the State's 2030 GHG target is achieved, including the following:

- SB 350 requires retail sellers of electric services to increase procurement from eligible renewable energy resources to 50% by 2030 (from 33% by 2020).
- Under SB 375, ARB adopted Regional Targets of 15% for 2035 for the area under ABG's jurisdiction, which includes Stanford University. The MTC and ABAG approved the final Plan Bay Area, which establishes strategies for meeting the Bay Area's Regional Targets.
- The Advanced Clean Cars Program will reduce GHG emissions by nearly 35% for new cars of model years 2017-2025.
- CPUC, CEC, and ARB have a shared, established goal of achieving ZNE for new residential construction by 2020 and new commercial construction by 2030.
- Executive Order B-16-12 sets targets for State ZEV infrastructure to be able to support one million vehicles by 2020; 1.5 million zero-emission vehicles to be on the road, displacing 1.5 billion gallons of petroleum fuels, by 2025; and an 80% reduction of GHG emissions from the transportation sector by 2050, compared to 1990 levels. At least 10 percent of California state fleet purchases of light-duty vehicles must be zero-emission by 2015, and at least 25 percent of fleet purchases of light-duty vehicles must be zero-emission by 2020.

The measures above will all help ensure that the State meets the 2030 GHG target. The Project will be consistent with all of these initiatives and regulatory requirements.

Executive Order S-3-05

This report also evaluates the Project's consistency with Executive Order No. S-3-05's goal of reducing the State's GHG emissions to 80 percent below the 1990 level by the year 2050. Based on existing emissions trends, the Project's emissions are expected to decline from

2030 through at least 2050 due to continued regulatory and technological advancements. As explained in the preceding impact analysis, the Project emissions would be lower than the Service Population target that Ramboll Environ calculated for 2035 based on the trajectory needed to achieve the GHG reduction goal established under EO S-3-05 (80 percent reduction below 1990 levels by 2030, taking into account the 1990 emissions levels and the projected 2030 statewide population and employment levels). Therefore, the Project is unlikely to obstruct the attainment of the State's long-term GHG reduction goal for 2050.

As of 2004, California was emitting 12 percent more GHG emissions than in 1990.[159] For California to emit 80 percent less than it emitted in 1990, the statewide GHG emissions would be only 18 percent of the 2004 statewide GHG emissions. Accounting for a population growth from 35,840,000 people in 2004 to approximately 55,000,000 people in 2050, the emissions per capita would have to be only 12 percent of what they were in 2004. This means 88 percent reductions in per capita GHG emissions from 2004 emissions intensities must be realized in order to achieve California's 2050 GHG goals. Clearly, energy efficiency and reduced vehicle miles traveled will play important roles in achieving this aggressive goal, but the decarbonization of fuel will also be necessary.

The extent to which GHG emissions from mobile sources indirectly attributed to the Project will change in the future depends on the quantity (e.g., number of vehicles, average daily mileage) and quality (i.e., carbon content) of fuel that will be available and required to meet both regulatory standards and residents' and workers' needs. In addition, renewable power requirements, low carbon fuel standards, and vehicle emissions standards discussed above will all decrease GHG emissions per unit of energy delivered or per vehicle mile traveled. Due to the technological shifts required and the unknown parameters of the regulatory framework in 2050, quantitatively analyzing a Project's impacts further relative to the 2050 target are speculative for purposes of CEQA.

That being said, studies have shown that, in order to meet the 2050 target, aggressive technology changes in the transportation and energy sectors, such as electrification and maturation of technologies still in development (e.g., advanced batteries and more efficient biofuels), will be required.[160] One recent study indicated that, even with these emerging technologies, the 2050 goal will not be met, due to the population growth to 55 million by 2050.[161] A more recent study, however, shows that the existing and proposed regulatory framework will allow the State to reduce GHG emissions to 40 percent below 1990 levels by 2030, and to 60 percent below 1990 by 2050.[162] Even though this study did not provide a regulatory and technology roadmap to achieve the Governor's 2050 goal, it demonstrated that various combinations of policies could allow Statewide emissions to remain very low

[159] CEC. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. October. Available at: http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-D.PDF.

[160] Lawrence Berkeley National Laboratory (LBL). 2011. California's Energy Future – The View to 2050. May. Available at: http://ccst.us/publications/2011/2011energy.php.

[161] LBL. 2013. Estimating Policy-Driven Greenhouse Gas Emissions Trajectories in California: The California Greenhouse Gas Inventory Spreadsheet (GHGIS) Model. Available at: http://eetd.lbl.gov/publications/estimating-policy-driven-greenhouse-g.

[162] Jeffery Greenblatt. 2015. Modeling California Impacts on Greenhouse Gas Emissions. Energy Policy. Volume 78, March 2015, pages 158-172. Abstract available at: http://www.sciencedirect.com/science/article/pii/S0301421514006892.

through 2050, suggesting that the combination of new technologies and other regulations not analyzed in the study could allow the State to meet the Governor's 2050 goal.

While it would be speculative to quantitatively estimate the Project's emissions level in 2050 and to assess the impacts to the Executive Order's horizon-year goal, statewide efforts are underway to facilitate the State's achievement of that goal and it is reasonable to expect the Project's emissions level (approximately 125,038 metric tons of CO_2e per year in 2035) to decline as the regulatory initiatives identified by CARB in the First Update to the Climate Change Scoping Plan are implemented, and other technological innovations occur. Many of these initiatives include reducing the carbon content of motor fuels and fuels for electricity generation.[163] Reducing the carbon content of motor fuels and fuels for electricity generation will reduce CO_2e emissions from this Project over time. Stated differently, the Project's emissions total at build-out (2035) represents the maximum emissions inventory for the Project as California's emissions sources are being regulated (and foreseeably expected to continue to be regulated in the future) in furtherance of the State's environmental policy objectives. Given the reasonably anticipated decline in Project emissions once fully constructed and operational, the Project is consistent with the Executive Order's horizon-year goal.

For example, CARB's First Update "lays the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050." And many of the emission reduction strategies recommended by CARB would serve to reduce the Project's post-2020 emissions level to the extent applicable by law:

- Energy Sector: Continued improvements in California's appliance and building energy efficiency programs and initiatives would serve to reduce the Project's emissions level. Additionally, further additions to California's renewable resource portfolio would favorably influence the Project's emissions level.
- Transportation Sector: Anticipated deployment of improved vehicle efficiency, zero emission technologies, lower carbon fuels, and improvement of existing transportation systems all will serve to reduce the Project's emissions level.
- Water Sector: The Project's emissions level will be reduced as a result of further desired enhancements to water conservation technologies.
- Waste Management Sector: Plans to further improve recycling, reuse and reduction of solid waste will beneficially reduce the Project's emissions level.

In addition to CARB's First Update, in January 2015, during his inaugural address, Governor Jerry Brown expressed a commitment to achieve "three ambitious goals" that he would like to see accomplished by 2030 to reduce the State's GHG emissions: (1) increasing the State's Renewable Portfolio Standard from 33 percent in 2020 to 50 percent in 2030; (2) cutting the petroleum use in cars and trucks in half; and, (3) doubling the efficiency of existing buildings and making heating fuels cleaner. Two of these expressions of Executive Branch policy – (1) and (3) – already have been manifested in adopted legislative action (i.e., SB 350).

In summary, because the Project meets and exceeds the emissions reduction targets presented in this report for 2020, 2030, and 2035, and because many aspects of the

[163] California Energy Commission. 2007. State Alternative Fuels Plan. December. CEC-600-2007-011-CMF. Available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF.

Project's emissions inventory will benefit from further regulatory and technological advancements, the Project is not expected to obstruct the attainment of the Governor's long-term GHG reduction goal for 2050. Therefore, the Project's impacts are **less than significant** under this methodology.

TABLES

Table 3-2-1
2014, 2015, Fall 2018, Fall 2020, and Project GHG Emissions - Summary
Stanford University
Stanford, CA

Sources	GHG Emissions					
	2014 Inventory	2015 Inventory	Fall 2018 (Baseline) Inventory	Fall 2020 Inventory	Fall 2035 (Project) Inventory[1]	Fall 2035 (Project) with RPS Projection Inventory[1]
	[MT CO_2e/yr]					
Electricity						
PGE Commercial	11	39	37	36	27	23
PGE Searsville/Olmstead	53	53	50	49	37	31
PGE New Faculty/Staff Housing	-	-	-	-	279	238
Direct Access	509	737	650	607	454	386
Cardinal Cogen	77,440	-	-	-	-	-
Imported to Campus and CEF	2,743	75,336	34,021	32,602	35,628	30,338
Commercial Non-Stanford	941	611	577	561	419	357
Subtotal	**81,698**	**76,776**	**35,336**	**33,854**	**36,844**	**31,372**
Natural Gas						
PGE Residential	3,359	3,006	3,112	3,623	4,281	4,281
PGE Commercial	4,325	15,718	16,942	16,942	20,559	20,559
PGE Searsville/Olmstead	71	71	71	71	71	71
PGE New Faculty/Staff Housing	-	-	-	-	347	347
Hot Water Generators	-	5,382	5,817	5,817	7,104	7,104
Replacement Process Steam Plant	-	4,371	4,725	4,725	5,770	5,770
Cardinal Cogen	71,012	-	-	-	-	-
Subtotal	**78,768**	**28,549**	**30,667**	**31,178**	**38,131**	**38,131**
Mobile Sources						
Worker Trips	21,528	21,528	20,377	18,307	15,524	15,524
Resident Trips	13,390	13,390	12,738	15,492	14,222	14,222
Campus Vehicles - On Road	5,859	5,859	5,678	5,573	1,170	1,170
Campus Vehicles - Off Road	235	235	235	235	235	235
Other Trips	14,901	14,901	14,609	13,728	11,767	11,767
Subtotal	**55,914**	**55,914**	**53,637**	**53,336**	**42,919**	**42,919**
Emergency Generators						
All Generators	279	336	363	363	444	444
Subtotal	**279**	**336**	**363**	**363**	**444**	**444**
Waste						
All waste	3,655	3,770	4,075	4,169	5,286	5,286
Subtotal	**3,655**	**3,770**	**4,075**	**4,169**	**5,286**	**5,286**
Water						
Domestic Water Use	435	327	327	336	320	272
Wastewater Treatment	138	124	124	127	121	103
Direct Wastewater Emissions	494	445	470	498	633	633
Subtotal	**1,066**	**896**	**920**	**962**	**1,074**	**1,009**
Miscellaneous Sources						
Propane, CO_2, Acetylene, Fire Suppression[2]	294	294	294	294	294	294
Construction Off-Road Equipment[3]	394	389	379	368	420	420
Subtotal	**688**	**683**	**674**	**662**	**714**	**714**
Total (MT)	**222,069**	**166,924**	**125,672**	**124,525**	**125,412**	**119,875**
Service Population (residents + workers)	51,443	51,443	53,268	55,490	68,781	68,781
Emissions per Service Population (MT/SP-yr)	4.3	3.2	2.4	2.2	1.8	1.7

Notes:

1. As described in the GHG Report, the Fall 2035 inventory assumes full development of the proposed 2018 General Use Permit, applying emission factors consistent with 2030. This is conservative, as the electricity intensity factors, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. The Fall 2035 With RPS Projection scenario incorporates anticipated renewable portfolio standards in 2035, which reduces the electricity intensity factors.

2. Data from Stanford. Propane, solid & gaseous CO_2, and acetylene are all used in on-campus research, with emissions based on purchase records from Stanford suppliers for calendar year 2015. The fire suppression system category includes both handheld fire extinguishers and larger fire suppression systems. Data from the campus Fire Marshall on the testing and discharge of fire suppression systems. In 2015, Stanford did not have any events that caused GHG leakage from the larger fire suppression systems (and only fans are activated during testing so there is no associated GHG leakage), so the number used simply captures the CO_2 released from the 40 fire extinguishers that were discharged throughout the course of the year.

3. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. Construction on-road emissions are included in the mobile sources.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

Table 3-5-1
Electricity Intensity Factor Derivations
Stanford University
Stanford, CA

	PGE 2014[1,2]	CAMX 2014[3]	Units
CO_2 Intensity Factor per Total Energy Delivered	434.9	568.6	lbs CO_2/MWh delivered
% of Total Energy From Renewables	27%	18.6%	
CO_2 Intensity Factor per Total Non-Renewable Energy[4]	596	699	lbs CO_2/MWh delivered
Estimated Intensity Factor for Total Energy Delivered[5,6]			
2018	411.1	501.6	lbs CO_2/MWh delivered
	413.7	503.6	lbs CO_2e/MWh delivered
2020 RPS (33%)	399.2	468.0	lbs CO_2/MWh delivered
	401.7	470.1	lbs CO_2e/MWh delivered
2030 RPS (50%)[7]	297.9	349.3	lbs CO_2/MWh delivered
	300.5	351.3	lbs CO_2e/MWh delivered
2035 RPS (57.5%)[8]	253.2	296.9	lbs CO_2/MWh delivered
	255.8	298.9	lbs CO_2e/MWh delivered

Notes:

1 Total CO_2 emission factor from The Climate Registry. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/. Accessed: February 2017.

2 Percent of total energy from eligible renewables is from the PGE 2015 Corporate Responsibility Report. Available at: http://www.pgecorp.com/corp_responsibility/reports/2015/PGE_CRSR_2015.pdf.

3 Total CO_2 emission factor and percentage of electricity from non-hydropower renewables (wind, solar, geothermal, and biomass) from the USEPA for the WECC California (CAMx) subregion. This is used for 'Direct Access' electricity unless the specific provider is otherwise known. Available at: https://www.epa.gov/sites/production/files/2017-02/documents/egrid2014_summarytables_v2.pdf. Accessed: April 2017. RPS-eligible technologies are defined at: http://docketpublic.energy.ca.gov/PublicDocuments/16-RPS-01/TN215573_20170125T160830_Renewables_Portfolio_Standard_Eligibility_Guidebook_Ninth_Editi.pdf.

4 The emissions metric presented here is calculated based on the total CO_2 intensity factor divided by the percent of energy delivered from non-renewable sources.

5 The intensity factor for total energy delivered is estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO_2 emissions per total non-renewable energy metric calculated above. The estimate provided here and the energy reports issued by PGE assume that renewable energy sources do not result in any CO_2 emissions.

6 Global Warming Potentials (GWP) are based on the IPCC Fourth Assessment Report. CH_4 and N_2O emission factors are from the CalEEMod version 2013.2.2 and eGRID 2014v2 defaults for PGE and CAMX, respectively, 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.

7 Emission factor presented here is 50% projected RPS for 2030 consistent with SB 32 and SB 350. Available at: http://www.energy.ca.gov/sb350/. Accessed: April 2017.

8 The projected 2035 RPS target is derived based on a linear trajectory for electricity to reach 80% RPS in 2050, consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1, 2016). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Abbreviations:

CARB - California Air Resources Board
CAMX - California-Mexico Power Area
CO_2 - carbon dioxide
GHG - greenhouse gases
lbs - pounds
MWh - megawatt-hour
RPS - Renewable Portfolio Standards
PGE - Pacific Gas & Electric
SB - Senate Bill
USEPA - US Environmental Protection Agency
WECC - Western Electricity Coordinating Council

Table 3-6-1
2014 Electricity Providers
Stanford University
Stanford, CA

Provider	Proportion of Total Annual Electricity Use	Service Areas
PGE Commercial	**0.02%**	Several addresses on campus (research laboratory, dormitory)
PGE Searsville/Olmstead	**0.10%**	Faculty/staff housing in Searsville Block and Olmstead (38 units)
Direct Access	**0.73%**	Residences, living communities, street lights, pump
Cardinal Cogen	**94%**	Majority of campus - academic buildings, dormitories, graduate student residences
Imported to Campus	**3.3%**	Cardinal Cogen service areas when Cardinal Cogen was down.
Imported to CEF	**0.67%**	The CEF while Cardinal Cogen was down.
Commercial Non-Stanford	**1.1%**	Commercial leases within the study area served by Cogen, not included in Cardinal Cogen to campus electricity

Abbreviations:

CEF - Central Energy Facility
GUP - General Use Permit
PGE - Pacific Gas & Electric

Table 3-6-2
2014 GHG Emissions - Electricity
Stanford University
Stanford, CA

		Emission Factors[1]			GWP[6]			Emissions			
Provider	**Annual Electricity Use**	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
	[MWh/yr]	**[lb/MWh]**						**[MT/yr]**			**[MT/yr]**
PGE Commercial[2]	57	435	0.029	0.0062				11	0	0	11
PGE Searsville/Olmstead[3]	269	435	0.029	0.0062				53	0	0	53
Direct Access	1,966	569	0.033	0.0040				507	1	1	509
Cardinal Cogen[4]	253,134	672	0.029	0.0062	1	25	298	77,145	83	211	77,440
Imported to Campus	8,797	569	0.033	0.0040				2,269	3	5	2,277
Imported to CEF	1,801	569	0.033	0.0040				465	1	1	466
Commercial Non-Stanford[5]	3,077	672	0.029	0.0062				938	1	3	941
Total	**269,100**							**81,388**	**89**	**221**	**81,698**

Notes:

1. Electricity intensity factor sources are shown in Table **3-5-1.**
2. PGE data provided by Stanford. Includes commercial accounts only, geocoded to contain only addresses within the Stanford boundary in the A1 zoned areas.
3. Areas on campus for which Stanford did not provide detailed electricity data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod(R) default for single family homes built to 2008 Title 24 standards in climate zone 4.
4. This includes Cogen electrical sales to Stanford Campus and to Stanford CEF but excludes electrical sales to PGE. Data provided by Stanford.
5. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. 2014 electricity came from the Cardinal Cogen. Electricity use data was provided by Stanford.
6. Global Warming Potentials from the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CEF - Central Energy Facility
CO_2 - carbon dioxide
CH_4 - methane
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
lb - pound
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
MWh - megawatt hour
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-3
2015 GHG Emissions - Electricity
Stanford University
Stanford, CA

		Emission Factors[1]			GWP[2]			Emissions			
Provider	Annual Electricity Use	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[lb/MWh]						[MT/yr]			[MT/yr]
PGE[3]	199	435	0.029	0.0062	1	25	298	39	0.003	0.001	39
PGE Searsville/Olmstead[4]	269	435	0.029	0.0062				53	0.004	0.001	53
Direct Access	2,846	569	0.033	0.0040				734	0.043	0.005	737
Campus and CEF Consumption[5]	291,036	569	0.033	0.0040				75,068	4.4	0.5	75,336
Commercial Non-Stanford[6]	3,077	435	0.029	0.0062				607	0.040	0.009	611
Total	**294,349**							**76,501**	**4.5**	**0.55**	**76,776**

Notes:

1. Electricity intensity factor sources are shown in Table **3-5-1.**
2. Global warming potentials are based on the IPCC Fourth Assessment Report.
3. PGE data provided by Stanford. Electricity data from July through December 2015 was doubled to approximate a full year of post-SESI operations.
4. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
5. Electricity data from July through December 2015 was doubled to approximate a full year of post-SESI operations. Stanford purchases this electricity through the direct access program, so the eGRID WECC California (2014v2) factor is used. This electricity is used to heat and cool water and to power campus buildings.
6. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. Use was provided by Stanford.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
SESI - Stanford Energy System Innovations
yr - year

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Table 3-6-4
Fall 2018 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	2015 Annual Electricity Use[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Electricity Use	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[%]	[MWh/yr]	[lb/MWh]			[MT/yr]			
PGE[5]	199	0%	199	411	0.029	0.0062	37	0.0026	5.6E-04	37
Direct Access[6]	2,846	0%	2,846	502	0.033	0.0040	648	0.043	0.0052	650
Campus and CEF Consumption[7]	291,036	8%	314,562	236	0.033	0.0040	33,731	4.7	0.58	34,021
PGE Searsville/Olmstead Housing[5,8]	269	0%	269	411	0.029	0.0062	50	0.0035	7.5E-04	50
Commercial Non-Stanford[5,9]	3,077	0%	3,077	411	0.029	0.0062	574	0.040	0.0086	577
Total	**294,349**		**320,952**	**-**	**-**	**-**	**35,040**	**4.8**	**0.59**	**35,336**

Notes

1. 2015 annual electricity use details are shown in **Table 3-6-3.**
2. Scaling for fall 2018 is primarily based on the increase in academic square footage and student housing expected from December 2015 to full buildout of the 2000 GUP. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers. Electricity use is assumed to scale linearly; e.g., efficiency of new buildings is assumed equal to current buildings. This is conservative, since newer buildings should be more energy efficient than older buildings.
3. CO_2 emission factors are described in the footnotes for each electricity provider. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.
4. Global warming potentials are based on the IPCC Fourth Assessment Report.
5. The PGE emission factor is based on the projection from 2014 to 2018 as shown in **Table 3-5-1.**
6. The Direct Access emission factor is based on the WECC California projection from 2014 to 2018 as shown in **Table 3-5-1.** A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category.
7. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the projected 2018 WECC California emission factor as shown in **Table 3-5-1.**
8. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® v2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
9. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2018 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-5
Fall 2020 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	Fall 2018 Annual Electricity Use[1]	Increase for 2020[2]	Fall 2020 Annual Electricity Use	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[MWh/yr]	[MWh/yr]	[lb/MWh]			[MT/yr]			
PGE	199	0	199	399	0.029	0.0062	36	0.0026	5.6E-04	36
Direct Access	2,846	0	2,846	468	0.033	0.0040	604	0.043	0.0052	607
Campus and CEF Consumption[5]	314,562	3,918	318,480	224	0.033	0.0040	32,308	4.8	0.58	32,602
PGE Searsville/Olmstead Housing[6]	269	0	269	399	0.029	0.0062	49	0.0035	7.5E-04	49
Commercial Non-Stanford[7]	3,077	0	3,077	399	0.029	0.0062	557	0.040	0.0086	561
Total	**320,952**		**324,870**	**-**	**-**	**-**	**33,554**	**4.9**	**0.60**	**33,854**

Notes

1. Fall 2018 annual electricity use details are shown in **Table 3-6-4.**
2. The increase from Fall 2018 to Fall 2020 is due to the occupancy of the new Escondido Village Graduate Residences. The annual electricity use is based on the CalEEMod® version 2013.2.2 default for mid rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017).

CalEEMod® Table 8.1 Energy Use for Apartments Mid Rise (kWh/DU)				Adjustment from 2008 to 2013 T24 Electricity[a]	Adjustment from 2013 to 2016 T24 Electricity[b]	Adjustment from 2008 to 2016 T24 Lighting[c]	Total Electricity for 2016 T24-Compliant Residence	Number of Dwelling Units	Total Electricity (MWh)
T24 Electricity	Non-T24 Electricity	Lighting Electricity	Total Electricity						
226.6	2,558.6	741.4	3,526.6	25%	28%	50%	3,051.6	1,284	3,918

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf
[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf
[c] CEC, 2015. http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf "All installed luminaires shall be high efficacy".

3. CO_2 emission factors are shown in **Table 3-5-1**. The PGE and WECC California emission factors are based on the utility achieving the State goal of 33% RPS in 2020. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.
4. Global warming potentials are based on the IPCC Fourth Assessment Report.
5. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to provide renewable generation credits for 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the 2020 projection of the 2014v2 WECC California emission factor.
6. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
7. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2018 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
RPS - Renewables Portfolio Standard
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-6a
Fall 2035 GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use				Emission Factors[3]			Emissions[4]			
Provider	Fall 2020 Annual Electricity Use[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Electricity Use	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[%]	[MWh/yr]	[lb/MWh]			[MT/yr]			
PGE	199	0%	199	298	0.029	0.0062	27	0.0026	5.6E-04	27
Direct Access	2,846	0%	2,846	349	0.033	0.0040	451	0.043	0.0052	454
Campus and CEF Consumption[5]	318,480	22%	388,914	200	0.033	0.0040	35,270	5.8	0.7	35,628
PGE Searsville/Olmstead Housing[6]	269	0%	269	298	0.029	0.0062	36	0.0035	7.5E-04	37
PGE New Faculty/Staff Housing[7]	0	N/A	2,049	298	0.029	0.0062	277	0.027	0.0057	279
Commercial Non-Stanford[8]	3,077	0%	3,077	298	0.029	0.0062	416	0.040	0.0086	419
Total	**324,870**		**397,353**	**-**	**-**	**-**	**36,477**	**6.0**	**0.7**	**36,844**

Notes

1. Fall 2020 annual electricity use details are shown in **Table 3-6-5.**

2. Scaling for fall 2035 is primarily based on the increase in academic square footage and student housing expected from Fall 2020 to full buildout of the 2018 GUP. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers, except for the additional faculty/staff housing added separately. Electricity use is assumed to scale linearly; e.g., efficiency of new buildings is assumed equal to current buildings. This is conservative, since newer buildings should be more energy efficient than older buildings.

3. CO_2 emission factors are shown in **Table 3-5-1**. The PGE and WECC California emission factors are based on the utility achieving the State goal of 50% RPS in 2030. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.

4. Global warming potentials are based on the IPCC Fourth Assessment Report.

5. The campus and CEF consumption emission factor is a weighted average between electricity from direct access electricity service providers and electricity from Stanford's solar panels. According to Stanford's Office of Sustainability, on-campus solar panels are expected to generate approximately 7,300 MWh/year, while the Stanford Solar Generation Farm is expected to generate 159,000 MWh/year. The 166,300 MWh/year are given an emission factor of 0 lb/MWh, while the remaining electricity use is assigned the WECC California emission factor adjusted for 50% RPS.

6. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual electricity use is based on the CalEEMod® 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.

7. This represents the electricity consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. These houses are assumed to contract electricity with PGE. The annual electricity use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown below. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

CalEEMod® Table 8.1 Energy Use for Condo/Townhouse (kWh/DU)				Adjustment from 2008 to 2013 T24 Electricity[a]	Adjustment from 2013 to 2016 T24 Electricity[b]	Adjustment from 2008 to 2016 T24 Lighting[c]	Total Electricity for 2016 T24-Compliant Residence
T24 Electricity	Non-T24 Electricity	Lighting Electricity	Total Electricity				
184.3	3,125.9	1,001.1	4,311.2	25%	28%	50%	3,725.9

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf
[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf
[c] CEC, 2015. http://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf. "All installed luminaires shall be high efficacy".

8. This category includes commercial buildings that are located on the Stanford campus in unincorporated Santa Clara County but are not under Stanford's operational control. Examples include the U.S. Post Office and the Carnegie Institute of Washington. In 2014, the electricity source for this category was Cardinal Cogen. The electricity use data was provided by Stanford. Ramboll Environ assumes no changes in electricity consumption for 2035 and that PGE is the default electricity provider.

Abbreviations

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
CPUC - California Public Utilities Commission
DU - Dwelling Unit
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
RPS - Renewables Portfolio Standard
T24 - Title 24
WECC - Western Electricity Coordinating Council
yr - year

Table 3-6-6b
Fall 2035 with RPS Projection GHG Emissions - Electricity
Stanford University
Stanford, CA

Electricity Use		Emission Factors[2]			Emissions[3]			
Provider	Fall 2035 Annual Electricity Use[1]	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[MWh/yr]	[lb/MWh]			[MT/yr]			
PGE	199	253	0.029	0.0062	23	0.0026	0.00056	23
Direct Access	2,846	297	0.033	0.0040	383	0.043	0.0052	386
Campus and CEF Consumption	388,914	170	0.033	0.0040	29,979	5.8	0.7120	30,338
PGE Searsville/Olmstead Housing	269	253	0.029	0.0062	31	0.0035	0.0008	31
PGE New Faculty/Staff Housing	2,049	253	0.029	0.0062	235	0.027	0.0057	238
Commercial Non-Stanford	3,077	253	0.029	0.0062	353	0.040	0.0086	357
Total Electricity Emissions with 2035 RPS Projection	**397,353**	**-**	**-**	**-**	**31,005**	**6.0**	**0.7**	**31,372**

Notes

1. Fall 2035 annual electricity use is shown in **Table 3-6-6a.**
2. The PGE and WECC California CO_2 emission factors are based on a projection of the utility achieving 57.5% RPS in 2035, as shown in **Table 3-5-1**. CH_4 and N_2O emission factors are assumed not to change from estimates for earlier years.
3. Global warming potentials are based on the IPCC Fourth Assessment Report.

Abbreviations

CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
MWh - Megawatt Hour
N_2O - nitrous oxide
RPS - Renewables Portolio Standard
WECC - Western Electricity Coordinating Council
yr - year

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Table 3-6-7
2014 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		GHG Emission Factors[3]			GWP[3]			Emissions			
			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
	[therms]	[MMBtu]	[kg/MMBtu]			[-]			[MT/yr]			[MT/yr]
PGE Residential[1]	632,937	63,294	53.02	0.001	0.0001	1	25	298	3,356	0.063	0.006	3,359
PGE Commercial[1]	814,953	81,495							4,321	0.081	0.008	4,325
PGE Searsville/Olmstead[2]	13,408	1,341							71	0.001	0.000	71
Total	**1,461,298**	**146,130**							**7,748**	**0.15**	**0.015**	**7,756**

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County A1 zoned areas was removed.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
therms - 100,000 British thermal units
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-8
2014 GHG Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lb/day]				Annual Emissions [MT/year]			
		CO_2	CH_4	N_2O	CO_2e[1]	CO_2	CH_4	N_2O	CO_2e[1]
Cardinal Cogen	Cogen Total Emissions[2]	1,260,000	86	2.4	1,262,864	208,607	14	0.4	209,082
	Cogen to Stanford Campus - GUP Emissions[3]	427,943	29	0.8	428,916	**70,851**	**4.8**	**0.13**	**71,012**

Notes:

1. Global warming potentials are based on the IPCC Fourth Assessment Report.
2. BAAQMD 2014 Cardinal Cogen Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day. Ramboll Environ assumed 365 days/year to calculate total annual emissions.
3. Total emissions shown here are only for natural gas combustion associated with non-electricity-generation activity for steam, heating, and chilled water on campus. Emissions associated with electricity generation are calculated separately and shown in Table 3-6-2. Additionally, emissions associated with steam, heating, and chilled water sold off campus are excluded. This breakout is based on data provided by the Stanford Sustainability Office.

End Use	Percent of Total Cogen Emissions
Steam and chilled water to hospitals	13%
Electricity to PGE	18%
Electricity to campus + CEF	35%
Chilled water and steam to campus	34%

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CEF - Central Energy Facility
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
N_2O - nitrous oxide

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Table 3-6-9
2015 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		Emission Factors[3]			GWP[3]			2015 Emissions
			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	
	[therms]	[MMBtu]	[kg/MMBtu]			[-]			[MT/yr]
PGE Residential[1]	566,432	56,643	53.02	0.001	0.0001	1	25	298	3,006
PGE Commercial[1]	2,961,553	296,155							15,718
PGE Searsville/Olmstead[2]	13,408	1,341							71
Hot Water Generators[1]	1,014,080	101,408							5,382
Replacement Process Steam Plant[1]	823,632	82,363							4,371
Total	**5,379,104**	**537,910**							**28,549**

Notes:

1. Annual Natural Gas usage provided by Stanford. Natural gas use within Stanford Academic Growth Boundary within unincorporated Santa Clara County in the A1 zoning areas. Natural gas data from the last six months of 2015 was doubled to approximate a full year of post-SESI operations.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
SESI - Stanford Energy System Innovations
therms - heat energy equal to 100,000 British thermal units
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-10
Fall 2018 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]			Fall 2018 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	56,643	4%	58,626	53.02	0.001	0.0001	3,112
PGE Commercial[4]	296,155		319,205				16,942
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	285,148	8%	308,198				16,358
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
Hot Water Generators (Central Energy Facility)	101,408	8%	109,605				5,817
Replacement Process Steam Plant	82,363	8%	89,021				4,725
Total	**537,910**		**577,799**				**30,667**

Notes:

1. 2015 natural gas use details are shown in **Table 3-6-9.**
2. Scaling for fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to full buildout of the 2000 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; e.g. efficiency and use in new buildings is assumed equal to current buildings.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

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Table 3-6-11
Fall 2020 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Fall 2018 Annual Natural Gas Usage[1]	Scaling for 2020[2]	Fall 2020 Annual Natural Gas Usage	Emission Factors[3]			Fall 2018 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	58,626	16%	68,256	53.02	0.001	0.0001	3,623
PGE Commercial[4]	319,205		319,205				16,942
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	308,198	0%	308,198				16,358
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
Hot Water Generators (Central Energy Facility)	109,605	0%	109,605				5,817
Replacement Process Steam Plant	89,021	0%	89,021				4,725
Total	**577,799**		**587,429**				**31,178**

Notes:

1. Fall 2018 natural gas use details are shown in **Table 3-6-10.**
2. The increase from Fall 2018 to Fall 2020 is due to the occupancy of the new Escondido Village Graduate Residences. Scaling is based on the number of net new beds.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year

References:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

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Table 3-6-12
Fall 2035 GHG Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Fall 2020 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]			Fall 2035 Emissions[3]
				CO_2	CH_4	N_2O	
	[MMBtu]	[%]	[MMBtu]	[kg/MMBtu]			[MT/yr]
PGE Residential	68,256	18%	80,651	53.02	0.001	1.0E-04	4,281
PGE Commercial[4]	319,205		387,365				20,559
PGE Commercial - Individual Replacement Boilers	11,007	0%	11,007				584
PGE Commercial - Remaining	308,198	22%	376,358				19,975
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				71
PGE New Faculty/Staff Housing[6]	0	N/A	6,531				347
Hot Water Generators (Central Energy Facility)	109,605	22%	133,845				7,104
Replacement Process Steam Plant	89,021	22%	108,709				5,770
Total	**587,429**		**718,441**				**38,131**

Notes:

1. Fall 2020 natural gas use details are shown in **Table 3-6-11.**
2. Scaling for fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2020 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; e.g. efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). GWPs are based on the IPCC Fourth Assessment Report.
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed natural gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown below. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

CalEEMod® Table 8.1 Energy Use for Condo/Townhouse (kBTU/DU)			Adjustment from 2008 to 2013 T24 Natural Gas[a]	Adjustment from 2013 to 2016 T24 Natural Gas[b]	Total Natural Gas for 2016 T24-Compliant Residence
T24 Natural Gas	Non-T24 Natural Gas	Total Natural Gas			
16,523.6	2,951.0	19,474.6	25%	28%	11,873.7

[a] CEC, 2012. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf
[b] CEC, 2016. http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

Abbreviations:

CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
GHG - greenhouse gas
GUP - General Use Permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MMBTU - million British thermal units
MT - metric tons
N_2O - nitrous oxide
PGE - Pacific Gas & Electric
yr - year
T24 - Title 24
DU - Dwelling Unit

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Table 3-6-13
2014 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[11]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	234		70,286		512,385	340	161		185
	Graduate	1,259		523,894		4,793,631				1,712
	Post-doc	555		246,412		2,335,983				833
	Faculty/Staff	5,443		2,416,714		27,803,160				9,829
	Casual Employees	302		133,960		1,793,719				631
	Contingent Employees	294		130,354		1,596,836				563
	Temporary Employees	604		268,165		3,421,786				1,205
	Non-Employee Affiliates: 20% FTEs	169		75,118		892,407				315
	Non-Employee Affiliates: FTEs	925		410,795		4,880,239				1,723
	Third Party Contractors	244		108,178		1,537,214				539
	Janitorial Shift Workers	195		86,543		1,229,771				431
	First Mile to Transit (all Workers + Students)	2,039		903,934		3,707,596				1404
	Construction	975		432,713		6,148,856				2,157
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**				**21,528**
On-Campus (Resident) Trips[3]	Undergraduate	1,582		1,962,450		7,612,107	340	161		2,900
	Graduate	3,648		5,264,378		27,554,538				10,202
	Post-doc	28		33,580		168,975				63
	Faculty/Staff	98		109,500		616,735				227
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**				**13,391**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	340	77		1,164
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	306			29
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	1,913		2,128	65
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	340	77		116
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	615		164	1,493
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	306			54
	Marguerite[10]	66				1,983,931				2,857
	Public Safety	31	2.8	31,879	7.3	232,720	340	77		82
	Sub-Total	**700**		**614,290**		**8,594,006**				**5,859**
Other Trips	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	340	161		9,137
	Worker Non-Commute Trips	already above		301,920		935,952				366
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443				1,024
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	1,913		2,128	757
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	340	161		2,307
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	615		164	1,310
	Construction Vendor Trucks[12]		*2.4*	*8,510*	*7.3*	*62,123*				*39*
	Construction Haul Trucks[12]		*2.4*	*7,987*	*20.0*	*159,740*				*99*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**				**14,901**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][6]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas[9]					38,837	859			33
	Siebel and Red Barn equip - diesel[9]					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**55,915**

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Table 3-6-13
2014 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC2014 mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC
equip - equipment
FTE - full-time equivalent
g - gram
GHG - greenhouse gas
GUP - general use permit
hp - horsepower
hr - hour
mi - mile
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - to be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled

Table 3-6-14
2015 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[11]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	234		70,286		512,385	340	161		185
	Graduate	1,259		523,894		4,793,631				1,712
	Post-doc	555		246,412		2,335,983				833
	Faculty/Staff	5,443		2,416,714		27,803,160				9,829
	Casual Employees	302		133,960		1,793,719				631
	Contingent Employees	294		130,354		1,596,836				563
	Temporary Employees	604		268,165		3,421,786				1,205
	Non-Employee Affiliates: 20% FTEs	169		75,118		892,407				315
	Non-Employee Affiliates: FTEs	925		410,795		4,880,239				1,723
	Third Party Contractors	244		108,178		1,537,214				539
	Janitorial Shift Workers	195		86,543		1,229,771				431
	First Mile to Transit (all Workers + Students)	2,039		903,934		3,707,596				1404
	Construction	975		432,713		6,148,856				2,157
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**				**21,528**
On-Campus (Resident) Trips[3]	Undergraduate	1,582		1,962,450		7,612,107	340	161		2,900
	Graduate	3,648		5,264,378		27,554,538				10,202
	Post-doc	28		33,580		168,975				63
	Faculty/Staff	98		94,698		619,941				226
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**				**13,390**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	340	77		1,164
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	306			29
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	1,913		2,128	65
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	340	77		116
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	615		164	1,493
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	306			54
	Marguerite[10]	66				1,983,931				2,857
	Public Safety	31	2.8	31,879	7.3	232,720	340	77		82
	Sub-Total	**700**		**614,290**		**8,594,006**				**5,859**
Other Trips	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	340	161		9,137
	Worker Non-Commute Trips	already above		301,920		935,952				366
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443				1,024
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	1,913		2,128	757
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	340	161		2,307
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	615		164	1,310
	Construction Vendor Trucks[12]		*2.4*	*8,510*	*7.3*	*62,123*				*39*
	Construction Haul Trucks[12]		*2.4*	*7,987*	*20.0*	*159,740*				*99*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**				**14,901**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][6]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas[9]					38,837	859			33
	Siebel and Red Barn equip - diesel[9]					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**55,914**

RAMBOLL ENVIRON

Table 3-6-14
2015 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC2014 mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC
equip - equipment
FTE - full-time equivalent
g - gram
GHG - greenhouse gas
GUP - general use permit
hp - horsepower
hr - hour
mi - mile
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - to be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled

Table 3-6-15
Fall 2018 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[1,2]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	312	71		134
	Graduate	1,286		534,884		4,894,189				1,603
	Post-doc	589		261,730		2,481,198				811
	Faculty/Staff	5,682		2,522,720		28,678,561				9,305
	Casual Employees	314		139,563		1,868,744				603
	Contingent Employees	306		135,808		1,663,642				538
	Temporary Employees	629		279,355		3,564,566				1,152
	Non-Employee Affiliates: 20% FTEs	176		78,281		929,974				301
	Non-Employee Affiliates: FTEs	964		428,097		5,085,797				1,647
	Third Party Contractors	263		116,833		1,660,191				535
	Janitorial Shift Workers	210		93,394		1,327,128				427
	First Mile to Transit (all Workers + Students)	2,125		941,983		3,864,416				1340
	Construction	975		432,713		6,148,856				1,980
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**				**20,377**
On-Campus (Resident) Trips[3]	Undergraduate	1,654		2,028,810		7,869,489	312	71		2,745
	Graduate	3,829		5,479,152		28,680,441				9,729
	Post-doc	28		33,580		168,975				58
	Faculty/Staff	98		94,698		619,941				207
	Sub-Total	**5,609**		**7,636,240**		**37,338,845**				**12,738**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	314	72		1,023
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	281			25
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	1,826		2,218	60
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	314	72		102
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	602		163	1,460
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	281			50
	Marguerite[10]	66				2,144,233				2,883
	Public Safety	31	2.8	31,879	7.3	232,720	314	72		75
	Sub-Total	**700**		**588,428**		**8,565,520**				**5,678**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	312	71		9,044
	Worker Non-Commute Trips			326,074		1,010,828				339
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985				987
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	1,826		2,218	725
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	312	71		2,131
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	602		163	1,383
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*38*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20.0*	*159,740*				*97*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**				**14,609**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][9]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**53,637**

RAMBOLL ENVIRON

Table 3-6-15
Fall 2018 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-16
Fall 2020 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[12]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	291	67		125
	Graduate	679		282,616		2,585,933				791
	Post-doc	589		261,730		2,481,198				757
	Faculty/Staff	5,682		2,522,720		28,678,561				8,687
	Casual Employees	314		139,563		1,868,744				563
	Contingent Employees	306		135,808		1,663,642				502
	Temporary Employees	629		279,355		3,564,566				1,075
	Non-Employee Affiliates: 20% FTEs	176		78,281		929,974				281
	Non-Employee Affiliates: FTEs	964		428,097		5,085,797				1,538
	Third Party Contractors	263		116,833		1,660,191				499
	Janitorial Shift Workers	210		93,394		1,327,128				399
	First Mile to Transit (all Workers + Students)	2,099		931,213		3,837,094				1242
	Construction	975		432,713		6,148,856				1,848
	Sub-Total	**13,073**		**5,757,792**		**60,236,063**				**18,307**
On-Campus (Resident) Trips[3]	Undergraduate	1,654		2,028,810		7,869,489	291	67		2,564
	Graduate	5,303		7,647,500		40,031,490				12,682
	Post-doc	28		33,580		168,975				54
	Faculty/Staff	98		94,698		619,941				193
	Sub-Total	**7,084**		**9,804,588**		**48,689,895**				**15,492**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	296	69		965
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	266			24
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	1,769		2,249	58
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	296	69		96
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	588		161	1428
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	266			47
	Marguerite[10]	66				2,144,233				2,883
	Public Safety	31	2.8	31,879	7.3	232,720	296	69		71
	Sub-Total	**700**		**588,428**		**8,565,520**				**5,573**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	291	67		8,446
	Worker Non-Commute Trips			326,074		1,010,828				316
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985				921
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	1,769		2,249	702
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	291	67		1,989
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	588		161	1,354
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*37*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*				*95*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**				**13,728**
Campus Vehicles - Off-road Equip[5]						[bhp-hr/yr][9]	[g/bhp-hr][7]			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**53,336**

RAMBOLL ENVIRON

Table 3-6-16
Fall 2020 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B2. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B2 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B2. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2020 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B2.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites is adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles compared to 2015.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-17
Fall 2035 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						GHG Emissions[12]			
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	CO_2 Emission Factor [g/mi]	CO_2 Emission Factor [g/trip]	CO_2 Emission Factor [g/vehicle-day]	Total CO_2 Emissions [MT/year]
Off-Campus (Worker) Trips[3]	Undergraduate	185		55,470		404,378	201	47		87
	Graduate	764		317,833		2,908,174				615
	Post-doc	828		367,634		3,485,170				736
	Faculty/Staff	7,220		3,205,524		35,698,523				7,489
	Casual Employees	398		176,826		2,367,699				493
	Contingent Employees	388		172,068		2,107,835				441
	Temporary Employees	797		353,942		4,516,305				943
	Non-Employee Affiliates: 20% FTEs	223		99,182		1,178,277				247
	Non-Employee Affiliates: FTEs	1,222		542,399		6,443,705				1,348
	Third Party Contractors	321		142,671		2,027,352				422
	Janitorial Shift Workers	257		114,049		1,620,630				337
	First Mile to Transit (all Workers + Students)	2,654		1,177,343		4,853,984				1088
	Construction	975		432,713		6,148,856				1,279
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**				**15,524**
On-Campus (Resident) Trips[3]	Undergraduate	2,079		2,550,030		9,891,078	201	47		2,231
	Graduate	5,974		8,613,822		45,087,773				9,888
	Post-doc	28		33,580		168,975				37
	Faculty/Staff	1,511		1,463,463		9,574,762				2,065
	Sub-Total	**9,592**		**12,660,895**		**64,722,587**				**14,222**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	221	52		360
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	204			9
	Bonair on-road buses diesel[11]	10	1.1	3,871	7.3	28,261	1,600		2,231	27
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	221	52		36
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	550		152	668
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	204			18
	Marguerite[10]	66				2,618,108				0
	Public Safety	31	2.8	31,879	7.3	232,720	221	52		53
	Sub-Total	**700**		**588,428**		**9,039,395**				**1,170**
Other Trips[3]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952	201	47		7,138
	Worker Non-Commute Trips			397,810		1,234,221				267
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599				747
	Non-event Visitor Trips - Buses[11]	5,250	2.0	10,500		390,000	1,600		2,231	636
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045	201	47		1,433
	Deliveries - Trucks[11]	221,428	2.0	442,856		2,747,957	550		152	1,546
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*				*35*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*				*88*
	Sub-Total	**3,012,148**		**6,604,231**		**47,996,774**				**11,767**
Campus Vehicles - Off-road Equip[5]						**[bhp-hr/yr][6,9]**	**[g/bhp-hr][7]**			
	Siebel and Red Barn equip - gas					38,837	859			33
	Siebel and Red Barn equip - diesel					52,854	570			30
	Off-road equip - gas					6,553	859			5.6
	Off-road equip - diesel					102,570	570			58
	Light Towers - gas					2,925	568			1.7
	Light Towers - diesel					186,791	568			106
	Sub-Total					**390,532**				**235**
									Total CO_2 Emissions from Mobile Sources [MT/yr]	**42,919**

RAMBOLL ENVIRON

Table 3-6-17
Fall 2035 GHG Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2035 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the Fall 2020 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2020 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2020. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford and is assumed to remain constant from 2015 to 2035. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles. By 2035, 70% of the Bonair fleet is assumed to be electric, in comparison to a 40% electric fleet in 2018.
11. Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation (adopted in August 2016), emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year. USEPA. Available at: https://www3.epa.gov/otaq/climate/documents/420f16044.pdf
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C. CH_4 and N_2O are expected to be very minor contributors to total mobile GHGs and were not quantified.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CO_2 - carbon dioxide
EMFAC - Emissions Factors
FTE - Full time equivalent
g - gram
GHG - greenhouse gas
hp - horsepower
hr - hour
mi - miles
mpg - miles per gallon
MT - metric tons
NEVES - Nonroad Engine and Vehicle Emission Study
PSSI - Peninsula Sanitary Service, Inc.
TBD - To be determined
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-14	755	8.3	470.7	2.9
S-15	1,490	8	470.7	5.6
S-16	73	7.2	470.7	0.25
S-17	300	20.5	470.7	2.9
S-18	135	7.2	470.7	0.46
S-21	465	21.7	470.7	4.7
S-23	465	11.1	470.7	2.4
S-25	587	0	470.7	0
S-28	900	7.1	470.7	3.0
S-30	166	7.2	470.7	0.56
S-31	166	9.1	470.7	0.71
S-32	390	7.6	470.7	1.4
S-33	1,008	16.2	470.7	7.7
S-34	605	10	470.7	2.8
S-35	170	13.2	470.7	1.1
S-37	207	11	470.7	1.1
S-38	380	7.9	470.7	1.4
S-39	210	6.9	470.7	0.68
S-46	79	8.4	470.7	0.31
S-47	207	6.6	470.7	0.64
S-52	102	2	470.7	0.10
S-56	60	5.6	470.7	0.16
S-57	218	5.1	470.7	0.52
S-58	504	6.1	470.7	1.4
S-59	135	6.1	470.7	0.39
S-60	317	6	470.7	0.90
S-61	300	70.2	470.7	9.9
S-62	300	6	470.7	0.85
S-63	300	8.7	470.7	1.2
S-65	672	7.4	470.7	2.3
S-67	1,008	7.3	470.7	3.5
S-68	1,848	7.8	470.7	6.8
S-71	270	23.8	470.7	3.0
S-72	380	6.7	470.7	1.2
S-73	900	7.8	470.7	3.3
S-74	102	7.9	470.7	0.38
S-75	102	6.7	470.7	0.32
S-76	317	15.3	470.7	2.3
S-77	755	8.8	470.7	3.1
S-78	2,220	5.5	470.7	5.7
S-79	470	6.8	470.7	1.5
S-80	2,220	7.8	470.7	8.2
S-81	230	10.6	470.7	1.1

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-82	317	6.9	470.7	1.0
S-83	755	9.3	470.7	3.3
S-84	317	8.1	470.7	1.2
S-88	395	6.7	470.7	1.2
S-89	317	7.2	470.7	1.1
S-91	395	6.2	470.7	1.2
S-92	750	8.2	470.7	2.9
S-93	325	8.2	470.7	1.3
S-94	277	15.1	470.7	2.0
S-95	750	6.3	470.7	2.2
S-96	325	10.1	470.7	1.5
S-97	1,175	9.5	470.7	5.3
S-98	1,523	8.5	470.7	6.1
S-99	1,523	8	470.7	5.7
S-100	2,220	15.8	470.7	16.5
S-102	207	8.3	470.7	0.81
S-105	1,490	9.3	470.7	6.5
S-106	755	9.2	470.7	3.3
S-110	364	9.4	470.7	1.6
S-111	145	28.3	470.7	1.9
S-112	2,220	10.2	470.7	10.7
S-113	398	8.5	470.7	1.6
S-115	130	7.8	470.7	0.48
S-116	364	11	470.7	1.9
S-44	170	6.7	470.7	0.54
S-66	166	6.5	470.7	0.51
S-70	102	6.8	470.7	0.33
S-107	755	7.8	470.7	2.8
S-108	755	7.4	470.7	2.6
S-109	755	6.9	470.7	2.5
None	100	5.9	470.7	0.28
S-114	1,214	7.2	470.7	4.1
S-11	1,807	11	470.7	9.4
S-12	1,186	66	470.7	36.8
S-13	1,186	11	470.7	6.1
S-53	250	12	470.7	1.4
S-69	1,680	12.2	470.7	9.6
S-90	102	7.9	470.7	0.38
S-101	480	12.5	470.7	2.8
S-104	2,206	15.7	470.7	16.3
S-117	274	14.4	470.7	1.9
S-124	2,206	0	470.7	0.0
None	50	6.6	470.7	0.16

Table 3-6-18
2014 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2014 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
None	50	9.3	470.7	0.22
None	50	10.3	470.7	0.24
S-112	50	10.2	470.7	0.24
			Subtotal	**279**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, and engine rating was provided by Stanford. There are three generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. Based on actual non-emergency and emergency run hours in 2014.
3. A representative GHG emission factor (in g/hp-hr) was derived for emergency generators because fuel consumption rate information was not available for all units. The emission factor was derived by taking the emission factor for diesel fuel (22.6 lb/gal), converting to grams, and normalizing by a fuel rate (34.7 gal/hr) and horsepower (755 HP) of a representative engine (Cummins, QSX15-G9 NR 2, @ 1800 RPM). The GHG CO_2e emission factor in lb/gal for diesel fuel was obtained from the CO_2, CH_4 and N_2O emission factors found in 40 CFR Part 98 Mandatory Greenhouse Gas Reporting Tables C-1 and C-2. Note that according to the Regulation, diesel fuel is defined as distillate fuel oil in Table C-1 and petroleum in Table C-2. Global warming potentials are from IPCC Fourth Assessment Report.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
bhp - brake horsepower
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
gal - gallon
GHG - Greenhouse gas
hp - horsepower
hr - hour
ID - identification
MT - metric tons
N_2O - nitrous oxide
RPM - revolutions per minute
yr - year

References:

Cummins Specification Sheet. QSX15-G9 NR 2, @ 1800 RPM, 755 HP
CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-19
2015, Fall 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-14	755	10.1	470.7	3.6
S-15	1,490	7.9	470.7	5.5
S-16	73	8.7	470.7	0.3
S-17	300	65.9	470.7	9.3
S-18	135	7.3	470.7	0.5
S-21	465	13	470.7	2.8
S-23	465	14.4	470.7	3.2
S-28	900	8.5	470.7	3.6
S-30	166	7.4	470.7	0.6
S-31	166	10.2	470.7	0.8
S-32	390	8	470.7	1.5
S-33	1,008	8.3	470.7	3.9
S-34	605	46.1	470.7	13.1
S-35	170	7.3	470.7	0.6
S-37	207	11.6	470.7	1.1
S-38	380	8.5	470.7	1.5
S-39	210	8.1	470.7	0.8
S-46	79	7.8	470.7	0.3
S-47	207	8	470.7	0.8
S-56	60	6.5	470.7	0.2
S-57	218	6.5	470.7	0.7
S-58	504	6.5	470.7	1.5
S-59	135	7	470.7	0.4
S-60	317	6.5	470.7	1.0
S-61	300	6.5	470.7	0.9
S-62	300	6.5	470.7	0.9
S-63	300	7	470.7	1.0
S-65	672	8.1	470.7	2.6
S-67	1,008	6.8	470.7	3.2
S-68	1,848	9.9	470.7	8.6
S-71	270	7.7	470.7	1.0
S-72	380	7.5	470.7	1.3
S-73	900	7.9	470.7	3.3
S-74	102	7.9	470.7	0.4
S-75	102	8.1	470.7	0.4
S-76	317	7.8	470.7	1.2
S-77	755	8	470.7	2.8
S-78	2,220	12.3	470.7	12.9

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-79	470	6.5	470.7	1.4
S-80	2,220	12.7	470.7	13.3
S-81	230	11.5	470.7	1.2
S-82	317	8.1	470.7	1.2
S-83	755	8.7	470.7	3.1
S-84	317	7.5	470.7	1.1
S-88	395	7.8	470.7	1.5
S-91	395	8.5	470.7	1.6
S-92	750	9.1	470.7	3.2
S-93	325	8.1	470.7	1.2
S-94	277	9.1	470.7	1.2
S-95	750	6.7	470.7	2.4
S-96	325	8.5	470.7	1.3
S-97	1,175	7.9	470.7	4.4
S-98	1,523	8.5	470.7	6.1
S-99	1,523	8.7	470.7	6.2
S-100	2,220	10.5	470.7	11.0
S-102	207	2.2	470.7	0.2
S-105	1,490	12.3	470.7	8.6
S-106	755	12.6	470.7	4.5
S-110	364	8.9	470.7	1.5
S-111	145	8.2	470.7	0.6
S-112	2,220	8.3	470.7	8.7
S-113	398	10.3	470.7	1.9
S-115	130	11.2	470.7	0.7
S-116	364	10.5	470.7	1.8
S-124	2,206	9	470.7	9.3
S-125	464	7.1	470.7	1.6
S-44	170	6.7	470.7	0.5
S-66	166	6.8	470.7	0.5
S-70	102	6.8	470.7	0.3
S-107	755	7.7	470.7	2.7
S-108	755	7.9	470.7	2.8
S-109	755	7.5	470.7	2.7
None	100	6.5	470.7	0.3
S-114	1,214	8.5	470.7	4.9
S-11	1,807	14	470.7	11.9

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]
S-12	1,186	41	470.7	22.9
S-13	1,186	13	470.7	7.3
S-53	250	13	470.7	1.5
S-69	1,680	12.6	470.7	10.0
S-90	102	34	470.7	1.6
S-101	480	13.6	470.7	3.1
S-104	2,206	41.6	470.7	43.2
S-117	274	10.9	470.7	1.4
None	50	10.2	470.7	0.2
None	50	8.4	470.7	0.2
None	50	3.6	470.7	0.1
None	50	2.2	470.7	0.1
S-122	755	5.8	470.7	2.1
S-123	2,922	11.9	470.7	16.4
S-121	145	5.4	470.7	0.4
			Total for 2015	**336**
			Scaling Factor for Fall 2018/2020[2]	8%
			Total for Fall 2018/2020	**363**
			Scaling Factor for Fall 2035[2]	22%
			Total for Fall 2035	**444**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, and engine rating was provided by Stanford for 2015. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

2. 2015 is based on actual non-emergency and emergency run hours in 2015. For Fall 2018 and Fall 2020, it is assumed that the number of generators will increase proportional to the increase in academic square footage (8%); however, since the size and type of generator is unknown, Ramboll Environ assumed an 8% increase in total emissions. This same methodology was used to represent the increase in academic square footage from Fall 2020 to the buildout of the 2018 GUP (an additional 22% increase).

3. A representative GHG emission factor (in g/hp-hr) was derived for emergency generators because fuel consumption rate information was not available for all units. The emission factor was derived by taking the emission factor for diesel fuel (22.6 lb/gal), converting to grams, and normalizing by a fuel rate (34.7 gal/hr) and horsepower (755 HP) of a representative engine (Cummins, QSX15-G9 NR 2, @ 1800 RPM). The GHG CO_2e emission factor in lb/gal for diesel fuel was obtained from the CO_2, CH_4 and N_2O emission factors found in 40 CFR Part 98 Mandatory Greenhouse Gas Reporting Tables C-1 and C-2. Note that according to the Regulation, diesel fuel is defined as distillate fuel oil in Table C-1 and petroleum in Table C-2. Global warming potentials are from IPCC Fourth Assessment Report.

Table 3-6-19
2015, 2018, Fall 2020, and Fall 2035 GHG Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data			2015 Emissions	
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	CO_2e Emission Factor[3]	CO_2e Emissions
	[hp]	[hr/yr]	[g/bhp-hr]	[MT/yr]

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
bhp - brake horsepower
CFR - Code of Federal Regulations
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
g - gram
gal - gallon
GHG - greenhouse gas
hp - horsepower
hr - hour
ID - identification
IPCC - Intergovernmental Panel on Climate Change
lb - pound
MT - metric tons
N_2O - nitrous oxide
RPM - revolutions per minute
yr - year

References:

Cummins Specification Sheet. QSX15-G9 NR 2, @ 1800 RPM, 755 HP
Code of Federal Regulations. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

Table 3-6-20
2014 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Amount of Waste Disposed[1]	Diversion Rate[1]	Amount of Waste Sent to Landfill	Collection Efficiency[2]	Destruction Efficiency[2]	Oxidation efficiency of CH_4[2]	Generation Fraction[3]	Amount emitted[4,5]	GWP[6]	CO_2e
	[Ton/year]	[%]	[Ton/year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	22,455	65%	8,343	75%	98%	10%	0.05	81	25	2,023
CO_2							0.13	1,632	1	1,632
Total										**3,655**

Notes

1. Waste disposal and diversion rates for 2014 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided for 2015 and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 65%, solve for amount diverted and add amount sent to landfill

2. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® defaults for a landfill with LFG collection.
3. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
4. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
5. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
6. GWP from IPCC 4th report (2.10.2)

Abbreviations

CalEEMod® - California Emissions Estimator Model
CH_4 - Methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

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Table 3-6-21
2015 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Amount of Waste Disposed[1]	Diversion Rate[1]	Amount of Waste Sent to Landfill	Collection Efficiency[2]	Destruction Efficiency[2]	Oxidation efficiency of methane[2]	Generation Fraction[3]	Amount emitted[4,5]	GWP[6]	CO_2e
	[Ton/year]	[%]	[Ton/year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	23,528	66%	8,106	75%	98%	10%	0.05	83	25	2,087
CO_2							0.13	1,683	1	1,683
Total										**3,770**

Notes:

1. Campus waste disposal and diversion rates for 2015 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill

2. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.

3. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.

4. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)

5. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))

6. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

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Table 3-6-22
Fall 2018 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	2015 Amount of Waste Disposed[1]	Scaling for Fall 2018[2]	Fall 2018 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[%]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	23,528	8%	25,430	66%	8,761	75%	98%	10%	0.05	90	25	2,255
CO_2									0.13	1,819	1	1,819
											Total	4,075

Notes:

1. Waste disposal and diversion rates for 2015 from Stanford as shown in **Table 3-6-21**. Campus waste disposal and diversion rates for 2015 from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. Scaling for Fall 2018 is based on the increase in academic square footage expected from December 2015 to full buildout of the 2000 GUP. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015.
3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-23
Fall 2020 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Fall 2018 Amount of Waste Disposed[1]	Increase for Fall 2020[2]	Fall 2020 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[Ton/Year]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	25,430	591	26,021	66%	8,964	75%	98%	10%	0.05	92	25	2,308
CO_2									0.13	1,862	1	1,862
											Total	4,169

Notes:

1. Waste disposal and diversion rates for Fall 2018 is shown in **Table 3-6-22**.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. The total Fall 2020 solid waste disposal adds estimated waste from the Escondido Village graduate residences. The annual solid waste disposal is based on the CalEEMod® version 2013.2.2 default for mid rise apartments from Appendix D Table 10.1, shown below.

Disposal Rate (ton/size/year)	Number of Dwelling Units	Total waste (ton/year)
0.46	1,284	590.64

3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

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Table 3-6-24
Fall 2035 GHG Emissions - Solid Waste
Stanford University
Stanford, CA

	Fall 2020 Amount of Waste Disposed[1]	Campus Scaling for Fall 2035[2]	Waste for new Faculty/Staff Houses[2]	Fall 2035 Amount of Waste Disposed	Diversion Rate[1,2]	Amount of Waste Sent to Landfill	Collection Efficiency[3]	Destruction Efficiency[3]	Oxidation efficiency of methane[3]	Generation Fraction[4]	Amount emitted[5,6]	GWP[7]	CO_2e
	[Ton/Year]	[%]	[Ton/Year]	[Ton/Year]	[%]	[Ton/Year]	[%]	[%]	[%]	[Ton CH_4 or CO_2 / Ton waste]	[MT/year]	[-]	[MT/year]
CH_4	26,021	22%	1,216	32,992	66%	11,366	75%	98%	10%	0.05	117	25	2,926
CO_2										0.13	2,360	1	2,360
												Total	5,286

Notes:

1. Waste disposal and diversion rates for Fall 2020 from Stanford as shown in **Table 3-6-23**. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.
   Calculation of amount of waste disposed: (Amount diverted)/(Amount diverted + amount disposed to landfill) = 66%, solve for amount diverted and add amount sent to landfill
2. The solid waste disposal data from Stanford gives one total for the entire campus, including faculty/staff housing, student housing, and academic buildings. Scaling for Fall 2035 is based on the increase in academic square footage expected from Fall 2020 to full buildout of the 2018 GUP. Waste disposal for the 550 new faculty/staff houses is estimated based on 2015, with the waste per house (before diversion) calculated as 2.21 tons per year per house; therefore, 550 houses x 2.21 tons/house is added to the amount of waste disposed. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015.
3. Waste is sent to Newby Island Landfill, which contains an LFG collection and destruction system. Collection efficiency, destruction efficiency, and oxidation efficiency based on CalEEMod® 2013.2.2 defaults for a landfill with LFG collection.
4. Generation fraction from CalEEMod® Appendix D table 10.2 assuming 75% collection efficiency, 98% destruction efficiency, and 10% oxidation efficiency of methane.
5. CO_2 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x destruction fraction x (1 - collection fraction) x oxidation fraction +1)
6. CH_4 amount emitted = amount of waste disposed x (1 - diversion rate) x generation fraction x (collection fraction x (1 - destruction fraction) + (1 - collection fraction) x (1 - oxidation fraction))
7. GWP from IPCC 4th report

Abbreviations:

CalEEMod® - California Emission Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - General use permit
GWP - Global Warming Potential
IPCC - Intergovernmental Panel on Climate Change
LFG - landfill gas
MT - metric tons
ton - short tons

Table 3-6-25
2014 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Total Water Use Rate[1]	Water Use Rate, Study Area[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
			Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[Mgal/yr]	[kWh/Mgal]					[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	738	626	2,117	111	1,272	--	3,500	0.437	0.695	435
Wastewater Treatment[4]	428	363	--	-	--	1,911	1,911		0.379	138
									Total Indirect Emissions:	**572**

Direct Emissions Associated with Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**494**	**MT CO_2e/yr**

Notes:

1. Stanford water use provided by the Stanford Sustainability and Energy Management Department. Emissions associated with electricity used to pump lake water are assumed to be captured under campus electricity GHG emissions. Total water use is initially overestimated for purpose of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the April 2017 Water Supply Assessment (WSA) actual water use rates for FY2015-16 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.
2. Energy intensities for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. Electricity emission factor for PGE.
4. Sewer water use rate taken from monthly sewer water data for 2014. This includes average daily indoor metered water use for Escondido Village (EVII Barnes and Abrams; EVII Units 56-69) and Stanford's Childcare Center, which do not have separate sewer water meters. December sewer water was calculated as the average of January through November monthly sewer use.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
kWh - kilowatt hour
lb - pound
Mgal - million gallons
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

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Table 3-6-26
2015 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Total Water Use Rate[1]	Water Use Rate, Study Area[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
			Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[Mgal/yr]	[kWh/Mgal]					[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	583	471	2,117	111	1,272	--	3,500	0.437	0.695	327
Wastewater Treatment[4]	404	327	--	-	--	1,911	1,911		0.379	124
									Total Indirect Water Emissions	**451**

Direct Emissions Associated with Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**445**	**MT CO_2e/yr**

Notes:

1. Stanford water use provided by the Stanford Sustainability and Energy Management Department. Emissions associated with electricity used to pump lake water are assumed to be captured under campus electricity GHG emissions. Total water use is overestimated for purposes of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the April 2017 Water Supply Assessment (WSA) actual water use rates for FY2015-16 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.
2. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. Electricity emission factor for PGE.
4. Sewer water use rate taken from monthly sewer water data for 2015. This includes average daily indoor metered water use for Escondido Village (EVII Barnes and Abrams; EVII Units 56-69) and Stanford's Childcare Center, which do not have separate sewer water meters.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt hour
lb - pound
Mgal - million gallons
MT - metric tons
PGE - Pacific Gas & Electric
yr - year

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Table 3-6-27
Fall 2018 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	2015 Water Use Rate[1]	Scaling for Fall 2018[2]							Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Total added	% Increase to Fall 2018	Fall 2018 Total	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	471	416	40.6	769,354	0.072	26.4	6%	497	2,117	111	1,272	--	3,500	0.414	0.657	327
Wastewater Treatment	327	-					6%	345	--	-	--	1,911	1,911		0.359	124
															Total Emissions	**450**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**470**	**MT CO_2e/yr**

Notes:

1. 2015 Stanford water use is as shown in **Table 3-6-26**.
2. Scaling for Fall 2018 is based on the increase in student beds and academic square footage from December 2015 to full buildout of the 2000 GUP. Water use rates are from the April 2017 Water Supply Assessment, which were based on pre-drought water use rates. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. Electricity emission factor for PGE as projected for 2018 is shown in **Table 3-5-1.**
5. Emissions are calculated based on the CalEEMod® 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

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Table 3-6-28
Fall 2020 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2018 Water Use Rate[1]	Scaling for Fall 2020[2]							Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Total added	% Increase to Fall 2020	Fall 2020 Total	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	497	2,020	40.6	0	0.072	29.9	6%	527	2,117	111	1,272	--	3,500	0.402	0.638	336
Wastewater Treatment	345	-					6%	366	--	-	--	1,911	1,911		0.348	127
															Total Emissions	**464**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**498**	**MT CO_2e/yr**

Notes:

1. Fall 2018 Stanford water use is as shown in **Table 3-6-26.**
2. Scaling for Fall 2020 is based on the increase in student beds due to the new Escondido Village Graduate Residences. Water use rates are from the April 2017 Water Supply Assessment, which were based on pre-drought water use rates. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. Electricity emission factor projection for PGE in 2020 is shown in **Table 3-5-1.**
5. Emissions are calculated based on the CalEEMod® 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

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Table 3-6-29a
Fall 2035 GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2020 Water Use Rate[1]	Scaling for Fall 2035[2]									Electricity Intensity[3]					Electricity Emission Factor[4]	CO_2e Emission Factor	GHG Emissions
		Undergraduate and Graduate Residences	Use Rate	Academic Buildings Added	Use Rate	Faculty and Staff Residences	Use Rate	Total added	% Increase to Fall 2035	Fall 2035 Total[2]	Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]	[# Beds Added]	[gal/bed/day]	[sq ft]	[gal/sf/day]	[# Units Added]	[gal/unit/day]	[Mgal/yr]	[%]	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	527	2,600	40.6	2,275,000	0.072	550	225	143	27%	671	2,117	111	1,272	--	3,500	0.300	0.477	320
Wastewater Treatment	366	--							27%	465	--	-	--	1,911	1,911		0.260	121
Total Indirect Water Emissions																		**441**

Wastewater[5]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**633**	**MT CO_2e/yr**

Notes:

1. Fall 2020 Stanford water use is as shown in **Table 3-6-28.**
2. 2035 water use rates are from the April 2017 Water Supply Assessment (WSA), which were based on pre-drought water use rates. The water use rate in Mgal/day is multiplied by 365 days to result in the totals in Mgal/yr. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use. Total water use is lower than the WSA because it does not include the faculty/staff houses outside the Study Area.
3. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
4. The PGE emission factor is based on the achieving 50% RPS in 2030 consistent with SB 350 and SB 32. See **Table 3-5-1** for derivation.
5. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

Table 3-6-29b
Fall 2035 with RPS Projection GHG Emissions - Water and Wastewater
Stanford University
Stanford, CA

Component	Fall 2035 Water Use Rate[1]	Electricity Intensity[2]					Electricity Emission Factor[3]	CO_2e Emission Factor	GHG Emissions
		Supply Water	Treat Water	Distribute Water	Wastewater Treatment	Total Electricity Intensity			
	[Mgal/yr]						[lb CO_2e/kWh]	[MT CO_2e/Mgal]	[MT CO_2e/yr]
Domestic Water Use	671	2,117	111	1,272	--	3,500	0.256	0.406	272
Wastewater Treatment	465	--	-	--	1,911	1,911		0.222	103
Total Indirect Water Emissions with 2035 RPS Projection									**376**

Wastewater[4]	Amount	Units
Septic Tank Emission Factor	5.91E-06	MT CO_2e/gal
Aerobic Emission Factor	6.14E-07	MT CO_2e/gal
Facultative Lagoon Emission Factor	9.70E-06	MT CO_2e/gal
Direct Emissions	**633**	**MT CO_2e/yr**

Notes:

1. Fall 2035 Stanford water use is as shown in **Table 3-6-29a.**
2. Emission factors for Santa Clara county from CalEEMod® 2013.2.2 Appendix D Table 9.2.
3. The PGE electricity intensity factor is based on a projection of the utility achieving 57.5% RPS in 2035, as shown in **Table 3-5-1.**
4. Emissions are calculated based on the CalEEMod® version 2013.2.2 default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Abbreviations:

CalEEMod® - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
ft - feet
gal - gallon
GHG - greenhouse gas
GUP - general use permit
kWh - kilowatt-hours
lb - pound
Mgal - Million gallons
PGE - Pacific Gas & Electric
sf - square feet
sq - square
yr - year

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Table 5-1-1
California 2020 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, CA

BAAQMD 2020 Service Population Calculation (Based on the 2008 Scoping Plan)[1]	
Land Use Sectors Greenhouse Gas Emissions Target (metric tons CO_2e/yr)	295,530,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)[2]	**4.6**

Notes:

1. Table 6 of May 2011 BAAQMD California Environmental Quality Act Guidelines Update - Proposed CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD). 2011.
2. This target is based on the IPCC Second Assessment Report Global Warming Potentials (GWP). If updated to the Fourth Assessment Report GWPs, the emissions would increase slightly, but would remain at 4.6 MT CO_2e/SP/yr, due to negligible impacts of the GWPs.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric tons
SP - service population
yr - year

Table 5-1-2
California 2030 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, CA

2030 Service Population Calculation (Based on the 2014 First Updated Scoping Plan)[1]	
Original 2020 Limit (MMT CO_2e) (i.e., 1990 level approved in 2007)[2]	427
BAAQMD-used California Land Use Sector Emissions Target Based on Original 2020 Limit (MMT CO_2e/yr)[3]	296
BAAQMD-used Land Use Sector 2020 Emission Target/2020 Emission Limit	69.21%
Updated 2020 Limit (i.e., 1990 level approved in 2014 and most correct) (MMT CO_2e)[2]	431
California Land Use Sector Emissions Target Based on Updated 2020 Limit (MMT CO_2e/yr)	298
Percentage the 2030 GHG Target Emissions Relative to 1990 level[3]	60%
Estimate 10-year employment growth rate (2012 -2022)[4]	14.9%
Estimated 2030 Data[4]	**CY 2030**
Land Use Sectors Greenhouse Gas Emissions Target[4] (MT CO_2e/yr)	178,979,059
Population[6]	44,085,600
Employment[7]	23,205,813
California Service Population (Population + Employment)	67,291,413
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)	**2.7**

Notes:

1. Using AR4 Global Warming Potentials for the 1990 Inventory
2. California 1990 Greenhouse Gas Emissions Level and 2020 Limit. Available at: http://www.arb.ca.gov/cc/inventory/1990level/1990level.htm. Accessed: February 2016.
3. Executive Order B-30-15. Available at: https://www.gov.ca.gov/news.php?id=18938. Accessed: February 2016.
4. California Industry Employment Projections Between 2012-2022. Employment Development Department (EDD), State of California, September 19, 2014. Available at: http://www.labormarketinfo.edd.ca.gov/file/indproj/cal$indnarr.pdf. Accessed: February 2016.
5. California Environmental Quality Act Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD), May 3, 2010. Emissions adjusted by AR4 GWP and reduction target for 2030.
6. Report P-1 (County): State and County Total Population Projections, 2010-2060 (5-year increments). California Department of Finance. Available at: http://www.dof.ca.gov/research/demographic/reports/projections/P-1/documents/P-1_Total_CAProj_2010-2060_5-Year.xls
7. Assume the 10-year employment growth rate between 2020 and 2030 is the same as that of the 2012-2022.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
SP - service population
yr - year

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Table 5-1-3
California 2035 GHG Emissions, Population Projections and GHG Service Population Target
Stanford University
Stanford, California

2035 Service Population Calculation (Based on the 2014 First Updated Scoping Plan) [1]	
Original 2020 Limit (MMT CO_2e) (i.e., 1990 level approved in 2007)[2]	427
BAAQMD-used California Land Use Sector Emissions Target Based on Original 2020 Limit (MMT CO_2e/yr)[3]	296
BAAQMD-used Land Use Sector 2020 Emission Target/2020 Emission Limit	69.21%
Updated 2020 Limit (i.e., 1990 level approved in 2014 and most correct) (MMT CO_2e)[2]	431
California Land Use Sector Emissions Target Based on Updated 2020 Limit (MMT CO_2e/yr)	298
Percentage the 2035 GHG Target Emissions Relative to 1990 level[3]	50%
Estimate 10-year employment growth rate (2012 -2022)[4]	14.9%
Estimated 2035 Data[4]	**CY 2035**
Land Use Sectors Greenhouse Gas Emissions Target[4] (MT CO_2e/yr)	149,149,215
Population[6]	45,747,645
Employment[7]	24,875,790
California Service Population (Population + Employment)	70,623,435
AB 32 Goal GHG emissions (MT CO_2e/SP/yr)	**2.1**

Notes:

1. Using AR4 Global Warming Potentials for the 1990 Inventory
2. California 1990 Greenhouse Gas Emissions Level and 2020 Limit. Available at: http://www.arb.ca.gov/cc/inventory/1990level/1990level.htm. Accessed: February 2016.
3. This percentage was calculated for 2035 based on a linear interpolation between the 2030 reduction target of 40% below 1990 levels and 2050 reduction target of 80% below 1990 levels.
4. California Industry Employment Projections Between 2012-2022. Employment Development Department (EDD), State of California, September 19, 2014. Available at: http://www.labormarketinfo.edd.ca.gov/file/indproj/cal$indnarr.pdf
5. California Environmental Quality Act Guidelines Update - Proposed Air Quality CEQA Thresholds of Significance. Bay Area Air Quality Management District (BAAQMD), May 3, 2010. Emissions adjusted by AR4 GWP and reduction target for 2030.
6. Report P-1 (County): State and County Total Population Projections, 2010-2060 (5-year increments). California Department of Finance. Available at: http://www.dof.ca.gov/research/demographic/reports/projections/P-1/documents/P-1_Total_CAProj_2010-2060_5-Year.xls
7. Assume the 10-year employment growth rate between 2025 and 2035 is the same as that of the 2012-2022.

Abbreviations:

AB - Assembly Bill
BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gases
MT - metric tonnes
SP - service population
yr - year

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FIGURES

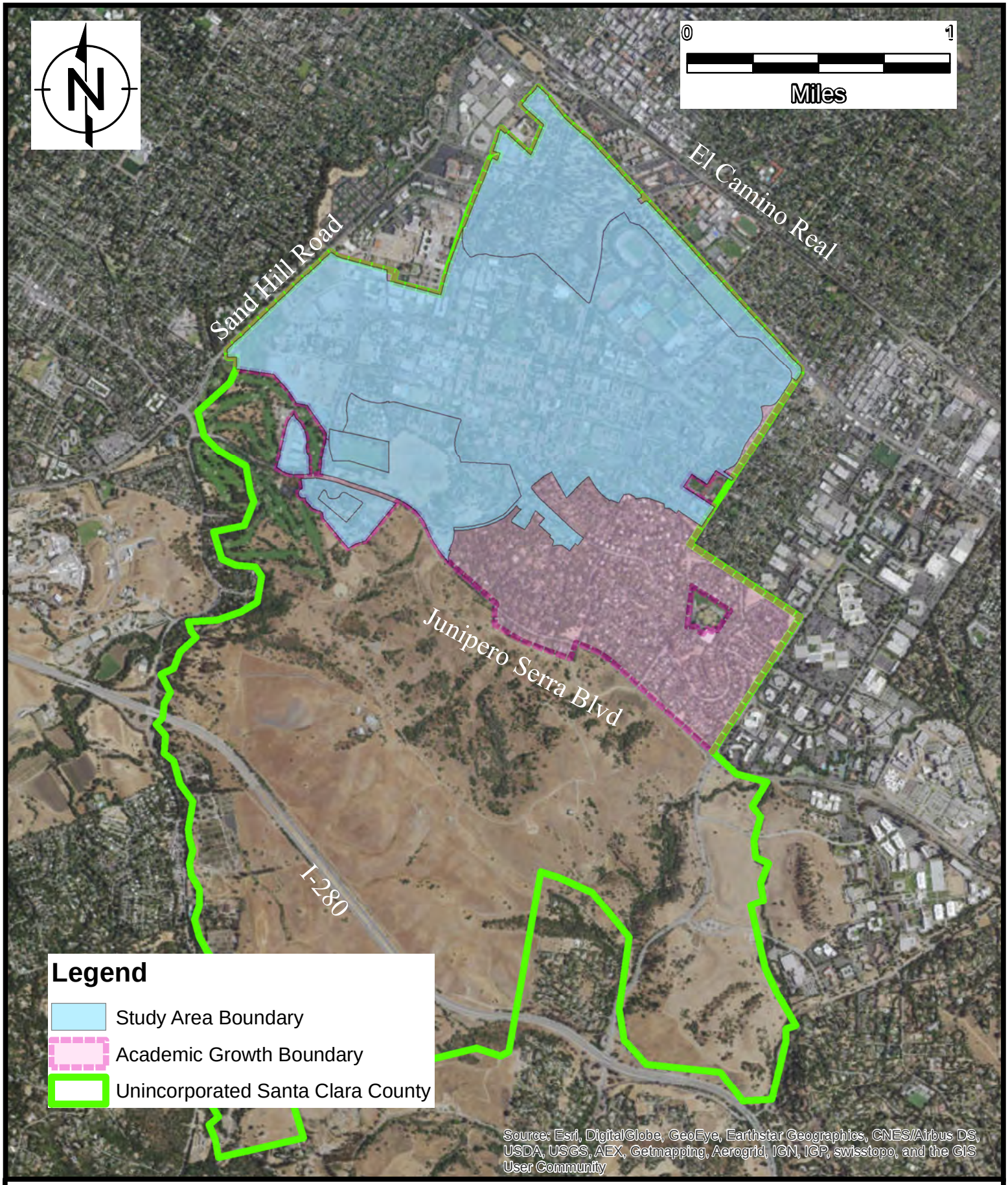

Figure 1-2 Study Area Boundaries
Stanford University
Stanford, CA

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APPENDIX A
RAMBOLL ENVIRON GHG TECHNICAL APPENDIX

Prepared for
Stanford University
Stanford, California

Prepared by
Ramboll Environ US Corporation
San Francisco, California

Project Number
0338006A

Date
August 2, 2017

APPENDIX A
STANFORD 2018 GENERAL USE PERMIT: GREENHOUSE GAS TECHNICAL REPORT
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
bhp-hr	Brake Horsepower-Hour
CalEEMod®	California Emissions Estimator Model
CEC	California Energy Commission
CEF	Central Energy Facility
CFR	Code of Federal Regulations
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPUC	California Public Utilities Commission
EMFAC	EMission FACtor Model
GHG	Greenhouse Gas
GUP	General Use Permit
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
hp	Horsepower
IPCC	Intergovernmental Panel on Climate Change
Lb	Pound
LFG	Landfill Gas
Mgal	Million Gallons
MSW	Municipal Solid Waste
MT	Metric Tons
MWh	Megawatt-Hour
N_2O	Nitrous Oxide
OFFROAD	Missions Inventory Program Model
PGE	Pacific Gas & Electric
PSSI	Peninsula Sanitary Service, Inc.
Ramboll Environ	Ramboll Environ US Corporation
SCAQMD	South Coast Air Quality Management District
SESI	Stanford Energy Systems Innovations

sq ft	Square Feet
USEPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
WECC	Western Electricity Coordinating Council
WSA	Water Supply Assessment

1. GHG EMISSIONS INVENTORIES

1.1 Methodology for Calculating Emissions

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and Project greenhouse gas (GHG) emission inventories, for construction and operational emissions. GHG operational emissions sources within the study area at Stanford University include: electricity use, natural gas use, mobile sources, emergency generator use, solid waste, and water supply and wastewater. This appendix provides the methodology for inventories developed for four existing conditions analysis years (i.e., 2014, 2015, Fall 2018, and 2020) and Project year (2035). The four existing conditions analysis years were selected based on the changes in operation as noted in Section 1.2.3 of the GHG Report: 2014 represents the actual historic emissions during the year before operation of the Stanford Energy Systems Innovations (SESI) project, 2015 is the year representative of the current operations after the implementation of SESI, Fall 2018 represents the conditions expected to exist prior to commencement of the proposed 2018 General Use Permit, and Fall 2020 represents the conditions that will exist after the occupation of the new Escondido Village Graduate Residences. For the Fall 2018 analysis, it is assumed that the development authorized by the 2000 General Use Permit (GUP) has been permitted and occupied, with the exception of the Escondido Village Graduate Residences. The Fall 2035 ("Project") analysis includes the anticipated construction and operation of the additional academic buildings and residences proposed in the 2018 GUP. The “Fall 2035 With RPS Projection” analysis represents an estimate of Project emissions in Fall 2035 incorporating intensity factors for electricity generation consistent with expected implementation of renewable portfolio standards in 2035.

1.1.1 Units of measurement: Tonnes of CO_2 and CO_2e

As discussed in Section 2 of the report, the term “GHGs” includes gases from fossil fuel use that contribute to the global l greenhouse effect, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs) and chlorofluorocarbons. Water, although a GHG, is not typically evaluated, as water vapor is ubiquitous and typically considered in the context of global feedback loops rather than as an emission from a single project. GHG emissions are typically measured in terms of mass of carbon dioxide equivalent (CO_2e). CO_2e are calculated as the product of the mass of a given GHG and its specific global warming potential (GWP), as described in Section 2.1 of the report.[1] GWPs of 25 and 298, corresponding to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, were used for CH_4 and N_2O, respectively, for this analysis.[2] In many sections of the report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

[1] CalEEMod® 2013.2.2, the primary tool used to develop the emissions inventory uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. The GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been manually incorporated to CalEEMod® output.

[2] IPCC Fourth Assessment Report: Climate Change 2007. Available at: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html.

In this report, a tonne refers to a metric ton (MT) (1,000 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

1.1.2 Resources

1.1.2.1 CalEEMod®

Ramboll Environ primarily utilized the methodology from the California Emissions Estimator Model (CalEEMod®) version 2013.2.2[3] to assist in quantifying the GHG 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, and 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 GHG emissions from a land use development project. The model also provides default values for water and energy use. Specifically, the model aids the user in estimating emissions from operational emissions associated with the land use development under evaluation. 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 use associated with water usage. This also includes solid waste disposal.

CalEEMod® uses sources such as the USEPA AP-42 emission factors,[4] ARB's approved on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD), and studies commissioned by California agencies such as the California Energy Commission (CEC) and CalRecycle. OFFROAD[5] is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment). The off-road diesel emission factors used by CalEEMod® are based on the ARB OFFROAD2011 program. EMFAC[6] is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles). The emission factors used by CalEEMod® are based on the ARB EMFAC2011 program. The California Air Resources Board (ARB) has released an updated EMFAC2014 version that includes various updates, notably the incorporation of the United States Environmental Protection Agency (USEPA) and ARB regulations and standards (e.g., Advanced Clean Cars and the Truck and Bus Rule). To more accurately assess the mobile GHG emission inventories, EMFAC2014 was incorporated into the analysis.

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[3] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[4] 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: http://epa.gov/ttnchie1/ap42/. Accessed: May 2016.

[5] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: September 2016.

[6] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: September 2016.

In addition, CalEEMod® contains default values and existing regulation methodologies to use in each specific local air district region. Appropriate statewide default values can be utilized if regional default values are not defined. Ramboll Environ used default factors for Santa Clara County for the GHG emission inventory, unless otherwise noted in the methodology descriptions below.

CalEEMod® 2013.2.2 uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. However, the GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 have been incorporated in these calculations instead, as the Fourth Assessment Report is the basis of the GWPs in the 2016 California GHG inventory.[7] The vast majority of emissions from this Project are CO_2. As a result, small changes in global warming potential for methane and nitrous oxide between the various scientific updates provided by the IPCC have a minimal impact on the overall GHG emissions from the project.

1.1.2.2 Other Resources

Ramboll Environ directly or indirectly relied on emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, Project specific studies, and emission estimation software as described above. In cases noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above. Where Stanford-specific data were available, it was 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.

1.1.3 Indirect GHG Emissions from Electricity Use

Indirect GHG emissions, which occur when electricity is used, are typically due to electricity generation from offsite power plant locations. Electrical power is supplied to the Project site by Pacific Gas & Electric (PGE), through the direct access program, and from the on-site Cardinal Cogen Plant (for the 2014 inventory only).

To estimate emissions, the electricity usage is multiplied by the emission intensity factors for the GHGs. Emission intensity factors are GHG emission rates from a given source in terms of the amount of GHG released pounds (lbs) per megawatt hour (MWh) of energy produced.

Stanford purchases “direct access” electricity for a portion of its operations. This program allows for a choice of energy services provider rather than solely purchasing electricity from the utility company.[8] The default intensity for the direct access electricity in the 2014 and 2015 inventories are based on the USEPA eGRID most recent (2014v2) values for the Western Electricity Coordinating Council (WECC) California electricity region for the electricity supplier mix specified by Stanford’s Office of Sustainability for each inventory year.[9] A more specific electricity intensity factor was not available for Stanford’s 2014 direct access provider, Constellation Energy. In addition, the Stanford Office of Sustainability provided the PGE intensity for the commercially supplied PGE electricity. Electricity intensity for the

[7] CARB. 2016. California Greenhouse Gas Emission Inventory – 2016 Edition. Available at: https://www.arb.ca.gov/cc/inventory/data/data.htm. Accessed: September 2016.

[8] PGE. 2016. Electricity – Direct Access. Available at: http://www.pge.com/b2b/retailenergysuppliers/espresourcecenter/directaccessfaqs/. Accessed: July 2016.

[9] USEPA. 2017. eGRID2014v2. Available at: https://www.epa.gov/energy/egrid-2014-summary-tables. Accessed: April 2017

Cardinal Cogen plant was provided by Stanford. Intensity factors for the Fall 2018 campus electricity are adjusted based on Stanford's commitment to operate the Stanford Solar Generating Station that will provide half of campus electricity by renewable sources by 2017;[10] renewable sources are assumed to have an electricity intensity of zero. The electricity intensity factors for the Fall 2018 inventory is based on a linear interpolation to meet the State's requirement for 33 percent renewable power supply by 2020. The 2020 electricity intensity factor is based on the assumption that the State's requirement for 33 percent renewable power supply is met. The electricity intensity factors for Project emissions are based on the assumption the PGE and WECC California achieve the State's SB 350 goal of acquiring 50 percent of energy from renewable sources in 2030.[11] The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[12] The default electricity intensity for CH_4 and N_2O were obtained from CalEEMod® Appendix D value for PGE and were conservatively not adjusted for future inventory years, even though as more renewable energy is integrated into the electricity grid, these intensity factors will also decrease which will cause the total CO_2e intensity factor to decrease.

1.2 Construction Emissions

This section describes the estimation of GHG emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from construction and demolition for all existing conditions inventory years and the Project year. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

GHG emissions from these construction phases are largely attributable to fuel use from off-road construction equipment and vendor vehicles. GHG emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section.

[10] Stanford. 2015. Stanford Energy System Innovations. Available at: http://news.stanford.edu/features/2015/sesi/. Accessed: July 2016.

[11] CEC. 2016. Clean Energy & Pollution Reduction Act SB 350 Overview. Available at: http://www.energy.ca.gov/sb350/. Accessed: October 2016.

[12] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft),demolition of 50,306 sq ft of buildings per year, and excavation of 62,062 cubic yards (CY) of soil, with the assumption that the annual construction activities occur each year. This annual average is based on the average construction and demolition on the Stanford campus from 2001 to 2015. The excavation quantity is derived by dividing the excavation quantity from a known large Stanford project by the square footage of floor area for that project, then multiplying by the annual average square footage of construction. If this constant annual construction activity is projected forward from Fall 2018 to Fall 2035, the total construction square footage will be similar to the total anticipated in the 2018 GUP. Approximately 200,000 net sq ft per year of construction is proposed in the 2018 GUP, on average. Annual demolition square footage is likely to be lower than in the 2000 GUP because most of the in-fill development under the 2000 GUP has been in the denser core campus, whereas much of the 2018 GUP development would occur as redevelopment at the less dense fringes or on parking lots. Additionally, annual excavation quantities are likely to be lower as the amount calculated and applied as an annual average is derived from a single large project and some future projects may not incorporate much, if any, excavation. Overall, this analysis is likely to be conservative because the total disturbed area (and thus construction emissions) in the 2018 GUP are likely to be lower than in this analysis.

1.2.1 Emissions from Construction Equipment

The emission calculations associated with construction equipment are from off-road equipment engine use based on the equipment list and phase length, and on-road vehicle trips and phase length.

Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod® assumes all of the equipment operates on diesel fuel. The calculations associated with this screen include the running exhaust emissions from off-road equipment. Since the equipment is assumed to be diesel, there are no starting emissions associated with the equipment, as these are de minimis for diesel-fueled equipment. CalEEMod® calculates the exhaust emissions based on CARB's OFFROAD2011 methodology using the equation presented below.[13]

$$\text{Emissions}_{\text{Diesel}} = \sum_i \left(\text{EF}_i \times \text{Pop}_i \times \text{AvgHP}_i \times \text{Load}_i \times \text{Activity}_i\right)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

[13] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

i = equipment type

Ramboll Environ assumes that the majority of construction equipment used by Stanford for these inventories meets final Tier 4 emissions standards.

1.2.1.1 Emissions from On-Road Construction Trips

Construction generates on-road vehicle GHG emissions trucks for soil and material hauling. These emissions are based on the number of trips and vehicle miles traveled (VMT) along with emission factors from EMFAC2011. Emissions associated with on-road worker,vendor, and hauling vehicles are captured separately in the operational mobile category, as these vehicle trips are included in the traffic analysis by Fehr & Peers (see **SB 743 VMT Analysis Appendices B, C,** and **D**).

The emissions from mobile sources were calculated in Excel with the trip rates, trip lengths and emission factors for running from EMFAC2014 as follows:[14]

$$\text{Emissions}_{\text{pollutant}} = \text{VMT} * \text{EF}_{\text{running, pollutant}}$$

Where:

$\text{Emissions}_{\text{pollutant}}$ = emissions from vehicle running for each pollutant

VMT = vehicle miles traveled

$\text{EF}_{\text{running, pollutant}}$ = emission factor for running emissions

Starting and idling emissions were also calculated in Excel by multiplying the number of trips by the respective emission factor for each pollutant.

1.2.1.2 Total Construction Emissions

The total annual emissions from construction are summarized in **GHG Report Table 3-2-1**. The construction emissions vary slightly based on the existing conditions and Project analysis years (i.e., 2014, 2015, Fall 2018, Fall 2020, and Fall 2035 Project) because the emission factors for the off-road equipment reflect lower GHG emissions over time, per regulation.[15] The Project inventory conservatively uses 2030 vehicle emission factors; if 2035 vehicle emission factors were used instead, it is expected that emissions would decrease. Detailed emission inventories from the CalEEMod® output files are included in **GHG Report Appendix B**.

1.2.2 Vegetation Changes

Permanent vegetation changes that occur as a result of land use development constitute a one-time change in the carbon sequestration capacity of a project site. In this case, no construction is proposed in open space areas, and redevelopment will primarily occur in the core campus and parking lots and will be landscaped with trees. This will result in an overall negligible change in carbon sequestration once the vegetation reaches a steady state (i.e.,

[14] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[15] Note that CalEEMod® off-road GHG emissions for the Project are higher than all other years, due to limitations of the OFFROAD model, which CalEEMod® relies on. OFFROAD2011, the current OFFROAD model, does not contain emission factors for years later than 2029, therefore for years 2030 and after, emission factors are derived from an older (and less accurate) version of the model (OFFROAD2007). This is an artefact of the calculation method, and does not reflect a true increase in GHG emissions from construction.

new vegetation replaces dying vegetation). Consequently, vegetation change results in a negligible change in GHG emissions.

1.3 Annual Operational Emissions: 2014 Inventory

1.3.1 Electricity

Locations on campus acquire electricity from several providers. These are summarized in **GHG Report Table 3-6-1**.

1.3.1.1 PGE Commercial

Monthly electricity consumption for all PGE commercial addresses associated with Stanford University were provided by the Stanford Office of Sustainability. Prior to the decommissioning of the Cardinal Cogen plant, PGE Commercial electricity was consumed typically by just a few entities within the study area, including a research laboratory and a dormitory. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned locations as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[16] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial PGE accounts in 2014 are shown in **Figure 1-3-1**. The total electricity consumption is the sum of the electricity consumption from each of these addresses.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the energy usage by the PGE electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2**.

1.3.1.2 PGE, Other Housing

As described in the GHG Technical Report, faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions are included in the study area. These make up a total of 38 single-family homes whose electricity use was not provided by Stanford.

Stanford does not have access to the individual electricity bills of private residents, therefore, default assumptions must be used to estimate electricity usage in these private, on-campus homes. Accordingly, CalEEMod® assumptions are used to calculate the residential energy use, with the assumption that the average faculty/staff unit uses a similar amount of electricity as a single-family home built to 2008 Title 24 standards. Climate Zone 4 is selected based on the CEC forecast climate zone map shown in the CalEEMod® User's Guide.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the usage by the PGE electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.3 Direct Access

Monthly electricity consumption for all direct access addresses associated with Stanford University were provided. The direct access accounts in 2014 do not include electricity distributed to the campus by the Cardinal Cogeneration plant. Direct access energy is distributed to addresses both inside and outside the study area. All addresses are geocoded

[16] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

using Batchgeo[17] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent direct access accounts within the study area. The locations with direct access accounts are shown in **Figure 1-3-1**. The total electricity consumption is the sum of the electricity consumption from each of these addresses.

The resulting energy use (in MWh) is converted to GHG emissions by multiplying the energy use by the eGRID 2014v2 electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.4 Cardinal Cogen

The Cardinal Cogen plant provided electricity and steam to Stanford through Spring 2015. Total emissions are from natural gas combustion associated with turbine and boiler operation. In addition to distribution throughout campus, a portion of electricity and steam was sold off-campus to PGE and the Stanford Hospital.

Stanford's Office of Sustainability provided the breakdown of energy consumption and emissions by end use for the 2014 inventory. Ramboll Environ uses the emissions by end use to divide the emissions among the following categories:

1. Cogen electrical sales to Stanford Campus and Stanford Central Energy Facility (CEF) (35%)
2. Cogen electrical sales to PGE (18%)
3. Chilled water and steam for campus (34%)
4. Chilled water and steam sold to the hospital (13%)

The Bay Area Air Quality Management District (BAAQMD) provided daily 2014 CO_2, CH_4, and N_2O emissions from the Cardinal Cogen plant in response to a stationary source information request. The fraction of the total emissions associated with electricity sales to the Stanford Campus and Stanford CEF is applied to this BAAQMD emissions inventory. The resulting electricity use quantities are converted to GHG emissions by multiplying the electricity use by the electricity intensity factor provided by Stanford. Consistent with the discussion above, this represents approximately 35% of the total emissions provided by BAAQMD. Emissions are summarized in **GHG Report Table 3-6-2**.

This section of the GUP inventory includes emissions associated with Cardinal Cogen electricity used on campus only. This electricity was distributed throughout the academic buildings, dormitories, and graduate student residences. Emissions associated with the remaining gas combustion and steam generation is discussed in Section 1.3.2. The reason for separating out the Cardinal Cogen into approximate electricity-related versus gas-related emissions is to enable an "apples-to-apples" comparison of campus electricity and gas consumption between existing conditions inventory years.

1.3.1.5 Imported to Campus

Electricity was imported to campus in 2014, such as during downtimes of the Cardinal Cogen. This electricity consumption was provided by Stanford and is converted to GHG emissions by multiplying the usage by the default eGRID electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

[17] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

1.3.1.6 Imported to CEF

Electricity was imported to the CEF in 2014, such as during downtimes of the Cardinal Cogen. This electricity consumption was provided by Stanford and is converted to GHG emissions by multiplying by the default eGRID electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.7 Commercial Non-Stanford

A subset of accounts that lease space on Stanford's campus used electricity from the Cardinal Cogen in 2014. Stanford provided the electricity consumption from these accounts, which include entities such as the Carnegie Institute and the US Post Office. Since these energy consumers are within the study area, emissions from their electricity usage was included in the overall existing conditions inventory. Stanford does not anticipate that there are other large commercial consumers who are not otherwise captured under the campus, PGE, or direct access accounts. The electricity use (in MWh) are converted to GHG emissions by multiplying the usage by the Cardinal Cogen electricity intensity factor. Emissions are summarized in **GHG Report Table 3-6-2.**

1.3.1.8 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-2.**

1.3.2 Natural Gas

1.3.2.1 PGE Residential

Monthly natural gas consumption for all PGE residential addresses associated with Stanford University were provided. This includes addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. It does not include private staff/faculty residences in the Searsville Block and Olmsted Staff Rental subdivisions located within the study area. All addresses are geocoded using Batchgeo[18] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE residential accounts within the study area, mainly concentrated in Escondido Village. The locations with residential PGE accounts is shown in **Figure 1-3-2**. The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 Code of Federal Regulations [CFR] 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.2 PGE Commercial

Monthly natural gas consumption for all PGE commercial addresses associated with Stanford University were provided. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[19] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial

[18] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

[19] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

PGE accounts are shown in **Figure 1-3-2.** The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors (on a per therm basis) presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.3 PGE Other Housing

Natural gas consumption and emissions from the private faculty/staff housing, Searsville Block and Olmsted Staff Rental subdivisions, included in the study area are estimated using CalEEMod® default assumptions. Similar to that described in section 1.3.1.2, CalEEMod® can be used to estimate GHGs from buildings from natural gas use. CalEEMod® defaults are used to calculate the private residential energy use, with the assumption that the average faculty/staff unit uses a similar amount of natural gas as a single-family home built to 2008 Title 24 standards in Santa Clara County.

The resulting energy use (in therms) are converted to GHG emissions. GHG emissions are calculated based on CO_2, CH_4, and N_2O emission factors on a per therm basis presented in Tables C-1 and C-2 of the Federal Mandatory Greenhouse Gas Reporting Regulation (40 CFR 98). Emissions are summarized in **GHG Report Table 3-6-7.**

1.3.2.4 Cardinal Cogen

As described in Section 3.2.1.3, the Cardinal Cogen plant emitted GHGs through combustion of natural gas. The portion of the total emissions associated with boilers and steam used on campus as described in Section 3.2.1.3 are included in the natural gas portion of the existing conditions inventory. This represents approximately 34% of the total emissions provided by BAAQMD. Emissions are summarized in **GHG Report Table 3-6-8.**

1.3.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-7 and 3-6-8**.

1.3.3 Mobile Sources

The GHG emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles associated with the land use types in the Project. The GHG emissions from the on-road mobile sources include running and starting exhaust emissions. Running emissions are dependent VMT. Starting emissions are associated with the number of starts or time between vehicle uses and the assumptions used in determining these values are described below. Ramboll Environ estimated mobile source emissions using the trip rates and trip length information specified by Fehr & Peers as described in **SB 743 VMT Analysis Appendix A**. Detailed emission factors and campus fleet calculations are shown in **GHG Report Appendix C.**

1.3.3.1 Off-campus (Worker) trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-13**.

1.3.3.2 On-campus (Resident) trips

Fehr & Peers calculated on-campus trips and VMT associated with workers or residents who travel from campus. This might include trips such as lunchtime excursions or home-based commercial trips for residents who live on campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-13**. Detailed emission factors and fleet breakdowns are shown in **GHG Report Appendix C.**

1.3.3.3 Campus fleet: On-road

Stanford-owned on-road vehicles can be split into the following fleets: Bonair fueling station, Peninsula Sanitary Service, Inc. (PSSI) fleet, Marguerite shuttle/buses, and Public Safety vehicles. Methodologies used for estimating emissions from each fleet are described in the sections below.

Bonair Fueling Station Fleet

Stanford provided a vehicles list with annual fuel totals for each vehicle using the Bonair fuel station for refueling. This list of vehicles was filtered using keywords to generate four major categories of vehicles: light passenger/mid-duty, buses, off-road/landscaping equipment, and light towers/generators. Stanford also provided additional "off-ledger" fuel totals that include gasoline and diesel purchases made outside the Bonair fueling station but used to fuel the campus fleet. This off-ledger fuel usage was added to the Bonair fuel totals to calculate GHG emissions. Annual fuel usage was converted to annual vehicle miles traveled using ARB's EMission FACtor model (EMFAC2014) average miles per gallons based on the specific vehicle category. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions. Fuel usage from off-road equipment and light towers/generators was converted to brake horsepower-hour in order to calculate emissions. More detail on off-road vehicle estimates can be found in Section 1.3.3.4.

Peninsula Sanitation Systems, Inc (PSSI) Fleet

Peninsula Sanitary Service, Inc. (PSSI) operates an aboveground diesel storage tank within the Bonair fuel station service yard to fuel its own fleet of recycling, compost, and garbage collection and hauling trucks, as well as some light duty company vehicles. Stanford provided fuel usage and fleet size for this fleet as well as an estimate of the trip length and frequency for the collection trucks. To estimate emissions, the fleet was split into larger hauling trucks and light duty company vehicles. Based on communication with Stanford, large trucks were assumed to travel 4 one-way 52-mile trips per day to the end-use facility plus the default trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) for collection. This information was used to estimate annual VMT and estimate emissions using ARB's EMission FACtor model (EMFAC2014). Only fuel usage information was available for the light duty company vehicle fleet, so annual fuel usage was converted to annual VMT using ARB's EMission FACtor model (EMFAC2014) average miles per gallon for light duty diesel vehicles. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions.

Marguerite Bus/Shuttle Fleet

Detailed data on vehicles and mileage traveled for each vehicle in this fleet allowed for more detailed emissions estimates. Emissions were estimated for each bus and shuttle individually

based on the vehicle classification, model year, fuel type, total vehicle miles traveled, and a fleet average trip length. Some routes never cross into the study area, so the vehicle miles traveled for the entire fleet was adjusted to remove mileage from routes that never cross into the boundary. Only break and tire wear particulate matter emissions were estimated for electric buses. Hybrid bus fuel efficiency is 33% greater than that of a normal bus so VMT for hybrid buses was reduced by 33% to account for the higher fuel efficiency. [20,21] By calculating emissions for each vehicle individually, future changes in the Marguerite fleet can be easily incorporated.

Public Safety Fleet

Stanford provided total vehicle miles traveled (by the entire public safety fleet) and the total number of vehicles. GHG emissions were calculated using the data provided and an assumed fleet population of light duty vehicles and trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County).

1.3.3.4 Campus fleet: Off-road

Off-road equipment was separated from the Bonair fueling station data. This includes landscaping equipment and light towers/generators. Annual fuel totals were used to estimate total brake horsepower-hour (bhp-hr) using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate GHG emissions.

Additionally, although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary. Equipment activity occurring in these two areas was estimated from a location-based allocation of total fuel usage from the golf course fuel tanks, provided by Stanford. Emissions were estimated using this annual fuel consumption estimate provided by Stanford to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate GHG emissions.

1.3.3.5 Visitors

Ramboll Environ calculated the trips and VMT associated with various types of campus visitors based on Stanford-specific information and assumptions. These visitor categories are divided below on whether they represent regular weekday trips, or one-time weekend trips to allow a determination of whether they should be considered in the total weekday cordon count.

- One-time visitor events primarily on weekends include the following types of events:
- Athletic events
- Milestone events (Graduation, Parent's Weekend, Homecoming, etc.)

[20] Duluth Transit Authority, 2016. http://www.duluthtransit.com/green/hybrid.

[21] Iowa State University Institute for Transportation, 2012. Assessing the Costs for Hybrid versus Regular Transit Buses. http://www.intercitytransit.com/SiteCollectionDocuments/HybridFactSheet20120802.pdf.

- Camps
- Stanford Live performances

Frequent visitor trips that happen throughout the year include the following categories:

- Alumni center
- Conferences
- Walking tours
- Tour bus visitors
- Executive education

Emissions are shown in **GHG Report Table 3-6-13.**

1.3.3.6 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix A**. Emissions are shown in **GHG Report Table 3-6-13.**

1.3.3.7 Mobile Emissions Summary

Mobile emissions are summarized in **GHG Report Table 3-6-13**.

1.3.4 Emergency Generators

A list of campus-wide emergency generators along with their BAAQMD Source ID, model year, engine rating, and actual non-emergency and emergency run hours in 2014 was provided by Stanford. There are three generators smaller than 50 horsepower (hp) that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

GHG emissions are calculated by multiplying the engine rating, hours of operation, and GHG emission factor. Emissions are shown in **GHG Report Table 3-6-18**.

1.3.5 Waste

Municipal solid waste (MSW) is the amount of material that is disposed of by landfilling, recycling, or composting. CalEEMod® calculates the indirect GHG emissions associated with waste that is disposed of at a landfill using waste disposal rates by land use and overall composition. The emission estimates in this Existing Conditions Report are based on Stanford actual disposal and diversion rates across campus in 2014.

CalEEMod® uses the overall California Waste Stream composition to generate the necessary types of different waste disposed into landfills. The program quantifies the GHG emissions associated with the decomposition of the waste, which generates methane based on the total amount of degradable organic carbon. The program also quantifies the CO_2 emissions associated with the combustion of methane, if applicable. Default landfill gas concentrations were used as reported in Section 2.4 of the USEPA's AP-42. The IPCC has a similar method to calculate GHG emissions from MSW in its 2006 Guidelines for National Greenhouse Gas Inventories.

The analysis assumes that additional waste is diverted from landfills by a variety of means, such as reducing the amount of waste generated, recycling, and/or composting. The remainder of the waste not diverted is disposed of at a landfill. GHG emissions from landfills

are associated with the anaerobic breakdown of material. The CalEEMod® version 2013.2.2 solid waste module determines the GHG emissions associated with the disposal of solid waste into landfills in quantities that are based upon land use type according to waste disposal studies conducted by CalRecycle. Stanford waste is sent to Newby Island Landfill, which contains a landfill gas (LFG) collection and destruction system. The collection efficiency, destruction efficiency, and oxidation efficiency used in the calculations are based on CalEEMod® defaults for a landfill with LFG collection.

GHG emissions associated with non-landfill diverted waste streams are not considered, because it is generally assumed that these diversions do not result in any appreciable amounts of GHG emissions when operated effectively.[22] These 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.[23] Biogenic CO_2 emissions were not included when ARB analyzed the GHG emissions inventory under Assembly Bill 32. Therefore, they are not included in the emissions inventory.

The 2014 operations within the Stanford campus generated 23,837 tons per year of solid waste and was estimated to result in 3,880 $MTCO_2e$ per year as shown in **GHG Report Table 3-6-20.** Waste disposal and diversion rates for 2014 are from Stanford Recycling and Peninsula Sanitary Service, Inc. Waste disposal and diversion rates for 663 Stanford faculty/staff houses was provided for 2015 and used to estimate the waste from only the 38 houses within the study area (Searsville and Olmstead). The waste per house (before diversion) was calculated as 2.21 tons per year per house, and the diversion rate was consistent with the overall campus diversion rate. Therefore, 38 houses x 2.21 tons/house was included in the amount of waste disposed, and the waste from the 625 faculty/staff houses outside the study area was excluded.

1.3.6 Water Use and Emissions

Indirect GHG emissions result from the production of electricity used to convey, treat, and distribute water and 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. Stanford potable water is sourced from the San Francisco Public Utilities Commission. Non-potable water comes from groundwater and lake water. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

Water usage and wastewater generation values are based on Stanford data for domestic water use for the Stanford campus in 2014 with adjustments based on the Stanford Water Supply Assessment (WSA)[24]. Emissions from electricity from lake water pumping is already captured under campus electricity. Wastewater quantities are derived by summing monthly sewer water records. Total water use is initially overestimated for purposes of this inventory because the water usage includes water from all of the faculty/staff housing within the Academic Growth Boundary, even though 899 of these units are not within the study area. The water use from these units was estimated and removed from the total based on the

[22] ARB. 2010. Local Government Operations Protocol. Chapter 9.4.

[23] This inventory represents scope 1 and 2 emission categories. A life-cycle analysis of waste diversion would be a scope 3 inventory. ARB's Local Government Operations Protocol Version 1.1 (May 2010) clearly states that scope 3 emissions should not be combined with scope 1 and 2 emissions.

[24] Stanford University and Schaaf & Wheeler. 2016. Water Supply Assessment for the Stanford 2018 General Use Permit. October.

October 2016 WSA actual water use rates for fiscal year 2015-2016 (WSA Table 2-4). Total water use from the 937 faculty/staff houses was 0.32 million gallons per day; water per house was thus 342 gallons per day. Water use for the 38 Searsville/Olmstead houses within the study area was retained, while water from the other 899 faculty/staff houses was removed. Wastewater was scaled proportionally since wastewater generation is proportional to indoor water use.

Ramboll Environ used CalEEMod® default assumptions for average embodied energy in water[25] for Santa Clara County, which are based on a study commissioned by the CEC.[26] This study published recommended electricity intensities for the supply and conveyance, treatment and distribution of water, as well as treatment of wastewater, for Northern and Southern California. These factors account for the energy embodied in water use and were used to calculate emissions for the campus. The PGE electricity emission factor is used to estimate GHG emissions per kilowatt-hour, since it is assumed that the electricity from the conveyance, treatment, and distribution comes from PGE.

Wastewater treatment emissions are calculated based on the CalEEMod® default factors for 'Santa Clara County' for the total wastewater quantity. This does not account for any recycled water or wastewater recovery. Direct emissions are based on a default split between septic tank, aerobic, and anaerobic wastewater treatment types (10.33%, 87.46%, and 2.21% respectively), as shown in CalEEMod® Appendix D Table 9.4. The gas produced by anaerobic digesters may be flared or sent to a cogeneration process; in this calculation, it is assumed all gas is flared or released as fugitive methane, as this is the default described in CalEEMod® Appendix A Section 8.4.

Emissions are shown in **GHG Report Table 3-6-25**.

1.3.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression. Emissions are shown in **GHG Report Table 3-2-1**.

1.3.8 2014 Inventory Emissions Summary

Emissions are summarized in **GHG Report Table 3-2-1**.

1.4 Annual Operational Emissions: Post-SESI 2015 Inventory

1.4.1 Electricity

The 2015 inventory electricity consumption is based on data and energy usage from the second half of 2015, because the Cardinal Cogen was not fully decommissioned until June 2015. To provide a reasonable estimate of campus energy consumption after the completion of SESI, electricity and gas consumption from July through December 2015 are doubled and assumed to represent annual energy consumption for the campus facilities operational by December 2015. Comparisons between total electricity consumption in the first versus second half of 2014 reveal that consumption from January through June is similar to that from July through December.

[25] Embodied energy refers to the amount of energy that was used in delivering water to the specific land use.

[26] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

1.4.1.1 PGE Commercial

The same methodology is used as that for the 2014 inventory, except data for usage from July through December 2015 is doubled to represent the 2015 electricity consumption. The locations of PGE commercial electricity accounts for the 2015 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.2 Direct Access

The same methodology is used as that for the 2014 inventory, except data for usage from July through December 2015 is doubled to represent the 2015 inventory electricity consumption. The locations of direct access electricity accounts for the 2015 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **GHG Report Table 3-6-3.**

1.4.1.3 Campus and New CEF Consumption

Similar to the methodology for 2014, Stanford provided the monthly campus and new CEF electricity consumption for 2015. The new CEF electricity is used in support of creating hot and chilled water for heating and cooling. This electricity is supplied by a direct access electricity service provider, so the 2014v2 WECC California emission factor is used to calculate GHG emissions. Emissions are summarized in **GHG Report Table 3-6-3.**

1.4.1.4 PGE, Other Housing

The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and electricity consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for the 2014 inventory, because these commercial on-campus energy consumers continue to exist and are assumed to purchase a similar amount of electricity from the grid that they previously purchased from the Cardinal Cogen. The emission factor has been updated to assume PGE is the electricity provider. Emissions are summarized in **GHG Report Table 3-6-3**.

1.4.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-3.**

1.4.2 Natural Gas

The emission factors for natural gas usage are from the same source as described in the 2014 calculations.

1.4.2.1 PGE Residential

The same methodology is used as that for the 2014 inventory, except usage data from July through December 2015 is doubled to represent the 2015 inventory natural gas consumption. The locations of PGE residential gas accounts for the 2015 inventory, which are slightly different than for the 2014 inventory are shown in **Figure 1-4-2**. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.2 PGE Commercial

The same methodology is used as that for the 2014 inventory, except data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The locations of PGE commercial gas accounts for the 2015 inventory, which are slightly different than for the

Fall 2015 inventory are shown in **Figure 1-4-2**. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.3 PGE, Other Housing

The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.4 New CEF and Replacement Process Steam Plant

Natural gas throughput was provided for the new CEF and Replacement Process Steam Plant. Throughput from July through December 2015 is doubled to represent the 2015 inventory natural gas consumption. Emissions are summarized in **GHG Report Table 3-6-9.**

1.4.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-9**.

1.4.3 Mobile Sources

The same methodology, traffic data, and assumptions are used as that for the 2014 inventory. Emissions are summarized in **GHG Report Table 3-6-14.**

1.4.4 Emergency Generators

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **GHG Report Table 3-6-19.**

1.4.5 Waste

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 waste generation data is used. Emissions are summarized in **GHG Report Table 3-6-21.**

1.4.6 Water Use and Emissions

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except data for 2015 water and wastewater usage is used. Emissions are summarized in **GHG Report Table 3-6-26.**

1.4.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015. Emissions are shown in **GHG Report Table 3-2-1**.

1.5 Annual Operational Emissions: Fall 2018 Inventory

The Fall 2018 inventory is based on the assumption that the remaining 2000 GUP square footage is permitted by Fall 2018, with the exception of the Escondido Village Graduate Residences. The 2015 inventory emissions are based on all the buildings and residences constructed by December 2015. The electricity, gas, water, and waste consumption for Fall 2018 are assumed to increase proportionally with academic square footage, population, or number of residential beds, depending on sub-category. Electricity emission factors are updated to reflect Fall 2018 projections and the Stanford solar commitment. The mobile emissions are updated to account for fleet turnover and changes in VMT as described in **SB 743 VMT Analysis Appendix B1** prepared by Fehr & Peers.

1.5.1 Electricity

1.5.1.1 PGE Commercial

The PGE Commercial category includes a few buildings such as a research lab, the driving range, and a few single-family homes near Escondido Village. No changes in energy use are assumed from 2015 to Fall 2018. The PGE emission factor has been updated to reflect the California Public Utilities Commission (CPUC) projection for 2018.[27] Emissions are summarized in **GHG Report Table 3-6-4**.

1.5.1.2 Direct Access not Included with the Campus and New CEF

Direct access not associated with the campus and CEF is a small energy use category, so no changes are assumed for Fall 2018. Emissions calculations continue to use the eGRID 'current' (2014v2)[28] emission factor for WECC California, but incorporate an interpolation from 2014 to the 2020 requirement of 33 percent RPS. Emissions are summarized in **GHG Report Table 3-6-4**.

1.5.1.3 Campus and New CEF Consumption

The majority of growth in energy consumption between 2015 and Fall 2018 is assumed to occur in the campus and new CEF category. This category includes both academic buildings and on-campus residential energy consumption. Electricity consumption is assumed to linearly increase based on the total academic square footage increase. As shown in **GHG Report Table 3-6-4**, the square footage increase from December 2015 to Fall 2018 is 8%; this factor is applied to the 2015 inventory electricity use. Since new buildings must meet more stringent California building energy efficiency standards than older buildings, the energy demand of the new buildings on campus will be much lower than that of existing buildings. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

By Fall 2018, Stanford will procure approximately 159,000 MWh/year of electricity from its Kern County solar farm and an additional 7,300 MWh/year from on-campus rooftop solar installations. The emission factor in **GHG Report Table 3-6-4** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the eGRID 2018 projected emission factor for WECC California.

1.5.1.4 PGE, Other Housing

The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and electricity consumption per home remaining constant. The PGE emission factor has been updated to reflect the projection for 2018 on the path to achieving 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-4.**

1.5.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for 2015 inventory. The PGE emission factor has been updated to reflect the projection for 2018. Emissions are summarized in **GHG Report Table 3-6-4.**

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[27] https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

[28] https://www.epa.gov/energy/egrid-2014-summary-tables

1.5.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-4.**

1.5.2 Natural Gas

1.5.2.1 PGE Residential

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage per bed in 2015, scaled for the increase in beds from new graduate and undergraduate housing projects by Fall 2018 (4%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-10.**

1.5.2.2 PGE Commercial

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage to built-and-occupied academic GUP square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by Fall 2018. Six individual replacement boilers included in the 2015 inventory serve select locations that do not connect to the new CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-10.**

1.5.2.3 PGE, Other Housing

The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **GHG Report Table 3-6-10.**

1.5.2.4 New CEF and Replacement Process Steam Plant

The same methodology is used as that for the 2015 inventory. The throughput for the new CEF and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase by Fall 2018. Emissions are summarized in **GHG Report Table 3-6-10.**

1.5.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-5-10.**

1.5.3 Mobile Sources

1.5.3.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Number of trips and VMT for workers and residents are scaled up for Fall 2018 based on scaled values provided by Fehr & Peers. Values are scaled by increase in academic square footage or number of residents (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B1**. The methodology used to estimate emissions remained unchanged from the 2015 inventory.

1.5.3.2 Campus Fleet

No changes will be made to emissions estimates for the Public Safety fleet from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be assumed to be electric by Fall 2018, contributing zero GHG emissions. As described above, the additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for

charging electric vehicles. Additionally, to accommodate for growth, Marguerite VMT was scaled up by the remaining GUP square footage allocation to be used by 2018. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Emissions are summarized in **GHG Report Table 3-6-15**.

1.5.3.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2018, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B1**.

1.5.3.4 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix B1**. Emissions are shown in **GHG Report Table 3-6-15.**

1.5.4 Emergency Generators

Emergency generator usage for Fall 2018 is based on the ratio of generator usage to built-and-occupied academic square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by Fall 2018. The same emissions methodology is used as that for the 2014 and 2015 inventories. Emissions are summarized in **GHG Report Table 3-6-19.**

1.5.5 Waste

The total disposal data from Stanford includes waste generation from academic buildings, on-campus residents, and faculty/staff housing. Waste generation is assumed to linearly increase based on the total academic square footage increase between 2015 and Fall 2018. The solid waste diversion rate is assumed to remain constant. As shown in **GHG Report Table 3-6-22**, the square footage increase from December 2015 to Fall 2018 is 8%; so the waste generation increases by 8% over that reported in the 2015 inventory. There is no new faculty/staff housing proposed between 2015 and Fall 2018.

1.5.6 Water Use and Emissions

Fall 2018 water use is based on 2015 water use plus increases on a gallons/bed/day and gallons/sqft/day basis from the October 2016 Stanford Water Supply Assessment (WSA) Report. These water use rates are conservatively calculated as pre-drought use rates. The calculation results in approximately 6% increase in total potable water consumption, which is assumed to result in a 6% increase in wastewater production. Total water use for this inventory is lower than shown in the WSA because it does not include the 899 faculty/staff houses outside the study area. The same emissions methodology is used as that for the 2014 and 2015 inventories. Emissions are summarized in **GHG Report Table 3-6-27.**

1.5.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015 Emissions are shown in **GHG Report Table 3-2-1**.

1.6 Annual Operational Emissions: Fall 2020 Inventory

1.6.1 Electricity

The Fall 2020 inventory electricity consumption is based on the Fall 2018 inventory, with additional electricity consumption calculated for the new Escondido Village Graduate Residences. This annual electricity use is based on the CalEEMod® 2013.2.2 default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). Electricity intensity factors have also been updated.

1.6.1.1 PGE Commercial

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.2 Direct Access

The same consumption is used as the Fall 2018 inventory, except the electricity intensity factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5.**

1.6.1.3 Campus and New CEF Consumption

The same consumption is used as the Fall 2018 inventory, with additions due to the new Escondido Village Graduate Residences. This annual electricity use is based on the CalEEMod® 2013.2.2 default for mid-rise apartments built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5.**

1.6.1.4 PGE, Other Housing

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.5 Commercial Non-Stanford

The same consumption is used as the Fall 2018 inventory, except the electricity intenstiy factor has been updated to reflect 33% RPS in 2020. Emissions are summarized in **GHG Report Table 3-6-5**.

1.6.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-5.**

1.6.2 Natural Gas

The emission factors for natural gas usage are from the same source as described in the Fall 2018 calculations.

1.6.2.1 PGE Residential

The same methodology is used as that for the Fall 2018 inventory, except the natural gas consumption is scaled up by the number of new beds due to the Escondido Village Graduate Residences. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.2 PGE Commercial

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.3 PGE, Other Housing

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.4 New CEF and Replacement Process Steam Plant

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-11.**

1.6.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-11**.

1.6.3 Mobile Sources

The same methodology, traffic data, and assumptions are used as that for the Fall 2018 inventory, except that the worker and resident VMT have been updated per **Fehr & Peers Appendix B2** to incorporate changes due to the new Escondido Village Graduate Residences. Mobile emission factors have been updated to reflect the 2020 calendar year. Emissions are summarized in **GHG Report Table 3-6-16.**

1.6.4 Emergency Generators

The same consumption is used as the Fall 2018 inventory. Emissions are summarized in **GHG Report Table 3-6-19.**

1.6.5 Waste

The Fall 2020 inventory waste emissions are based on the Fall 2018 inventory, with additional waste disposal calculated for the new Escondido Village Graduate Residences. Waste generated by the new residents is based on the CalEEMod® 2013.2.2 default for mid-rise apartments. The diversion rate is assumed to remain constant from the 2015 rate. Emissions are summarized in **GHG Report Table 3-6-23.**

1.6.6 Water Use and Emissions

The Fall 2020 inventory water and wastewater use are based on the Fall 2018 inventory, with additional water use calculated for the new Escondido Village Graduate Residences on a per-bed basis based on the consumption in the WSA. The 2020 PGE electricity intensity factor is incorporated. Emissions are summarized in **GHG Report Table 3-6-28.**

1.6.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene combustion as well as the HFCs used in fire suppression in 2015. Emissions are shown in GHG Report **Table 3-2-1**.

1.7 Annual Operational Emissions: Fall 2035 (Project) Inventory

1.7.1 Electricity

1.7.1.1 PGE Commercial

The PGE Commercial category includes a few buildings such as a research lab, the driving range, and a few single-family homes near Escondido Village. This category is small with respect to total campus electricity use. No changes in energy use are assumed from Fall 2020 to Fall 2035. The PGE emission factor has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030.[29] The derivation of the emission factor is shown in **GHG Report Table 3-5-1**. Emissions are summarized in **GHG Report Table 3-6-6a**.

1.7.1.2 Direct Access not Included with the Campus and New CEF

Direct access not associated with the campus and CEF is a small energy use category, so no changes are assumed for Fall 2035. The Direct access emission factor is based on achieving 50% RPS in 2030 consistent with SB 350 and SB 32. See **GHG Report Table 3-5-1** for derivation. A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category. Emissions are summarized in **GHG Report Table 3-6-6a**.

1.7.1.3 Campus and CEF Consumption

The majority of growth in electricity consumption between Fall2020 and Fall 2035 is assumed to occur in the campus and CEF category. This category includes both academic buildings and on-campus residential energy consumption. Since the majority of electricity consumption within the study area is within the Campus and CEF Consumption category, all increases are assigned to this category, with no expected changes in electricity use for the other providers, except for the additional faculty/staff housing added separately. Electricity consumption is assumed to linearly increase based on the total academic square footage increase. As shown in **GHG Report Table 3-6-6a**, the square footage increase from Fall 2020 to Fall 2035 is 22%; this factor is applied to the Fall 2020 inventory electricity use. Since new buildings must meet more stringent California building energy efficiency standards than older buildings, the energy demand of the new buildings on campus will be much lower than that of existing buildings, making this a conservative scaling assumption. This additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles.

Just as in the Fall 2018 and Fall 2020 inventories, this category accounts for electricity provided by Stanford's Solar Generation Farm and on-campus solar panels. The emission factor in **GHG Report Table 3-6-6** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the WECC California emission factor adjusted for achieving 50% RPS in 2030 consistent with SB 350 and SB 32.

[29] http://www.energy.ca.gov/sb350/

1.7.1.4 PGE, Other Housing

No changes in electricity use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® 2013.2.2 default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high-density homes are to be constructed within the study boundary by 2035. The annual electricity use is based on the CalEEMod® 2013.2.2 default for the "condo/townhouse" category built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **GHG Report Table 3-6-6a**. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24 standards.

The PGE emission factor for both housing categories listed above has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030. Emissions are summarized in **GHG Report Table 3-6-6a.**

1.7.1.5 Commercial Non-Stanford

The same electricity consumption is assumed as that for Fall 2020 inventory. The PGE emission factor has been updated to reflect the California SB 350/SB 32 mandate that providers achieve 50% of electricity from renewables by 2030. Emissions are summarized in **GHG Report Table 3-6-6a.**

1.7.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-6a.**

1.7.2 Natural Gas

1.7.2.1 PGE Residential

Natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2020 to full buildout of the 2018 GUP (an increase of 18%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the quantity of natural gas per bed remains constant. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-12.**

1.7.2.2 PGE Commercial

Natural gas usage for Fall 2035 is based on the percent increase in academic square footage from Fall 2020 to full buildout of the 2018 GUP (an increase of 22%). Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **GHG Report Table 3-6-12.**

1.7.2.3 PGE, Other Housing

No changes in natural gas use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® 2013.2.2 default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high-density homes are to be constructed within the study boundary by 2030. The annual natural gas use is based on the CalEEMod® 2013.2.2 default for the "condo/townhouse" category built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **GHG Report Table 3-6-12**. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

Emissions are summarized in **GHG Report Table 3-5-11.**

1.7.2.4 CEF and Replacement Process Steam Plant

The throughput for the CEF and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase from Fall 2020 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Emissions are summarized in **GHG Report Table 3-6-12.**

1.7.2.5 Emissions Summary

Natural gas consumption and emission factors are summarized in **GHG Report Table 3-6-12.**

1.7.3 Mobile Sources

1.7.3.1 Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **GHG Report Table 3-6-17**. Detailed emission factors and fleet breakdowns are shown in **GHG Report Appendix C.**

1.7.3.2 Campus Fleet

Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the Fall 2020 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the Fall 2020 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in Fall 2020 Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. As described above, the additional predicted increase in electricity consumption (which is likely overestimated due to using older Title 24 efficiency predictions) is assumed to incorporate any increase in electrical demand for charging electric vehicles. To accommodate for growth, Marguerite VMT is scaled up based on the percent increase in academic square footage from Fall 2020 to full buildout of the 2018 GUP (an increase of 22%).

Emissions due to electricity consumption from electric vehicles are assumed to be captured in the "Campus and CEF Consumption" electricity use category, as these EVs will constitute additional plug loads on campus. New buildings will be much more energy-efficient than existing buildings due to increasingly stringent building codes, so if not for additional plug loads due to EV charging, the electricity consumption in **GHG Report Table 3-6-6** would

likely be overestimated. Emission factors for operational year 2030 are used. Emissions are summarized in **GHG Report Table 3-6-17**.

1.7.3.3 Visitors

Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**.

1.7.3.4 Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix C**. Emissions are shown in **GHG Report Table 3-6-17.** Since EMFAC2014 does not incorporate the GHG benefits of the NHTSA Phase 2 regulation, emissions for medium- and heavy-duty vehicles are overestimated for the 2035 operational year.

1.7.4 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2020 to the buildout of the 2018 GUP (a 22% increase). Emissions are summarized in **GHG Report Table 3-6-19.**

1.7.5 Waste

The total disposal data from Stanford includes waste generation from academic buildings, on-campus residents, and faculty/staff housing. Waste generation is assumed to linearly increase based on the increase in academic square footage expected from Fall 2020 to full buildout of the 2018 GUP. Waste associated with the new faculty/staff housing is added based on the 2015 per-house waste disposal rates. Waste disposal is assumed to scale linearly; i.e., disposal rates in new buildings is assumed equal to current buildings. The diversion rate is assumed to remain constant from 2015, even though diversion rate statewide is expected to increase by 2035. Emissions are summarized in **GHG Report Table 3-6-23.**

1.7.6 Water Use and Emissions

Fall 2035 water use rates are from the April 2017 Stanford Water Supply Assessment, which were based on pre-drought water use rates per undergraduate and graduate bed, academic building square foot, and faculty and staff residence. These water use rates in million gallons per day (Mgal/day) are multiplied by 365 days to result in the totals in Mgal/yr for the incremental increase in water consumption from Fall 2020 to Fall 2035. Consistent with the existing inventories, total water consumption is lower in the GHG Report than in the Water Supply Assessment, because the WSA includes water use from the 899 faculty and staff houses not included in the study area. Ramboll Environ assumes wastewater (sewer water) will increase at the same overall rate as domestic water use.

Emissions from domestic water use and wastewater treatment are summarized in **GHG Report Table 3-6-29a.**

1.7.7 Miscellaneous GHG sources

In addition to the main inventory items described above, miscellaneous GHG sources were also added based on Stanford Office of Sustainability estimates for propane and acetylene

combustion as well as the HFCs used in fire suppression in 2035. Emissions are shown in **GHG Report Table 3-2-1**.

1.8 Annual Operational Emissions: Fall 2035 (Project) with RPS Projection Inventory

The Fall 2035 with RPS Projection inventory mirrors the Fall 2035 inventory with the exception of the electricity emission factors, affecting the electricity and water/wastewater category emissions as discussed below.

1.8.1 Electricity

1.8.1.1 PGE Commercial

PGE Commercial electricity usage (in MWh) is consistent with the Fall 2035 inventory.

The PGE emission factor has been updated based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050. This is consistent with the CARB Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan[30], and results in 57.5% of electricity from renewables by 2035. The derivation of the emission factor is shown in **GHG Report Table 3-5-1**. Emissions are summarized in **GHG Report Table 3-6-6b**.

1.8.1.2 Direct Access not Included with the Campus and New CEF

Direct access electricity usage (in MWh) is consistent with the Fall 2035 inventory.

The Direct access emission factor is based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of electricity from renewables by 2035. See **GHG Report Table 3-5-1** for derivation. A portion of Stanford's Direct Access electricity will actually be net metered with on-campus solar generation, but for simplicity this adjustment has been reflected in the Campus and CEF Consumption category. Emissions are summarized in **GHG Report Table 3-6-6b**.

1.8.1.3 Campus and CEF Consumption

The Campus and CEF electricity usage (in MWh) is consistent with the Fall 2035 inventory.

Just as in the Fall 2018, Fall 2020, and Fall 2035 inventories, this category accounts for electricity provided by Stanford’s Solar Generation Farm and on-campus solar panels. The emission factor in **GHG Report Table 3-6-6b** incorporates the 166,300 MWh/year of solar electricity with zero GHG emissions and the remainder with the WECC California emission factor adjusted for achieving 57.5% RPS in 2035, based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels.

1.8.1.4 PGE, Other Housing

PGE electricity use (in MWh) for Other Housing is consistent with the Fall 2035 inventory.

The PGE emission factor for both the Searsville/Olmstead housing units and the new faculty/staff high-density homes has been updated to reflect a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of

[30] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

electricity from renewables by 2035. Emissions are summarized in **GHG Report Table 3-6-6b.**

1.8.1.5 Commercial Non-Stanford

Commercial Non-Stanford electricity use (in MWh) is consistent with the Fall 2035 inventory.

The PGE emission factor has been updated to reflect a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, resulting in 57.5% of electricity from renewables by 2035. Emissions are summarized in **GHG Report Table 3-6-6b.**

1.8.1.6 Emissions Summary

Electricity consumption and emission factors are summarized in **GHG Report Table 3-6-6b.**

1.8.2 Water Use and Emissions

Waster use rates are consistent with the Fall 2035 inventory.

The electricity emission factor has been updated consistent with the update described in **Section 1.8.1.1** above.

Emissions from domestic water use and wastewater treatment are summarized in **GHG Report Table 3-6-29b.**

2. GHG INVENTORIES IN CONTEXT

This section compares the three existing conditions inventories and one Project inventory.

2.1 2014 Inventory

The site emitted approximately 222,069 $MTCO_2e$ per year in 2014 (see **GHG Report Table 3-2-1**). The dominant emissions sources were the Cardinal Cogen and transportation, which contributed 67% and 25% of the total inventory, respectively.

2.2 2015 Inventory

The site emitted approximately 166,924 $MTCO_2e$ per year in 2015 (see **GHG Report Table 3-2-1**). The dominant emissions sources were transportation and electricity imported to campus, which contributed 45% and 33% of the total inventory, respectively. The reduction compared to 2014 primarily is due to completion of the SESI.

2.3 Fall 2018 Inventory

The site is expected to emit approximately 125,672 $MTCO_2e$ per year in Fall 2018 prior to commencement of the proposed 2018 General Use Permit (see **GHG Report Table 3-2-1)**. The dominant emissions sources are transportation and electricity imported to campus, which contributed 42% and 27% of the total inventory, respectively. The reduction compared to 2015 primarily is due to operation of the Stanford Solar Generating Station.

2.4 Fall 2020 Inventory

The site is expected to emit approximately 124,525 $MTCO_2e$ per year in Fall 2020 (see **GHG Report Table 3-2-1)**. The dominant emissions sources are transportation and electricity imported to campus, which contributed 43% and 27% of the total inventory, respectively. The slight decrease in emissions compared to Fall 2018 is due to the addition of the Escondido Village Graduate Residences that reduces graduate student mobile trips coupled with a decrease in electricity and mobile emission factors.

2.5 Fall 2035 Inventory

The site is expected to emit approximately 125,412 $MTCO_2e$ per year in Fall 2035 (see **GHG Report Table 3-2-1)**. The dominant emissions sources are almost evenly transportation, electricity imported to campus, and natural gas which contributed 34%, 30%, and 30% of the total inventory, respectively.

2.6 Fall 2035 with RPS Projection Inventory

Emissions for a second Fall 2035 scenario ("Fall 2035 with RPS Projection") are calculated to represent a reasonable estimate of 2035 Project emissions as the electricity grid continues to incorporate additional renewables after 2030. The electricity intensity factor for the Fall 2035 with RPS Projection inventory is derived based on a linear trajectory for electricity to meet California's 2050 GHG goal of 80% below 1990 levels, assuming the State will similarly achieve 80% RPS by 2050.[31] This linear trajectory would require 57.5 percent of electricity to come from renewable sources in 2035. As shown in **Table 3-2-1**, the site is expected to

[31] CARB. 2016. Discussion Draft for the 2030 Target Scoping Plan Update Draft Scoping Plan, Scenario & Alternatives Modeling Description, pg 11 (December 1). Available at: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_scenario_description2016-12-01.pdf

emit approximately 119,875 $MTCO_2e$ per year in Fall 2035 after incorporating the 2035 RPS projection**.**

2.7 Summary

A category-by-category comparison of emissions between the three existing conditions inventories is shown in **GHG Report Table 3-2-1.** Even with growth in population and building square footage, total mass emissions of GHGs decrease significantly from 2014 to 2015 to Fall 2018. The decrease from 2014 to 2015 is due to the changes in electricity and gas consumption due to SESI, and the continued decrease through Fall 2018 and Fall 2020 are due to the Stanford Solar Generating Station and the cleaner PGE electricity. The relatively flat GHG level from Fall 2020 to Fall 2035, despite campus growth, is primarily due to the cleaner electricity and cleaner mobile vehicles. As described in GHG Report Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the electricity intensity factor, mobile emission factors, and other GHG sources are expected to continue to decrease after 2030 to meet California's long-term GHG reduction goals. As shown in the Fall 2035 with RPS Projection scenario, incorporating a reasonable estimate of the electricity intensity factor in 2035 further decreases GHG emissions. The Project would not result in a net increase in campus-wide GHG emissions from the baseline year of 2018 through full build out of the 2018 General Use Permit in 2035.

FIGURES

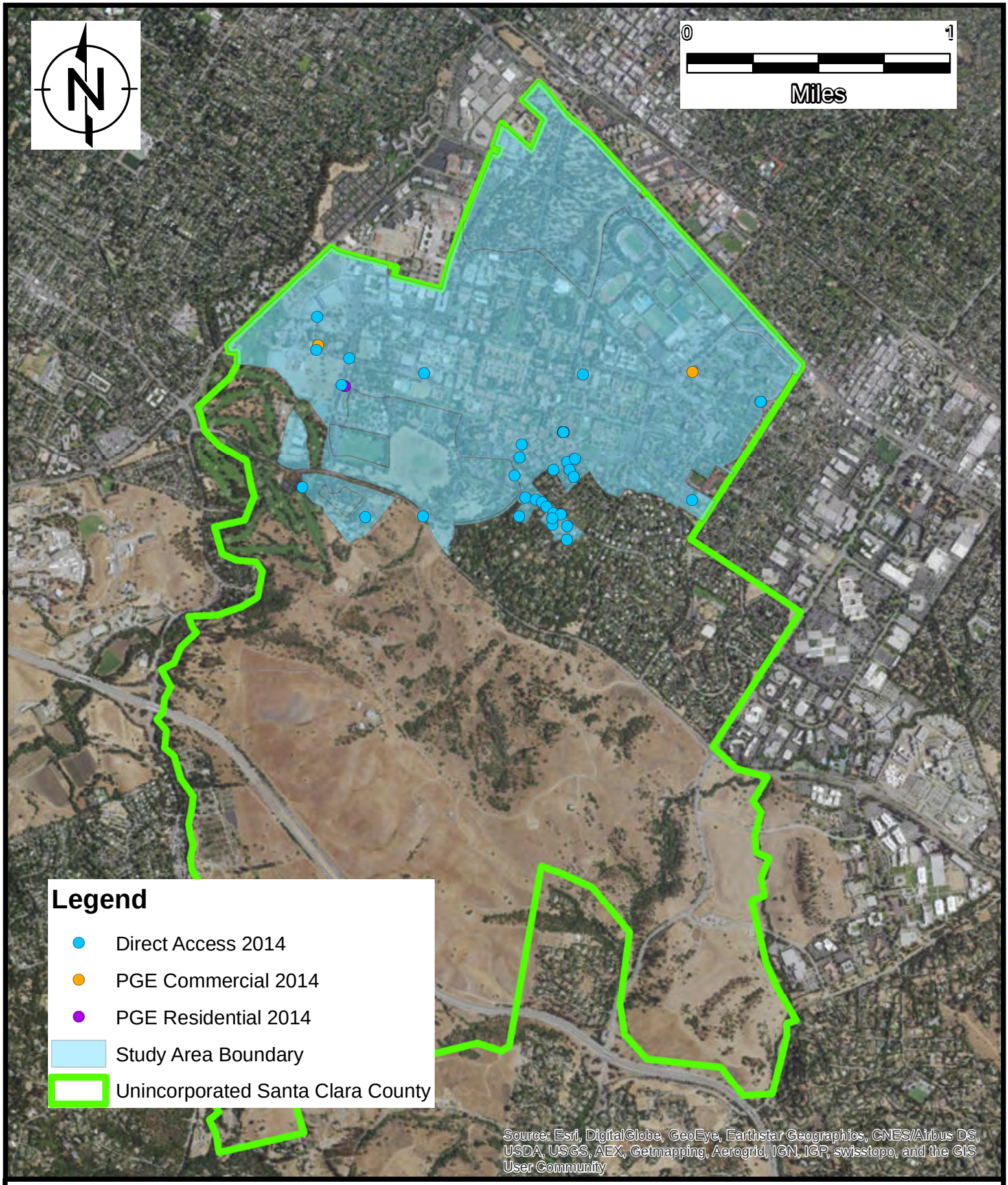

Figure 1-3-1 2014 Electricity Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

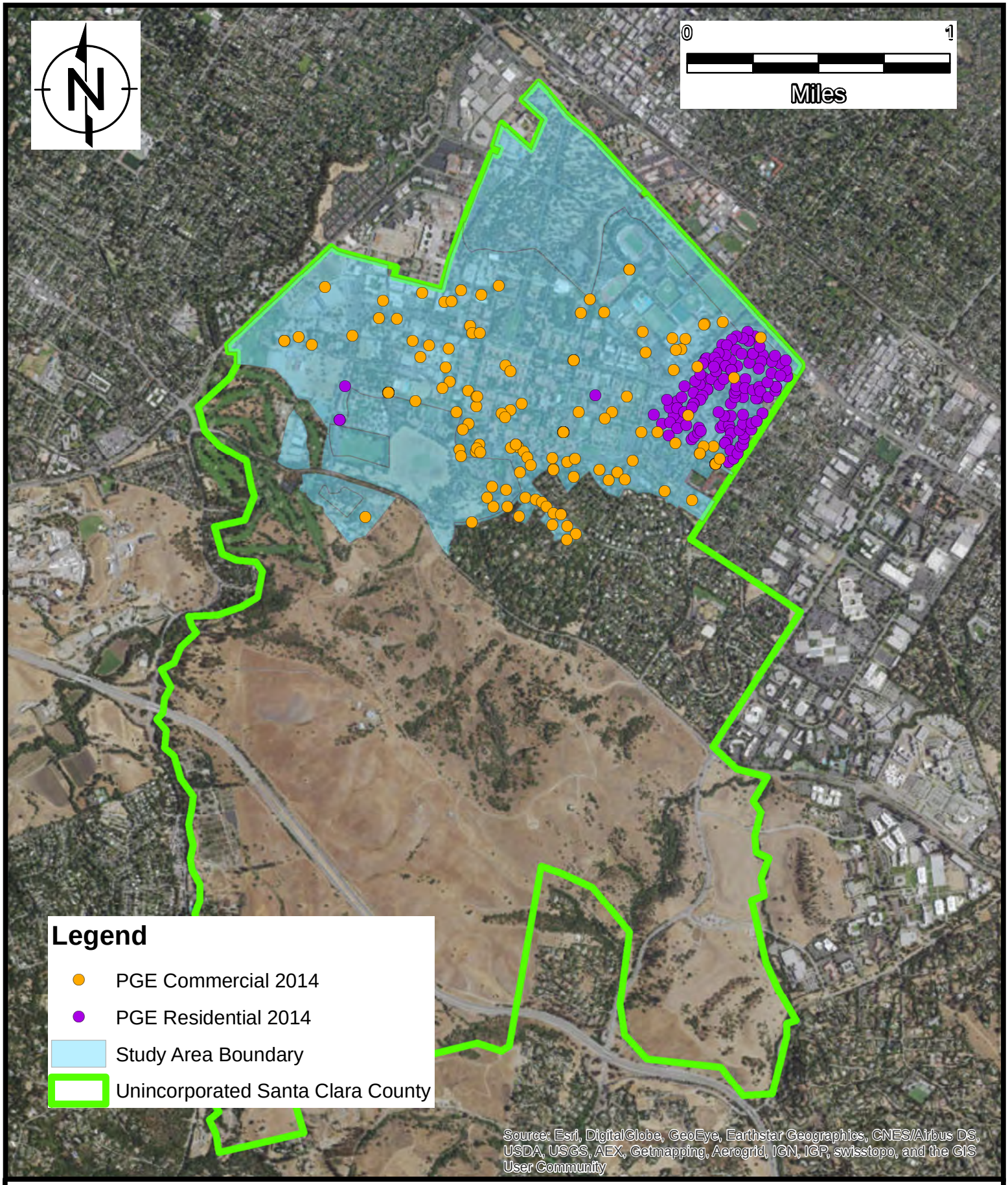

Figure 1-3-2 2014 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

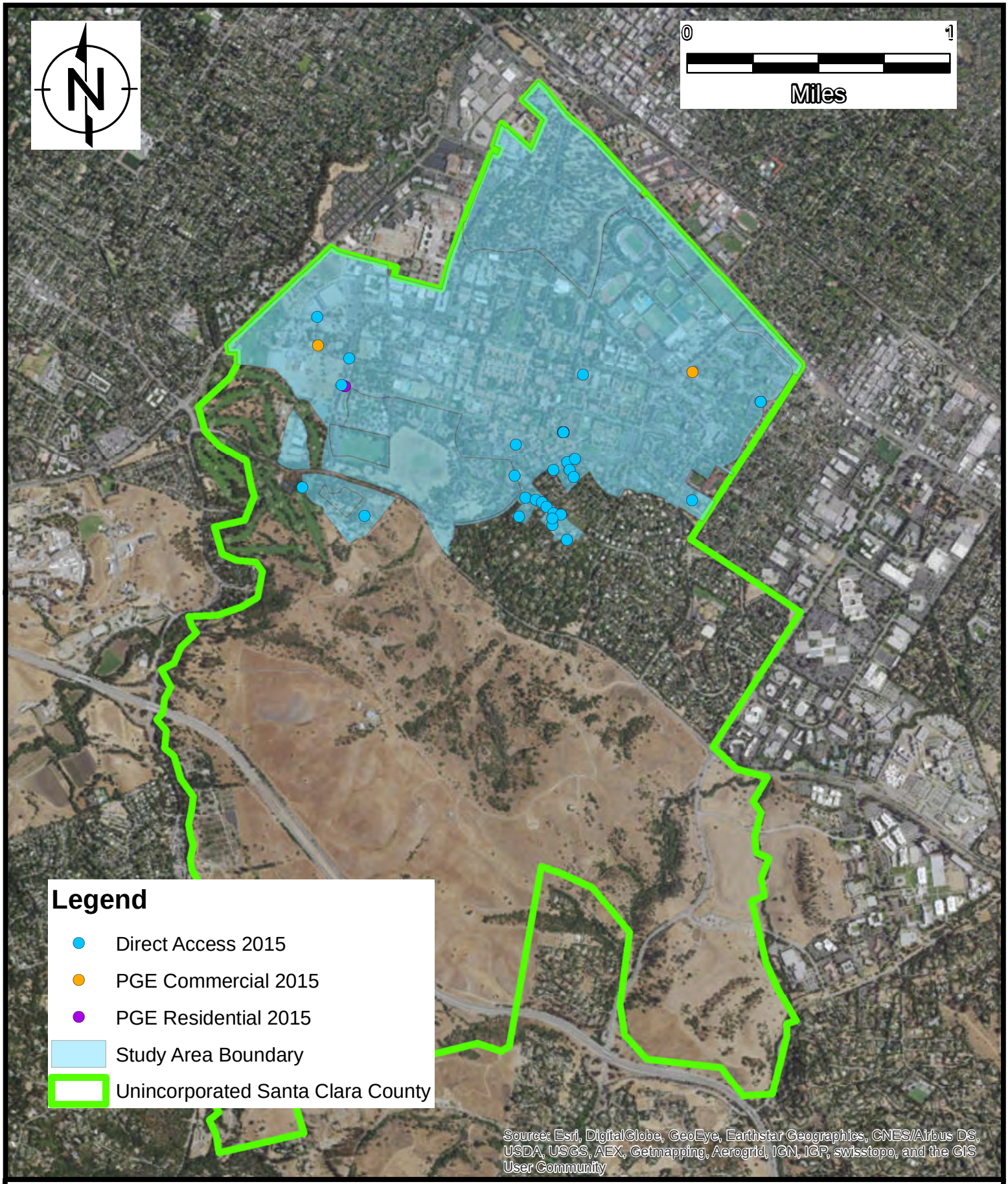

Figure 1-4-1 2015 Electricity Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

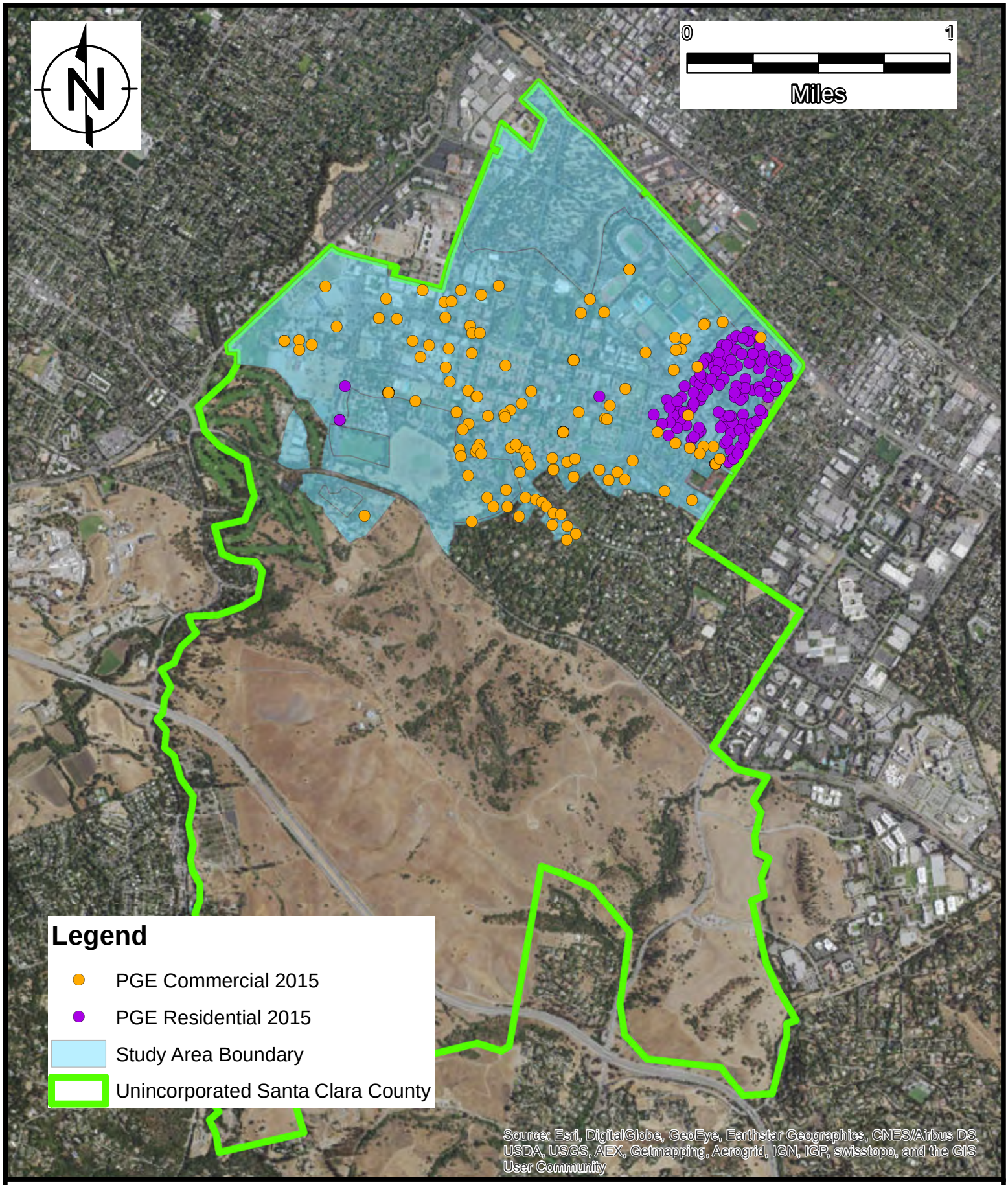

Figure 1-4-2 2015 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

APPENDIX B
CALEEMOD® CONSTRUCTION OUTPUT FILES

Table B-1. CalEEMod® Model Outputs Descriptions
Stanford University
Stanford, California

Construction CalEEMod® Runs	
Output	**Scenario**
2014 Average Output	2014 Annual Average Off-Road Construction Emissions
2015 Average Output	2015 Annual Average Off-Road Construction Emissions
2018 Average Output	2018 Annual Average Off-Road Construction Emissions
2020 Average Output	2020 Annual Average Off-Road Construction Emissions
2030 Average Output	2030 Annual Average Off-Road Construction Emissions

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

Stanford Construction/Demolition, Average Year (2014)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2014. Made schedule fit in 1 year

Trips and VMT - Worker/vendor trips already captured in other mobile emissions calcs. - Hauling trips also captured in mobile emission calcs

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/6/2014	12/31/2014
tblConstructionPhase	PhaseEndDate	1/13/2015	12/31/2014
tblConstructionPhase	PhaseEndDate	1/14/2015	3/11/2014
tblConstructionPhase	PhaseStartDate	4/9/2014	12/4/2014
tblConstructionPhase	PhaseStartDate	2/26/2014	2/13/2014
tblConstructionPhase	PhaseStartDate	1/1/2015	2/26/2014

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

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

Year	tons/yr										MT/yr					
2014	1.7598	5.0773	3.1910	4.2300e-003	0.1841	0.3379	0.5220	0.0876	0.3168	0.4045	0.0000	391.9506	391.9506	0.1028	0.0000	394.1099
Total	**1.7598**	**5.0773**	**3.1910**	**4.2300e-003**	**0.1841**	**0.3379**	**0.5220**	**0.0876**	**0.3168**	**0.4045**	**0.0000**	**391.9506**	**391.9506**	**0.1028**	**0.0000**	**394.1099**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.2552	0.6161	2.7110	4.2300e-003	0.1841	0.0249	0.2090	0.0876	0.0237	0.1113	0.0000	391.9502	391.9502	0.1028	0.0000	394.1095
Total	**1.2552**	**0.6161**	**2.7110**	**4.2300e-003**	**0.1841**	**0.0249**	**0.2090**	**0.0876**	**0.0237**	**0.1113**	**0.0000**	**391.9502**	**391.9502**	**0.1028**	**0.0000**	**394.1095**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**28.67**	**87.87**	**15.04**	**0.00**	**0.00**	**92.64**	**59.96**	**0.00**	**92.51**	**72.48**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

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

Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

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

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/28/2014	5	20	
2	Paving	Paving	1/29/2014	2/25/2014	5	20	
3	Building Construction	Building Construction	2/13/2014	12/31/2014	5	230	
4	Site Preparation	Site Preparation	2/26/2014	3/11/2014	5	10	
5	Grading	Grading	3/12/2014	4/8/2014	5	20	
6	Architectural Coating	Architectural Coating	12/4/2014	12/31/2014	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0460	0.4954	0.3629	4.0000e-004		0.0253	0.0253		0.0236	0.0236	0.0000	37.7760	37.7760	0.0102	0.0000	37.9903

Total	**0.0460**	**0.4954**	**0.3629**	**4.0000e-004**	**0.0248**	**0.0253**	**0.0500**	**3.7500e-003**	**0.0236**	**0.0273**	**0.0000**	**37.7760**	**37.7760**	**0.0102**	**0.0000**	**37.9903**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0119	0.0716	0.2380	4.0000e-004		4.8500e-003	4.8500e-003		4.8500e-003	4.8500e-003	0.0000	37.7759	37.7759	0.0102	0.0000	37.9903
Total	**0.0119**	**0.0716**	**0.2380**	**4.0000e-004**	**0.0248**	**4.8500e-003**	**0.0296**	**3.7500e-003**	**4.8500e-003**	**8.6000e-003**	**0.0000**	**37.7759**	**37.7759**	**0.0102**	**0.0000**	**37.9903**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Unmitigated Construction Off-Site

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

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4448	3.5942	2.1769	3.0900e-003		0.2562	0.2562		0.2412	0.2412	0.0000	282.6403	282.6403	0.0719	0.0000	284.1495
Total	**0.4448**	**3.5942**	**2.1769**	**3.0900e-003**		**0.2562**	**0.2562**		**0.2412**	**0.2412**	**0.0000**	**282.6403**	**282.6403**	**0.0719**	**0.0000**	**284.1495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0900e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	282.6400	282.6400	0.0719	0.0000	284.1492
Total	**0.0376**	**0.2563**	**2.0023**	**3.0900e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**282.6400**	**282.6400**	**0.0719**	**0.0000**	**284.1492**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Site Preparation - 2014

Unmitigated Construction On-Site

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

Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2881	0.2148	2.0000e-004		0.0157	0.0157		0.0144	0.0144	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**0.0265**	**0.2881**	**0.2148**	**2.0000e-004**	**0.0903**	**0.0157**	**0.1060**	**0.0497**	**0.0144**	**0.0641**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.4110	0.2675	3.0000e-004		0.0237	0.0237		0.0218	0.0218	0.0000	28.6891	28.6891	8.4800e-003	0.0000	28.8671
Total	**0.0387**	**0.4110**	**0.2675**	**3.0000e-004**	**0.0690**	**0.0237**	**0.0927**	**0.0342**	**0.0218**	**0.0560**	**0.0000**	**28.6891**	**28.6891**	**8.4800e-003**	**0.0000**	**28.8671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.6890	28.6890	8.4800e-003	0.0000	28.8671
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.6890**	**28.6890**	**8.4800e-003**	**0.0000**	**28.8671**

Mitigated Construction Off-Site

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

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4600e-003	0.0278	0.0192	3.0000e-005		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1803**	**0.0278**	**0.0192**	**3.0000e-005**		**2.4500e-003**	**2.4500e-003**		**2.4500e-003**	**2.4500e-003**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

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

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058138	0.185246	0.125281	0.029961	0.004506	0.012317	0.020953	0.001764	0.001280	0.005920	0.000536	0.001765

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

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

5.2 Energy by Land Use - NaturalGas

Unmitigated

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

Mitigated

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

Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Unmitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

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

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

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

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2015)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2015
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2015. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseEndDate	2/24/2015	2/23/2015
tblConstructionPhase	PhaseEndDate	3/9/2015	2/10/2015
tblConstructionPhase	PhaseStartDate	12/30/2015	12/2/2015
tblConstructionPhase	PhaseStartDate	3/11/2015	2/11/2015
tblConstructionPhase	PhaseStartDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseStartDate	2/24/2015	1/28/2015
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2015

tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.7313	4.8790	3.1470	4.2100e-003	0.1829	0.3218	0.5047	0.0874	0.3015	0.3889	0.0000	386.9797	386.9797	0.1008	0.0000	389.0955
Total	**1.7313**	**4.8790**	**3.1470**	**4.2100e-003**	**0.1829**	**0.3218**	**0.5047**	**0.0874**	**0.3015**	**0.3889**	**0.0000**	**386.9797**	**386.9797**	**0.1008**	**0.0000**	**389.0955**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.2535	0.5998	2.6990	4.2100e-003	0.1829	0.0239	0.2068	0.0874	0.0227	0.1102	0.0000	386.9792	386.9792	0.1008	0.0000	389.0951
Total	**1.2535**	**0.5998**	**2.6990**	**4.2100e-003**	**0.1829**	**0.0239**	**0.2068**	**0.0874**	**0.0227**	**0.1102**	**0.0000**	**386.9792**	**386.9792**	**0.1008**	**0.0000**	**389.0951**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**27.60**	**87.71**	**14.24**	**0.00**	**0.00**	**92.59**	**59.03**	**0.00**	**92.46**	**71.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

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

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	1/27/2015	5	20	
2	Paving	Paving	1/27/2015	2/23/2015	5	20	
3	Site Preparation	Site Preparation	1/28/2015	2/10/2015	5	10	
4	Grading	Grading	2/11/2015	3/10/2015	5	20	
5	Building Construction	Building Construction	2/11/2015	12/29/2015	5	230	
6	Architectural Coating	Architectural Coating	12/2/2015	12/29/2015	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0428	0.4595	0.3427	3.8000e-004		0.0233	0.0233		0.0217	0.0217	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0428**	**0.4595**	**0.3427**	**3.8000e-004**	**0.0235**	**0.0233**	**0.0468**	**3.5600e-003**	**0.0217**	**0.0253**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0107	0.0644	0.2258	3.8000e-004		4.2100e-003	4.2100e-003		4.2100e-003	4.2100e-003	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0107**	**0.0644**	**0.2258**	**3.8000e-004**	**0.0235**	**4.2100e-003**	**0.0277**	**3.5600e-003**	**4.2100e-003**	**7.7700e-003**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2845	0.2132	2.0000e-004		0.0154	0.0154		0.0142	0.0142	0.0000	18.6506	18.6506	5.5700e-003	0.0000	18.7675
Total	**0.0263**	**0.2845**	**0.2132**	**2.0000e-004**	**0.0903**	**0.0154**	**0.1058**	**0.0497**	**0.0142**	**0.0639**	**0.0000**	**18.6506**	**18.6506**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.6505	18.6505	5.5700e-003	0.0000	18.7675
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.6505**	**18.6505**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0383	0.4042	0.2667	3.0000e-004		0.0233	0.0233		0.0214	0.0214	0.0000	28.3860	28.3860	8.4700e-003	0.0000	28.5639
Total	**0.0383**	**0.4042**	**0.2667**	**3.0000e-004**	**0.0690**	**0.0233**	**0.0923**	**0.0342**	**0.0214**	**0.0556**	**0.0000**	**28.3860**	**28.3860**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.3859	28.3859	8.4700e-003	0.0000	28.5639
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.3859**	**28.3859**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4208	3.4534	2.1556	3.0800e-003		0.2434	0.2434		0.2289	0.2289	0.0000	280.5935	280.5935	0.0704	0.0000	282.0719
Total	**0.4208**	**3.4534**	**2.1556**	**3.0800e-003**		**0.2434**	**0.2434**		**0.2289**	**0.2289**	**0.0000**	**280.5935**	**280.5935**	**0.0704**	**0.0000**	**282.0719**

3.6 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	280.5932	280.5932	0.0704	0.0000	282.0716
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**280.5932**	**280.5932**	**0.0704**	**0.0000**	**282.0716**

3.6 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0700e-003	0.0257	0.0190	3.0000e-005		2.2100e-003	2.2100e-003		2.2100e-003	2.2100e-003	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1799**	**0.0257**	**0.0190**	**3.0000e-005**		**2.2100e-003**	**2.2100e-003**		**2.2100e-003**	**2.2100e-003**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

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

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552608	0.057937	0.185322	0.124470	0.029726	0.004465	0.012479	0.021685	0.001768	0.001276	0.005971	0.000530	0.001762

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

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

5.2 Energy by Land Use - NaturalGas

Unmitigated

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

5.2 Energy by Land Use - NaturalGas

Mitigated

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

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Unmitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

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

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

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

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2018)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2018. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/4/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	4/6/2018
tblConstructionPhase	PhaseStartDate	4/7/2018	12/2/2018
tblConstructionPhase	PhaseStartDate	3/10/2018	2/10/2018
tblConstructionPhase	PhaseStartDate	12/29/2018	3/10/2018

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.5889	3.7737	2.9182	4.2300e-003	0.1841	0.2299	0.4140	0.0876	0.2153	0.3029	0.0000	376.3667	376.3667	0.0972	0.0000	378.4085
Total	**1.5889**	**3.7737**	**2.9182**	**4.2300e-003**	**0.1841**	**0.2299**	**0.4140**	**0.0876**	**0.2153**	**0.3029**	**0.0000**	**376.3667**	**376.3667**	**0.0972**	**0.0000**	**378.4085**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.2451	0.5122	2.7052	4.2300e-003	0.1841	0.0181	0.2022	0.0876	0.0174	0.1050	0.0000	376.3663	376.3663	0.0972	0.0000	378.4080
Total	**1.2451**	**0.5122**	**2.7052**	**4.2300e-003**	**0.1841**	**0.0181**	**0.2022**	**0.0876**	**0.0174**	**0.1050**	**0.0000**	**376.3663**	**376.3663**	**0.0972**	**0.0000**	**378.4080**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**21.64**	**86.43**	**7.30**	**0.00**	**0.00**	**92.12**	**51.15**	**0.00**	**91.93**	**65.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

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

Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

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

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
3	Grading	Grading	2/10/2018	3/9/2018	5	20	
4	Building Construction	Building Construction	2/10/2018	12/28/2018	5	230	
5	Paving	Paving	3/10/2018	4/6/2018	5	20	
6	Architectural Coating	Architectural Coating	12/2/2018	12/28/2018	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Pavers	2	8.00	125	0.42

Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2018

Unmitigated Construction On-Site

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

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0356	0.3683	0.3173	4.0000e-004		0.0181	0.0181		0.0169	0.0169	0.0000	36.1362	36.1362	9.9900e-003	0.0000	36.3460
Total	**0.0356**	**0.3683**	**0.3173**	**4.0000e-004**	**0.0248**	**0.0181**	**0.0429**	**3.7500e-003**	**0.0169**	**0.0206**	**0.0000**	**36.1362**	**36.1362**	**9.9900e-003**	**0.0000**	**36.3460**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3100e-003	0.0570	0.2369	4.0000e-004		3.2200e-003	3.2200e-003		3.2200e-003	3.2200e-003	0.0000	36.1361	36.1361	9.9900e-003	0.0000	36.3459
Total	**9.3100e-003**	**0.0570**	**0.2369**	**4.0000e-004**	**0.0248**	**3.2200e-003**	**0.0280**	**3.7500e-003**	**3.2200e-003**	**6.9700e-003**	**0.0000**	**36.1361**	**36.1361**	**9.9900e-003**	**0.0000**	**36.3459**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0215	0.2280	0.1812	2.0000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**0.0215**	**0.2280**	**0.1812**	**2.0000e-004**	**0.0903**	**0.0118**	**0.1022**	**0.0497**	**0.0109**	**0.0605**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Mitigated Construction Off-Site

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

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0300	0.3107	0.2400	3.0000e-004		0.0172	0.0172		0.0158	0.0158	0.0000	27.1530	27.1530	8.4500e-003	0.0000	27.3305
Total	**0.0300**	**0.3107**	**0.2400**	**3.0000e-004**	**0.0690**	**0.0172**	**0.0862**	**0.0342**	**0.0158**	**0.0500**	**0.0000**	**27.1530**	**27.1530**	**8.4500e-003**	**0.0000**	**27.3305**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	27.1529	27.1529	8.4500e-003	0.0000	27.3304
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**27.1529**	**27.1529**	**8.4500e-003**	**0.0000**	**27.3304**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.6750	2.0163	3.0800e-003		0.1718	0.1718		0.1616	0.1616	0.0000	272.2851	272.2851	0.0666	0.0000	273.6844
Total	**0.3069**	**2.6750**	**2.0163**	**3.0800e-003**		**0.1718**	**0.1718**		**0.1616**	**0.1616**	**0.0000**	**272.2851**	**272.2851**	**0.0666**	**0.0000**	**273.6844**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	272.2848	272.2848	0.0666	0.0000	273.6841

Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**272.2848**	**272.2848**	**0.0666**	**0.0000**	**273.6841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Mitigated Construction Off-Site

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

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.9900e-003	0.0201	0.0185	3.0000e-005		1.5100e-003	1.5100e-003		1.5100e-003	1.5100e-003	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1788**	**0.0201**	**0.0185**	**3.0000e-005**		**1.5100e-003**	**1.5100e-003**		**1.5100e-003**	**1.5100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Unmitigated Construction Off-Site

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

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

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

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

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

5.2 Energy by Land Use - NaturalGas

Unmitigated

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

Mitigated

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

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

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

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2020)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2020. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2021	12/29/2020
tblConstructionPhase	PhaseEndDate	12/29/2020	12/28/2020
tblConstructionPhase	PhaseEndDate	1/25/2021	3/10/2020
tblConstructionPhase	PhaseEndDate	4/7/2020	12/29/2020
tblConstructionPhase	PhaseStartDate	12/30/2020	12/2/2020
tblConstructionPhase	PhaseStartDate	2/12/2020	2/11/2020

tblConstructionPhase	PhaseStartDate	12/29/2020	2/12/2020
tblConstructionPhase	PhaseStartDate	3/11/2020	12/2/2020
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2020
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	1.5095	3.1128	2.7824	4.2300e-003	0.1841	0.1748	0.3589	0.0876	0.1636	0.2512	0.0000	365.7192	365.7192	0.0951	0.0000	367.7161
Total	**1.5095**	**3.1128**	**2.7824**	**4.2300e-003**	**0.1841**	**0.1748**	**0.3589**	**0.0876**	**0.1636**	**0.2512**	**0.0000**	**365.7192**	**365.7192**	**0.0951**	**0.0000**	**367.7161**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	1.2412	0.4723	2.7034	4.2300e-003	0.1841	0.0154	0.1996	0.0876	0.0148	0.1025	0.0000	365.7188	365.7188	0.0951	0.0000	367.7157
Total	**1.2412**	**0.4723**	**2.7034**	**4.2300e-003**	**0.1841**	**0.0154**	**0.1996**	**0.0876**	**0.0148**	**0.1025**	**0.0000**	**365.7188**	**365.7188**	**0.0951**	**0.0000**	**367.7157**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**17.77**	**84.83**	**2.84**	**0.00**	**0.00**	**91.17**	**44.40**	**0.00**	**90.93**	**59.22**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

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

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2020	1/28/2020	5	20	
2	Site Preparation	Site Preparation	1/29/2020	2/11/2020	5	10	
3	Building Construction	Building Construction	2/11/2020	12/28/2020	5	230	
4	Grading	Grading	2/12/2020	3/10/2020	5	20	
5	Paving	Paving	12/2/2020	12/29/2020	5	20	
6	Architectural Coating	Architectural Coating	12/2/2020	12/29/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37

Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2020

Unmitigated Construction On-Site

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

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0310	0.3102	0.2961	4.0000e-004		0.0149	0.0149		0.0139	0.0139	0.0000	34.9914	34.9914	9.9200e-003	0.0000	35.1997
Total	**0.0310**	**0.3102**	**0.2961**	**4.0000e-004**	**0.0248**	**0.0149**	**0.0397**	**3.7500e-003**	**0.0139**	**0.0176**	**0.0000**	**34.9914**	**34.9914**	**9.9200e-003**	**0.0000**	**35.1997**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.3000e-003	0.0508	0.2365	4.0000e-004		2.5300e-003	2.5300e-003		2.5300e-003	2.5300e-003	0.0000	34.9914	34.9914	9.9200e-003	0.0000	35.1997
Total	**8.3000e-003**	**0.0508**	**0.2365**	**4.0000e-004**	**0.0248**	**2.5300e-003**	**0.0273**	**3.7500e-003**	**2.5300e-003**	**6.2800e-003**	**0.0000**	**34.9914**	**34.9914**	**9.9200e-003**	**0.0000**	**35.1997**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0186	0.1943	0.1646	2.0000e-004		9.6500e-003	9.6500e-003		8.8800e-003	8.8800e-003	0.0000	17.2015	17.2015	5.5600e-003	0.0000	17.3183
Total	**0.0186**	**0.1943**	**0.1646**	**2.0000e-004**	**0.0903**	**9.6500e-003**	**0.1000**	**0.0497**	**8.8800e-003**	**0.0585**	**0.0000**	**17.2015**	**17.2015**	**5.5600e-003**	**0.0000**	**17.3183**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.2015	17.2015	5.5600e-003	0.0000	17.3183
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.2015**	**17.2015**	**5.5600e-003**	**0.0000**	**17.3183**

Mitigated Construction Off-Site

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

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2428	2.1947	1.9330	3.0800e-003		0.1280	0.1280		0.1203	0.1203	0.0000	265.2474	265.2474	0.0646	0.0000	266.6045
Total	**0.2428**	**2.1947**	**1.9330**	**3.0800e-003**		**0.1280**	**0.1280**		**0.1203**	**0.1203**	**0.0000**	**265.2474**	**265.2474**	**0.0646**	**0.0000**	**266.6045**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	265.2471	265.2471	0.0646	0.0000	266.6042
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**265.2471**	**265.2471**	**0.0646**	**0.0000**	**266.6042**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0256	0.2590	0.2268	3.0000e-004		0.0137	0.0137		0.0126	0.0126	0.0000	26.1236	26.1236	8.4500e-003	0.0000	26.3010
Total	**0.0256**	**0.2590**	**0.2268**	**3.0000e-004**	**0.0690**	**0.0137**	**0.0828**	**0.0342**	**0.0126**	**0.0469**	**0.0000**	**26.1236**	**26.1236**	**8.4500e-003**	**0.0000**	**26.3010**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	26.1236	26.1236	8.4500e-003	0.0000	26.3010
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**26.1236**	**26.1236**	**8.4500e-003**	**0.0000**	**26.3010**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1378	0.1435	2.2000e-004		7.3900e-003	7.3900e-003		6.8000e-003	6.8000e-003	0.0000	19.6021	19.6021	6.3400e-003	0.0000	19.7352
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0133**	**0.1378**	**0.1435**	**2.2000e-004**		**7.3900e-003**	**7.3900e-003**		**6.8000e-003**	**6.8000e-003**	**0.0000**	**19.6021**	**19.6021**	**6.3400e-003**	**0.0000**	**19.7352**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1378	0.1435	2.2000e-004		7.3900e-003	7.3900e-003		6.8000e-003	6.8000e-003	0.0000	19.6020	19.6020	6.3400e-003	0.0000	19.7352
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0133**	**0.1378**	**0.1435**	**2.2000e-004**		**7.3900e-003**	**7.3900e-003**		**6.8000e-003**	**6.8000e-003**	**0.0000**	**19.6020**	**19.6020**	**6.3400e-003**	**0.0000**	**19.7352**

Mitigated Construction Off-Site

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

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4200e-003	0.0168	0.0183	3.0000e-005		1.1100e-003	1.1100e-003		1.1100e-003	1.1100e-003	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5574
Total	**1.1782**	**0.0168**	**0.0183**	**3.0000e-005**		**1.1100e-003**	**1.1100e-003**		**1.1100e-003**	**1.1100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5574**

Unmitigated Construction Off-Site

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

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5574
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5574**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

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

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551785	0.058740	0.185183	0.122735	0.029388	0.004432	0.012603	0.023662	0.001776	0.001268	0.006159	0.000502	0.001767

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

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

5.2 Energy by Land Use - NaturalGas

Unmitigated

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

Mitigated

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

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.0900e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.0900e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

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

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2030)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2030
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2030. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/24/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/13/2031	12/20/2030
tblConstructionPhase	PhaseEndDate	1/17/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/10/2031	12/27/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	2/26/2030	2/2/2030

tblConstructionPhase	PhaseStartDate	12/21/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/14/2030
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2030
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.3898	1.2250	2.4831	4.8400e-003	0.1841	0.0284	0.2125	0.0876	0.0284	0.1160	0.0000	419.4097	419.4097	0.0173	0.0000	419.7725
Total	**1.3898**	**1.2250**	**2.4831**	**4.8400e-003**	**0.1841**	**0.0284**	**0.2125**	**0.0876**	**0.0284**	**0.1160**	**0.0000**	**419.4097**	**419.4097**	**0.0173**	**0.0000**	**419.7725**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.2396	0.3886	2.7145	4.8400e-003	0.1841	9.6700e-003	0.1938	0.0876	9.6700e-003	0.0973	0.0000	419.4092	419.4092	0.0173	0.0000	419.7720
Total	**1.2396**	**0.3886**	**2.7145**	**4.8400e-003**	**0.1841**	**9.6700e-003**	**0.1938**	**0.0876**	**9.6700e-003**	**0.0973**	**0.0000**	**419.4092**	**419.4092**	**0.0173**	**0.0000**	**419.7720**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**10.81**	**68.27**	**-9.32**	**0.00**	**0.00**	**65.94**	**8.81**	**0.00**	**65.94**	**16.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

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

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2030	1/28/2030	5	20	
2	Paving	Paving	1/29/2030	2/25/2030	5	20	
3	Building Construction	Building Construction	2/2/2030	12/20/2030	5	230	
4	Grading	Grading	12/2/2030	12/27/2030	5	20	
5	Architectural Coating	Architectural Coating	12/2/2030	12/27/2030	5	20	
6	Site Preparation	Site Preparation	12/14/2030	12/27/2030	5	10	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74

Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2030

Unmitigated Construction On-Site

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

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0208	0.0941	0.1962	4.4000e-004		3.4300e-003	3.4300e-003		3.4300e-003	3.4300e-003	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**0.0208**	**0.0941**	**0.1962**	**4.4000e-004**	**0.0248**	**3.4300e-003**	**0.0282**	**3.7500e-003**	**3.4300e-003**	**7.1800e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4200e-003	0.0352	0.2360	4.4000e-004		9.2000e-004	9.2000e-004		9.2000e-004	9.2000e-004	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**6.4200e-003**	**0.0352**	**0.2360**	**4.4000e-004**	**0.0248**	**9.2000e-004**	**0.0257**	**3.7500e-003**	**9.2000e-004**	**4.6700e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Mitigated Construction Off-Site

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

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1500	0.9106	1.8551	3.5400e-003		0.0170	0.0170		0.0170	0.0170	0.0000	300.9635	300.9635	0.0121	0.0000	301.2172
Total	**0.1500**	**0.9106**	**1.8551**	**3.5400e-003**		**0.0170**	**0.0170**		**0.0170**	**0.0170**	**0.0000**	**300.9635**	**300.9635**	**0.0121**	**0.0000**	**301.2172**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.5400e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	300.9631	300.9631	0.0121	0.0000	301.2168
Total	**0.0376**	**0.2563**	**2.0023**	**3.5400e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**300.9631**	**300.9631**	**0.0121**	**0.0000**	**301.2168**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0163	0.0766	0.1739	3.4000e-004		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	31.1492	31.1492	1.3100e-003	0.0000	31.1768
Total	**0.0163**	**0.0766**	**0.1739**	**3.4000e-004**	**0.0690**	**2.4500e-003**	**0.0715**	**0.0342**	**2.4500e-003**	**0.0367**	**0.0000**	**31.1492**	**31.1492**	**1.3100e-003**	**0.0000**	**31.1768**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.4000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	31.1491	31.1491	1.3100e-003	0.0000	31.1767
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.4000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**31.1491**	**31.1491**	**1.3100e-003**	**0.0000**	**31.1767**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Architectural Coating - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.3100e-003	8.5600e-003	0.0180	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1771**	**8.5600e-003**	**0.0180**	**3.0000e-005**		**2.0000e-004**	**2.0000e-004**		**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Mitigated Construction Off-Site

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

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Site Preparation - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0121	0.0653	0.0847	2.1000e-004		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	20.4388	20.4388	9.9000e-004	0.0000	20.4595
Total	**0.0121**	**0.0653**	**0.0847**	**2.1000e-004**	**0.0903**	**2.1100e-003**	**0.0924**	**0.0497**	**2.1100e-003**	**0.0518**	**0.0000**	**20.4388**	**20.4388**	**9.9000e-004**	**0.0000**	**20.4595**

Unmitigated Construction Off-Site

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

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.1000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	20.4387	20.4387	9.9000e-004	0.0000	20.4594
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.1000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**20.4387**	**20.4387**	**9.9000e-004**	**0.0000**	**20.4594**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

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

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058808	0.184358	0.118913	0.029447	0.004459	0.013404	0.026791	0.001843	0.001224	0.006259	0.000436	0.001725

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

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

5.2 Energy by Land Use - NaturalGas

Unmitigated

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

Mitigated

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

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Unmitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

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

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

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

10.0 Vegetation

APPENDIX C
RAMBOLL ENVIRON MOBILE EMISSIONS CALCULATIONS
(provided electronically)