11 Greenhouse Gases and Climate Change

This chapter provides an overview of the environmental setting for greenhouse gases (GHGs) and climate change, based on Appendix C, Air Quality and Greenhouse Gases Technical Report. The American Meteorological Society refers to climate change as any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer. The Society also indicates that climate change may be due to natural external forcing, such as changes in solar emission or slow changes in the Earth's orbital elements; natural internal processes of the climate system; or anthropogenic forcing[1] (AMS 2012). The climate system can be influenced by changes in the concentration of various GHGs in the atmosphere that affect the Earth's absorption of radiation. Section 11.1, Environmental Setting, presents local and regional GHG conditions and pertinent regulations. This chapter concludes with an evaluation of the Proposed Program's contribution to GHG emissions and conclusions of environmental impact. Section 11.2, Environmental Impacts and Mitigation Measures, presents the following:

- Environmental concerns and evaluation criteria used to determine whether the Program components would cause significant impacts to GHGs throughout the region
- Evaluation methods and assumptions
- Discussion of GHG impacts from the existing and future Program activities within the Program components, and recommendations for mitigation, if required, for those impacts
- A summary of environmental impacts due to GHGs

While contributions to climate change occur at the local and regional levels, climate change is really a global issue that results from the cumulative impacts of GHG emissions at all levels and locations. Section 13.9 focuses on the cumulative effects of GHGs from the Proposed Program.

11.1 Environmental Setting

11.1.1 Global Climate Change

Climate change refers to any measurable alteration of climate lasting for an extended period of time – several decades or longer – and includes recordable changes in temperature, precipitation, or wind patterns. The average temperature of the Earth has increased about 0.7 to 1.5°F (0.4 to 0.8°C) over the past century, and is projected to rise another 2 to 11.5°F (1.1 to 6.4°C) over the next 100 years (IPCC 2001; USEPA 2012c). Seemingly small changes in the average temperature of the planet can translate to large and potentially hazardous shifts in climate and weather. Climate change is suspected as the cause of changes in rainfall amounts and distribution that can result in flooding, droughts, or more frequent and severe heat waves. Also, oceans are warming and becoming more acidic, polar ice caps are melting, glaciers are receding, and sea levels are rising due to thermal expansion and ice loss. Long-term studies indicate that ocean surface temperatures have been rising at an average rate of 0.13°F (0.07°C) per decade and since 1901, average sea level has increased by about 8 inches (20 centimeters) during the same period, and average pH has decreased (acidified) by about 0.05 pH units since the mid-1980s. Late summer Arctic Ocean sea ice coverage has decreased by half since 1979, and glaciers have receded and lost significant mass since the 1970s (USEPA 2012c). As climate change progresses in the coming decades, it will likely present challenges to society and the environment.

[1] Anthropogenic forcing means due to human, rather than natural, factors. Such factors include increased greenhouse gas concentrations associated with fossil fuel burning, sulphate aerosols produced as an industrial by-product, human-induced changes in land surface properties among other things. (http://www.realclimate.org/index.php/archives/2004/11/anthropogenic-forcing/)

11.1.1.1 Local Climate

The Program Area climate is characterized by moderately wet winters and dry summers. For the region, including the San Mateo County Mosquito and Vector Control District (SMCMVCD), about 90 percent of the annual total rainfall is received in the November through April period. Between June and September, normal rainfall is typically less than 0.6 inch (1.5 centimeters). Temperatures in the Program Area average about 60°F (15°C) annually, with average summer highs in the 70 to 80°F (21 to 27°C) range and average winter lows in the 40 to 50°F (4 to 10°C) range. Precipitation averages about 23 inches (58 centimeters) per year, although annual precipitation can vary significantly from year to year. Annual average wind speeds in the Program Area are about 8 miles per hour (3.6 meters per second). The predominant direction of air pollution transport in the Program Area is inland from the coastal areas (BAAQMD 2010a; World Climate 2012; NOAA 2008).

11.1.2 The Greenhouse Effect

Over the past century, human activities have released large amounts of carbon dioxide (CO_2) and other GHGs into the atmosphere. The majority of GHGs are the by-product of burning fossil fuels to release energy in the form of heat, although deforestation, industrial processes, and some agricultural practices also emit GHGs into the atmosphere. GHGs trap solar energy in the atmosphere and cause it to warm. This phenomenon is called the greenhouse effect and is necessary to support life on Earth; however, excessive buildup of GHGs can change Earth's climate and result in undesirable effects on ecosystems, which affect human health and welfare. (USEPA 2012c)

In its *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011* (USEPA 2012d), the USEPA provides summary information on the work of the United Nations Framework Convention on Climate Change (UNFCCC 2009) and the Intergovernmental Panel on Climate Control (IPCC 1990-2013); key information from that report is summarized below – more details may be found in the cited source documents.

The United Nations Framework Convention on Climate Change defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UNFCCC 2009). In its *Second Assessment Report* of the science of climate change, the IPCC concluded “human activities are changing the atmospheric concentrations and distributions of greenhouse gases and aerosols” (IPCC 1995). These changes can produce a radiative forcing by changing either the reflection or absorption of solar radiation, or the emission and absorption of terrestrial radiation.” Building on this conclusion, the IPCC *Third Assessment Report* (IPCC 2001) asserted “concentrations of atmospheric greenhouse gases and their radiative forcing have continued to increase as a result of human activities.”

The IPCC reports the global average surface temperature of the Earth has increased by 1.1 ± 0.4°F (0.6 ± 0.2°C) over the 20th century. This value is about 0.27°F (0.15°C) larger than that estimated by the Second Assessment Report, which reported for the period up to 1994, “owing to the relatively high temperatures of the additional years (1995 to 2000) and improved methods of processing the data.”

While the *Second Assessment Report* concluded, “the balance of evidence suggests there is a discernible human influence on global climate,” the *Third Assessment Report* more directly connects the influence of human activities on climate. IPCC concluded, “In light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations.”

In its *Fourth Assessment Report*, IPCC stated warming of Earth’s climate is unequivocal, and that warming is very likely attributable to increases in atmospheric GHGs caused by human activities (IPCC 2007). IPCC further stated changes in many physical and biological systems, such as increases in global temperatures, more frequent heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread

of infectious disease, and other potential environmental impacts, are linked to changes in the climate system, and some changes might be irreversible.

In its newly released *Fifth Assessment Report* (2013), the IPCC reinforced evidence for warming of the climate system since the 1950s. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and GHG concentrations have increased. Each of the last 3 decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983 to 2012 was likely the warmest 30-year period of the last 1,400 years. IPCC reports (IPCC 2013):

- The atmospheric concentrations of CO_2, methane (CH_4), and nitrous oxide (N_2O) have all increased since 1750 due to human activity. In 2011, average concentrations of CO_2, CH_4, and N_2O were 390, 1.8, and 0.3 parts per million per volume (ppmv), respectively, which are higher than preindustrial levels by about 40, 150, and 20 percent, respectively.
- The globally averaged combined land and ocean surface temperature data, as calculated by a linear trend, showed an average warming of 1.5°F (0.85°C) over the period 1880 to 2012. The average total increase between the 1850 to 1900 period and the 2003 to 2012 period was 1.4°F (0.78°C).
- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010. The rate of sea-level rise since the mid-19th century has been larger than the mean rate during the previous 2 millennia. Over the period 1901 to 2010, global mean sea level rose by 0.62 foot (0.19 meter).

Over the last 2 decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

The mobile sources used in mosquito and vector control activities emit GHGs and, therefore, contribute incrementally to climate change; however, as described in Section 11.2.2, these emissions comprise a very small fraction of the Bay Area, California, and national GHG inventories. This fact precludes any meaningful analysis of quantitative effects that mosquito and vector control operations may specifically have on climate, although taken together with regional, national, and worldwide GHG emissions, global effects are as described above.

11.1.3 Greenhouse Gases and Their Emissions

11.1.3.1 The Atmosphere

Air is a mixture of constituent gases and its composition varies slightly with location and altitude. For 20th century scientific and engineering purposes, it became necessary to define a standard composition known as the US Standard Atmosphere. In addition to the common gases (nitrogen, oxygen, CO_2, CH_4, hydrogen, N_2O), the atmosphere contains noble or inert gases (argon, neon, helium, krypton, xenon). Radon is also present in low concentrations near ground level in limited geographic areas where it is naturally emitted from certain types of rock and soil. Table 11-1 shows the typical composition of dry standard air, which is over 99 percent nitrogen and oxygen (UIG 2008; USEPA 2012d). The apparent molecular weight of dry standard air is 28.966 grams per mole (Jennings 1970; du Pont 1971).

Table 11-1 Standard Composition of Dry Air

Principal Gas	Chemical Symbol	Gas MW g/mole	Concentration ppmv	Fraction Percent	Fraction MW g/mole
Nitrogen	N_2	28.014	780,805.00	78.080500	21.873471
Oxygen	O_2	31.998	209,440.00	20.944000	6.701661
Argon	Ar	39.948	9,340.00	0.934000	0.373114
Carbon Dioxide	CO_2	44.009	387.69	0.038769	0.017062
Neon	Ne	20.183	18.21	0.001821	0.000368
Helium	He	4.003	5.24	0.000524	0.000021
Methane	CH_4	16.043	1.81	0.000181	0.000029
Krypton	Kr	83.800	1.14	0.000114	0.000096
Hydrogen	H_2	2.016	0.50	0.000050	0.000001
Nitrous Oxide	N_2O	44.013	0.32	0.000032	0.000014
Xenon	Xe	31.300	0.09	0.000009	0.000003
Totals			**1,000,000.00**	**100.000**	**28.966**

Sources: UIG 2008; USEPA 2012d; du Pont 1971; Jennings 1970

Notes:

MW = molecular weight, g/mole
ppmv = parts per million by volume (10^{-6})

The atmosphere consists of five basic altitude zones: troposphere (sea level to 8 miles), stratosphere (8 to 32 miles), mesosphere (32 to 50 miles), thermosphere (50 to 350 miles), and exosphere (350 to 500 miles). Within the stratosphere is the ozone layer (9 to 22 miles), which absorbs ultraviolet wavelengths; and within the mesosphere is the ionosphere (62 to 190 miles), which reflects shortwave radio signals and produces auroras. These approximate altitude ranges vary with latitude, season, solar activity, and turbulence. GHGs persist mainly in the troposphere and stratosphere – some in the mesosphere – for different lengths of time, ranging from less than 5 years to over 50,000 years, long enough to become well-mixed, meaning that atmospheric concentrations are about the same all over the world, regardless of source locations (USEPA 2012e). Thus, the homogeneous composition of the lower atmosphere is the global setting for climate change.

11.1.3.2 Greenhouse Gases

Gases that trap heat in the atmosphere are called GHGs. Principal GHGs include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride (SF_6), and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers. GHGs occur naturally because of volcanoes, forest fires, and biological processes such as enteric fermentation and aerobic decomposition. They are also produced by combustion of fuels, industrial processes, agricultural operations, waste management, and land use changes such as loss of farmland to urbanization. The most common GHG from human activity (fuel combustion) is CO_2, followed by CH_4 and N_2O. (USEPA 2012e)

Concentration, or abundance, is the amount of a particular gas in the air. Larger GHG emissions lead to higher concentrations in the atmosphere. GHG concentrations are measured in units of parts per million (ppm), parts per billion (ppb), and parts per trillion (ppt). One ppm is equivalent to 1 cubic centimeter (cc) of pure gas diluted in 1 cubic meter of air. Similarly, 1 ppb is 1 cc diluted in 1,000 cubic meters, and 1 ppt is 1 cc diluted in 1,000,000 cubic meters. (USEPA 2012e)

11.1.3.2.1 Carbon Dioxide

CO_2 enters the atmosphere through burning fossil fuels (coal, natural gas, and petroleum products), decomposition of solid waste, trees and wood products, fermentation, and also as a result of certain chemical reactions, such as manufacture of cement. CO_2 is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biologic carbon cycle. In the carbon cycle, carbon in various molecular forms is cycled among atmospheric, oceanic, land biotic, marine biotic, and mineral reservoirs. Atmospheric CO_2 is part of this global carbon cycle. CO_2 concentrations in the atmosphere have increased from about 280 ppm in preindustrial times to about 390 ppm today, a 39 percent increase. The IPCC notes that "this concentration has not been exceeded during the past 420,000 years, and likely not during the past 20 million years. The rate of increase over the past century is unprecedented, at least during the past 20,000 years." The IPCC definitively states that "the present atmospheric CO_2 increase is caused by anthropogenic emissions of CO_2." (USEPA 2012e; IPCC 2007)

Global Warming Potential (GWP) is a quantified measure of the globally averaged relative radiative forcing impacts of a particular GHG. It is defined as the cumulative radiative forcing both direct and indirect effects integrated over a period of time from the emission of a unit mass of gas relative to a reference gas. CO_2 is the reference gas with a GWP of unity (1). Carbon dioxide equivalents (CO_2e) are calculated by summing the products of mass GHG emissions by species times their respective USEPA official GWP coefficients. The persistence of CO_2 in the atmosphere is estimated to be in the range of 50 to 200 years, depending on variations in the carbon cycle. (USEPA 2012d, e)

11.1.3.2.2 Methane

CH_4 is primarily produced through anaerobic decomposition of organic matter in biological systems. Agricultural processes such as wetland rice cultivation, enteric fermentation in ruminant animals (e.g., cows), and the decomposition of animal wastes emit CH_4, as does the decomposition of municipal solid wastes. CH_4 is also fugitively emitted during the production and distribution of natural gas and petroleum, and is released as a by-product of coal mining and incomplete fossil fuel combustion. Pipeline-quality natural gas is over 90 percent CH_4 by volume and is considered a "clean fuel" by industry with CO_2 and water vapor as its main combustion by-products. Atmospheric concentrations of CH_4 have increased by about 160 percent since preindustrial times, although the rate of increase has been declining. The IPCC has estimated that slightly more than half of the current CH_4 flux to the atmosphere is anthropogenic, from human activities such as agriculture, fossil fuel use, and waste disposal. The USEPA's official GWP coefficient of CH_4 is 21, and its persistence in the atmosphere is estimated to be about 9 to 15 years. (USEPA 2012d, e)

11.1.3.2.3 Nitrous Oxide

N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Anthropogenic sources of N_2O emissions include agricultural soils, especially the use of synthetic and manure fertilizers; fossil fuel combustion, especially from mobile combustion; adipic (nylon) and nitric acid production; wastewater treatment and waste combustion; and biomass burning. The atmospheric concentration of N_2O has increased by about 19 percent since 1750, from a preindustrial value of about 270 to about 320 ppb today, a concentration that has not been exceeded during the last thousand years. The USEPA's official GWP coefficient of N_2O is 310, and its persistence in the atmosphere is estimated to be about 110 to 120 years. (USEPA 2012d, e)

11.1.3.2.4 Fluorinated Gases

Hydrofluorocarbons, perfluorocarbons, and SF_6 are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). In the electric utility industry, SF_6 is used as a dielectric gas in high-voltage equipment, such as switchgear and circuit breakers. As man-made gas, SF_6 in the atmosphere has increased from 0 to about 7 ppt in modern times. Due to their expense, all of these fluorinated gases are typically emitted (lost) in small quantities relative to combustion by-products, but because they are potent GHGs, they are sometimes referred to as "High GWP gases" with estimated persistence in the atmosphere ranging from 1.5 to 50,000 years. Of these, SF_6 is the most potent, with an USEPA official GWP of 23,900 and an estimated persistence of about 3,200 years. (USEPA 2012d, e)

11.1.3.3 Emission Sources

The USEPA tracks GHG emissions in the US and publishes the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, which is updated annually (USEPA 2012d). This detailed report contains estimates of the total national GHG emissions and removals associated with human activities in all 50 states. From the current report, the main sources of GHG emissions in the US are identified below (USEPA 2012e):

- Electric power generation
- Transportation
- Industry
- Commercial and residential
- Agriculture
- Land Use and Forestry offsets (absorbs or sequesters) about 15 percent of GHG emissions nationwide. Land areas can act as GHG sinks (absorbing CO_2 from the atmosphere) or GHG sources. Since 1990, well-managed forests and other lands have absorbed more CO_2 from the atmosphere than they emit.

11.1.3.4 Mobile Sources

While stationary sources such as power plants and oil refineries emit large quantities of GHGs, mobile sources, due to their sheer numbers nationwide, also emit significant amounts. Mobile sources include onroad vehicles (e.g., automobiles, trucks, motorcycles), offroad equipment (e.g., earthmovers, cranes, portable pumps, and generators), trains (e.g., freight, passenger, light rail), vessels (e.g., boats, ships, watercraft), and aircraft (e.g., general aviation, commercial, military). Mobile source fuels include gasoline, diesel, heavy fuel oil (large marine vessels), and jet fuel, all of which emit GHGs when combusted.

Mobile sources used in mosquito and/or vector control activities include onroad fleet vehicles (light- and medium-duty trucks, vans, passenger cars), offroad ATVs, watercraft (motorboats, airboats), aircraft (helicopters and fixed-wing), portable equipment (pumps, sprayers, generators), and small equipment (handheld sprayers, foggers, dusters). Except for 2-stroke engines used in small lightweight equipment (spark ignition, 50:1 gas/oil mix), engines are 4-stroke gasoline (spark ignition) or diesel fuel (compression ignition). The dominant fuel used for these mobile sources is motor gasoline along with some diesel fuel (larger trucks), aviation gasoline (fixed-wing aircraft), and jet fuel (turbine-powered helicopters). Light trucks, vans, and passenger cars are normally used for responding to public service requests and disease surveillance. Typical GHG contents of common fuels are presented in Table 11-2.

Table 11-2 Typical GHG Contents of Common Fuels

Fuel	CO_2 kg/mmBTU	CH_4 kg/mmBTU	N_2O kg/mmBTU	CO_2e lb/mmBTU	Energy BTU/gal	CO_2e lb/gal
Diesel Fuel No. 2	73.96	0.0105	0.0006	163.97	138,300	22.68
Kerosene	73.19	0.0105	0.0006	162.27	138,700	22.51
Jet Fuel	72.23	0.0105	0.0006	160.17	135,000	21.62
Motor Gasoline	71.35	0.0105	0.0006	158.23	122,600	19.40
Aviation Gasoline	69.15	0.0105	0.0006	153.38	120,200	18.44
Propane	62.22	0.0053	0.0001	137.49	91,300	12.55
Pipeline Natural Gas	53.02	0.0053	0.0001	117.20	—	—

Sources: USEPA 2012d, 2011a

Notes:

BTU = the amount of energy (heat) required to raise 1 pound of liquid water 1 degree Fahrenheit from 39 to 40°F

kg/mmBTU = kilogram(s) per million British thermal units

lb/mmBTU = pound(s) per million British thermal units

11.1.3.5 Sensitive Receptors

Certain population groups are considered more sensitive to air pollution and odors than others; in particular, children, elderly, and acutely ill and chronically ill persons, especially those with cardiorespiratory diseases such as asthma and bronchitis. Sensitive receptors (land uses) indicate locations where such individuals are typically found, namely schools, daycare centers, hospitals, convalescent homes, residences of sensitive persons, and parks with active recreational uses, such as youth sports.

None of the GHGs described in Section 11.2.2 are considered toxic; however, all are classified as asphyxiants. Thus, in high enough concentrations in confined spaces they can displace the oxygen in air and present hazards to industrial workers, however, GHG concentrations in ambient air (see Table 11-1) are far below any danger levels. Therefore, no risk to sensitive receptors or the general public is posed by GHGs emitted to outdoor air, either from stationary or mobile sources.

11.1.4 California Climate Impacts

Climate change is already affecting California. Average temperatures have increased, leading to more extreme hot days and fewer cold nights. Shifts in the water cycle have been observed, with less winter precipitation falling as snow, and both snowmelt and rainwater running off earlier in the year. Sea levels have risen. Wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later. These climate-driven changes affect resources critical to the health and prosperity of California. (CEC 2010)

If the state takes no action to reduce or minimize expected impacts from future climate change, the costs could be severe. In November 2008, the Governor directed the California Natural Resources Agency to develop a climate adaptation strategy for California. The Natural Resources Agency coordinated with ten state agencies, multiple scientists, a consulting team, and stakeholders to develop the first statewide, multisector adaptation strategy in the country. The resulting report, *2009 California Climate Adaptation Strategy*, summarizes the best-known science to assess the vulnerability of the state to climate change impacts, and outlines possible solutions that can be implemented within and across state agencies to promote resiliency. This strategy is the first step in an evolving process to reduce California's vulnerability to climate change impacts. (CEC 2010)

The Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32) (see Appendix C) required CARB to prepare a Scoping Plan to achieve substantial GHG emissions reductions, both from within the state and from "exported" emissions, such as importing electric power generated at coal-fired power plants located in neighboring western states. The 2008 Scoping Plan outlines a wide range of strategies for reducing statewide GHG emissions to 1990 levels by 2020. This goal will be achieved by cutting about 30 percent from business-as-usual emission levels projected for 2020, or about 15 percent from 2008 levels. Allowing for population growth, the goal is to reduce annual per capita emissions from 14 metric tonnes (MT) CO_2e down to about 10 MT CO_2e per capita by 2020. (CARB 2008b)

11.1.5 Emissions Inventories

The bulk of mosquito and vector control activity emissions would occur in the Bay Area. Therefore, the comprehensive 2007 Bay Area GHG inventory is used as the regional benchmark for comparison purposes.

Table 11-3 shows aggregated national, state, and regional GHG emissions for all sources on a gross basis (i.e., CO_2e emissions only, not including CO_2 sinks such as forestry and agriculture). As shown, California accounts for about 7 percent of gross CO_2e emissions in the US annually, and the Bay Area accounts for about 20 percent of gross CO_2e emissions in California.

Table 11-3 Greenhouse Gas Emissions Inventories - Gross Basis

Summary Year	National MMT CO_2e	California MMT CO_2e	Bay Area MMT CO_2e
2005	7,204	482.5	—
2006	7,159	481.9	—
2007	7,253	488.8	95.8
2008	7,048	484.7	—
2009	6,608	456.8	—
5-Year Average	**7,054**	**478.9**	—
Average Annual Variation	**2.6%**	**1.8%**	—

Sources: USEPA 2012d; CARB 2011; BAAQMD 2010c

Notes:

MMT = million metric tonnes (annual)
1 metric tonne = 1,000 kilograms or 2,204.6 pounds
2009 is most recent CARB published data; Bay Area for 2007 only

The bulk of the District's GHG emissions would occur in the San Francisco Bay Area. Tables 11-4, 11-5, 11-6, and 11-7 present progressively focused Bay Area GHG emissions inventory data for 2007 broken down by sectors, counties, and applicable subsectors. The District's Program Area counties within the BAAQMD are shown in bold. This information will be used as a basis for comparisons with estimated mosquito and vector control activity emissions for the District presented in Section 11.2.2. Only portions of Solano and Sonoma counties are located within the BAAQMD.

Table 11-4 Bay Area GHG Emissions by Sector

End-Use Sector	District Emissions Percent	District Emissions MMT CO_2e
Industrial / Commercial	36.4%	34.9
Residential Fuel Use	7.1%	6.8
Local Electric Power Generation	8.5%	8.1
Imported Electric Power Generation	7.4%	7.1
Offroad Equipment	3.0%	2.9
Transportation	36.4%	34.9
Agriculture / Farming	1.2%	1.1
Totals	**100.0%**	**95.8**

Source: BAAQMD 2010c

Notes:

MMT = million metric tonnes (annual)
1 metric tonne = 1,000 kilograms or 2,204.6 pounds

Table 11-5 Bay Area GHG Emissions by County

County	District Emissions Percent	District Emissions MMT CO_2e
Alameda	16.4%	15.7
Contra Costa	32.9%	31.5
Marin	2.8%	2.7
Napa	1.8%	1.7
San Francisco	7.4%	7.1
San Mateo	8.9%	8.5
Santa Clara	19.6%	18.8
Solano (within BAAQMD)	5.9%	5.7
Sonoma (within BAAQMD)	4.3%	4.1
Totals	**100.0%**	**95.8**

Source: BAAQMD 2010c

Notes:

MMT = million metric tonnes (annual)
1 metric tonne = 1,000 kilograms or 2,204.6 pounds

Table 11-6 Mobile Sectors GHG Emissions by County

County	Offroad MT CO_2e	Transportation MT CO_2e
Alameda	569,000	8,351,000
Contra Costa	406,000	4,998,000
Marin	99,000	1,286,000
Napa	50,000	917,000
San Francisco	415,000	2,673,000
San Mateo	270,000	4,850,000
Santa Clara	790,000	7,859,000
Solano (within BAAQMD)	147,000	1,834,000
Sonoma (within BAAQMD)	175,000	2,103,000
Totals	**2,921,000**	**34,871,000**

Source: BAAQMD 2010c

Notes:

MMT = million metric tonnes (annual)
1 metric tonne = 1,000 kilograms or 2,204.6 pounds
Values rounded to nearest 1,000 tonnes
"Offroad" is offroad equipment category

Table 11-7 Offroad Subsectors GHG Emissions by County

County	Utility MT CO_2e	Commercial MT CO_2e	Combined MT CO_2e
Alameda	29,800	49,900	79,700
Contra Costa	20,300	26,900	47,200
Marin	7,900	12,300	20,200
Napa	2,900	4,300	7,200
San Francisco	14,200	43,900	58,100
San Mateo	14,200	27,200	41,400
Santa Clara	32,900	56,500	89,400
Solano (within BAAQMD)	3,900	6,800	10,700
Sonoma (within BAAQMD)	7,800	13,500	21,300
Totals	**133,900**	**241,300**	**375,200**

Source: BAAQMD 2010c

Notes:

MMT = million metric tonnes (annual)
1 metric tonne = 1,000 kilograms or 2,204.6 pounds
Values rounded to nearest 100 tonnes
"Utility" is small landscaping equipment selected for comparisons to District's activities
"Commercial" is light commercial equipment selected for comparisons to District's activities

11.1.6 Potential for Mitigation

With respect to mosquito and vector control activities, District BMP A14 includes fuel conservation, which minimizes GHG emissions by the Program.

11.1.7 Regulatory Setting

Currently, no local, state, or federal regulatory standards directly apply to GHG emissions from temporary or intermittent mobile sources such as mosquito and vector control activities. However, in the context of the Scoping Plan discussed in Section 11.1.4.1, implementation of Low Carbon Fuel Standard (Executive Order S-1-7, below) would indirectly apply to mosquito and vector control activities via fuel usage. Principal federal, state, and local GHG statutes, regulations, and programs that affect other types of sources are presented in Appendix C with total CEQA guidelines summarized below in Section 11.1.7.3.

11.1.7.1 Federal

11.1.7.1.1 40 CFR Part 98 – Greenhouse Gas Reporting

On October 30, 2009, the USEPA issued the Mandatory Reporting of Greenhouse Gases rule (74 FR 56260, 40 CFR 98, effective December 29, 2009), which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States pursuant to Fiscal Year 2008 Consolidated Appropriations Act (HR 2764; Public Law 110-161).

The rule facilitates collection of accurate and comprehensive emissions data to provide a basis for future USEPA policy decisions and regulatory initiatives. The rule requires specified industrial source categories and facilities with an aggregated heat input of 30 million British thermal units or more per hour or that emit 25,000 MT or more per year of GHG to submit annual reports to the USEPA. The gases covered by the rule are CO_2, CH_4, N_2O, and hydrofluorocarbons, perfluorocarbons, SF_6, and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers. Since the Program does not meet the definition of an affected stationary source (i.e., mobile sources only), the GHG reporting rule does not apply.

Notwithstanding the GHG reporting rule, no federal regulations currently limit or curtail GHG emissions of CO_2 and CH_4, and USEPA cap-and-trade programs currently apply only to acid rain precursors SO_2 and NO_X (USEPA 2012d). However, N_2O emissions are regulated, albeit indirectly, through limitation of NO_X emissions as a criteria pollutant under New Source Performance Standards and federal, state, and local operating permits.

11.1.7.2 State

11.1.7.2.1 Global Warming Solutions Act

The Global Warming Solutions Act of 2006 (AB 32) codifies California's goal of reducing statewide GHG emissions to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on global warming emissions that was phased in starting in 2012 to achieve maximum technologically feasible and cost-effective GHG emission reductions. To effectively implement the cap, AB 32 directs CARB to develop appropriate regulations and establish a mandatory reporting system to track and monitor global warming emissions levels.

On September 25, 2009, CARB adopted the AB 32 Cost of Implementation Fee Regulation (Health and Safety Code 38597). The Office of Administrative Law approved the regulation on June 17, 2010, and it became effective on July 19, 2010. For the first year of the fee program, CARB administratively provided compliance flexibility and did not enforce reporting and fee requirements until after the passage of the state budget for fiscal year 2010-11. Until CARB provides detailed compliance criteria, facilities subject to the regulation do not need to pay fees or report information required by the regulation. However, since the Program is not affected by stationary sources, the AB 32 fee regulation does not apply.

11.1.7.2.2 Cap and Trade

CARB's new "Cap and Trade" regulation (Subchapter 10, Article 5, Sections 95800 to 96023, Title 17, CCR) is a set of rules (effective September 1, 2012) that establishes a limit on GHG emissions from the largest sources of GHGs in the state. The purpose of *California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms* is to reduce GHG emissions from affected stationary sources through the establishment, administration, and enforcement of an aggregate GHG allowance budget and to provide a trading mechanism for compliance instruments (i.e., "GHG allowances" or "carbon credits"). Since the Program is not affected by stationary sources under the rule, Cap and Trade does not apply. No other statewide quantitative standards of significance for GHG impacts have been established for nonaffected sources under CEQA.

11.1.7.2.3 Assembly Bill 939

California AB 939, known as the Integrated Waste Management Act of 1989, was enacted due to increasing waste stream volumes and decreasing landfill capacities in the state. As a result of AB 939, the California Integrated Waste Management Board was created. A disposal reporting system with its oversight was established, and facility and program planning was required. AB 939 mandated that sanitation districts (jurisdictions) meet diversion goals of 25 percent by 1995 and 50 percent by 2000, primarily through recyclables collection and green waste compositing. AB 939 also established an integrated framework for program implementation, solid waste planning, and solid waste facility and landfill compliance.

11.1.7.2.4 Senate Bill 1368

California Senate Bill (SB) 1368 adds Sections 8340 and 8341 to the Public Utilities Code (effective January 1, 2007) with the intent "to prevent long-term investments in power plants with GHG emissions in excess of those produced by a combined-cycle natural gas power plant" with the aim of "reducing emissions of GHGs from the state's electricity consumption, not just the state's electricity production." SB 1368 provides a mechanism for reducing the GHG emissions of electricity providers, both in state and out of state, thereby assisting CARB in meeting its mandate under AB 32, the Global Warming Solutions Act of 2006.

11.1.7.2.5 Senate Bill 97

California SB 97 directs the Office of Planning and Research to prepare, develop, and transmit to the Resources Agency CEQA guidelines for the feasible mitigation of GHG emissions or their effects by July 1, 2009. The Resources Agency was required to certify or adopt those guidelines by January 1, 2010. SB 97 also protects, for a short time, certain projects funded by the Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, or the Disaster Preparedness and Flood Protection Bond Act of 2006 (Proposition 1B or 1E) from claims of inadequate analysis of GHGs as a legitimate cause of action. This latter provision was repealed on January 1, 2010.

11.1.7.2.6 Senate Bill 375

California SB 375 aims to reduce GHG emissions by curbing sprawl, because the largest sources of GHG emissions in California are passenger vehicles and light trucks. SB 375 provides emission reduction goals for which regions can plan, integrates disjointed planning activities, and provides incentives for local governments and developers to follow new conscientiously planned growth patterns. SB 375 enhances CARB's ability to reach AB 32 goals by requiring metropolitan planning organizations to include defined sustainable community strategies in their regional transportation plans for the purpose of reducing GHG emissions, aligns planning for transportation and housing, and creates specified incentives for the implementation of the strategies.

11.1.7.2.7 Senate Bills 1078 and 10

California SB 1078 was signed into legislation in 2002 and required California load-serving entities (electric utilities) to procure 20 percent of their retail customer load with renewable energy by the year 2017. Four years later (2006), SB 10 accelerated the 20 percent renewable deadline to 2010.

11.1.7.2.8 Executive Order S-20-04

On July 27, 2004, Executive Order S-20-04 was issued committing the state to aggressive action to reduce state-owned building electricity usage by retrofitting, building, and operating the most energy and resource efficient buildings by taking all cost-effective measures described in the Green Building Action Plan with the goal of reducing grid-based energy purchases by 20 percent by 2015. This order also directed the California Public Utilities Commission to support a campaign to improve commercial building energy efficiency to help achieve the 20 percent goal and to develop a benchmarking methodology.

11.1.7.2.9 Executive Order S-3-05

On June 1, 2005, Executive Order S-3-05 was issued establishing GHG emission reduction targets: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; and by 2050, reduce GHG emissions to 80 percent below 1990 levels.

11.1.7.2.10 Executive Order S-1-07

On January 18, 2007, the Low Carbon Fuel Standard (LCFS) was issued mandating a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. It instructed Cal/EPA to coordinate activities among the University of California, the California Energy Commission (CEC), and other state agencies to develop and propose a draft compliance schedule to meet the 2020 target. Furthermore, it directed CARB to consider initiating regulatory proceedings to establish and implement the LCFS. In response, CARB identified the LCFS as an early action item with a regulation to be adopted and implemented by 2010.

11.1.7.2.11 Executive Order S-13-08

On November 14, 2008, Executive Order S-20-04 was issued directing the California Resources Agency, in cooperation with the California Department of Water Resources, the CEC, California's coastal management agencies, and the Ocean Protection Council to request that the National Academy of Sciences convene an independent panel to complete the first California Sea Level Rise Assessment Report by December 1, 2010. As part of this effort, the Resources Agency is to create an independent sea-level rise science and policy committee made up of state, national, and international experts and to hold public workshops to gather policy-relevant information.

11.1.7.3 Local

11.1.7.3.1 BAAQMD CEQA Guidelines

The BAAQMD is in the process of updating its *CEQA Air Quality Guidelines,* and the most current version is dated May 2017 and is used in this impact analysis. The May 2017 version of the Guidelines includes revisions made to the BAAQMD's 2010 Guidelines in order to address the California Supreme Court's 2015 opinion in Cal. Bldg. Indus. Ass'n vs. Bay Area Air Quality Mgmt. Dist., 62 Cal.4th 369. The *CEQA Air Quality Guidelines* is a guidance document to provide lead government agencies, consultants, and project proponents with uniform procedures for assessing air quality impacts and preparing the air quality sections of environmental documents for projects subject to CEQA. The document describes the criteria that BAAQMD uses when reviewing and commenting on the adequacy of environmental documents. It recommends quantitative thresholds for use in determining whether construction and operational activities associated with projects would have significant adverse environmental impacts, identifies methodologies

for predicting project emissions and impacts, and identifies measures that can be used to avoid or reduce air quality and GHG impacts. (BAAQMD 2017)

The 2017 *CEQA Air Quality Guidelines* do not comprise enforceable rules or regulations per se; nevertheless, the guidelines established the following quantitative thresholds of significance for GHG emissions[2] (see Table 10-3):

- Stationary Sources: 10,000 MT CO2e per year
- Other than Stationary Sources: 1,100 MT CO2e per year or 4.6 MT CO2e per SP per year
- Plans: 6.6 MT CO2e per SP per year

Under the 2010/2011 *CEQA Air Quality Guidelines*, Program status would presumably be as follows:

- Mosquito and vector control activities do not meet the regulatory definition of a stationary source of air contaminants; therefore, the 10,000 MT CO_2e per year stationary source GHG threshold would not apply.
- For nonstationary source land use development projects, BAAQMD's adopted "bright-line" threshold of significance differs from other proposed GHG thresholds currently under consideration in California. Under this threshold, to conclude that a project's GHG impacts are less than significant, a project would need to be in compliance with a "Qualified Greenhouse Gas Reduction Strategy," emit less than 1,100 MT CO_2e per year, or emit less than 4.6 MT CO_2e per year per capita SP (residents + employees). However, the District's IMVMP does not qualify as a land use development project; therefore, these GHG thresholds would not apply.
- No GHG thresholds exist for temporary construction emissions from mobile and portable sources, neither daily nor annual, whether for stationary or nonstationary source projects. Since mosquito and vector control activities comprise mobile and portable sources similar to construction, no quantitative GHG significance thresholds would apply to the Program since activities such as mosquito and vector control are not specified, defined, or addressed in the guidelines.
- Notwithstanding the above criteria, for evaluation purposes the estimated maximum annual Program emissions are compared to the 1,100 MT CO_2e per year significance threshold for projects that are not stationary sources, e.g., mosquito and vector control activities, as presumptive "land use" projects.

11.1.7.3.2 San Mateo County and Cities Climate Change-Related Policies

Notwithstanding air district CEQA guidelines on GHGs and climate change, many counties and cities in California have developed climate change policies and action plans that are primarily used as planning and operations management tools. As planning tools, the general aim is to implement "smart growth" policies, prevent unmitigated sprawl, conserve energy and water, and reduce automobile dependence – all of which reduce climate impacts either directly or indirectly. As operations management tools, the general aim is to minimize direct and indirect GHG emissions from government operations, mainly through energy conservation.

San Mateo County

General Plan

The San Mateo County General Plan was amended in 2013 (San Mateo County 2013a) to include a number of provisions related to climate change. They include acknowledging climate change as an ecological stressor requiring study, adaptation, and the protection of sensitive resources, as well as a factor that is expected to exacerbate natural hazards. They also include the addition of more specific

[2] MT = metric tonne, 1,000 kilograms or 2,204.6 pounds; SP = Service Population, residents + employees

discussions of alternative energy sources, including wind turbines, photovoltaics, fuel cells, microturbines, and energy storage systems. The amended plan also encourages the integration of land uses to provide neighborhood-serving uses and facilitate clean transportation options, such as pedestrian and bicycle activity, and discourages an overreliance on auto travel to the exclusion of other travel modes.

Climate Action Plan

San Mateo County's Energy Efficiency Climate Action Plan (CAP) (2013b) includes goals, policies, and actions required to meet the State of California-recommended target and achieve the County's reduction target of 17 percent below 2005 emissions by 2020. This CAP also includes strategies to further reduce GHG emissions up to 2035. The reduction measures included in this CAP build upon existing efforts and provide a diverse mix of regulatory and incentive-based programs for both new and existing development. The reduction measures also aim to reduce GHG emissions from each source to avoid reliance on any one strategy or sector to achieve the target. In total, GHG reduction measures in this CAP will reduce GHG emissions in the unincorporated county in 2020 by 67,000 MT CO2e. Most of the reduction strategies are related to existing and proposed land uses; the CAP, does, however, include a reduction measure intended to reduce emissions from heavy-duty construction equipment by limiting idling and using cleaner fuels, equipment, and vehicles to exceed the BAAQMD's requirements. By 2020, 40 percent of construction equipment is planned to be efficient or alternatively fueled, with local idling restrictions being met 50 percent of the time. By 2035, the percentage of construction equipment targeted to be efficient or alternatively fueled increases to 65 percent, and the idling restrictions are to be met 2/3 of the time.

City of Burlingame

The City of Burlingame's CAP (City of Burlingame 2009) indicates that Burlingame must reduce emissions by 15 percent below the base year of 2005 by 2020 and 80 percent by the year 2050. GHG reduction recommendations are organized in separate program categories: energy efficiency and green building, transportation and land use, waste reduction and recycling, education and promotion, and municipal operations. Recommendations are grouped into two phases. Phase 1 includes a variety of measures, addressing such issues as water efficiency, residential energy conservation, green building, energy efficiency technical assistance and incentives, transportation, recycling, and education. The second phase of program recommendations includes several that are mandatory requirements and capitalize on the voluntary compliance period of Phase 1 programs. Recommendations for Phase 2 were selected because they can provide increased GHG reductions, have an increased number of requirements, and continue to focus on Burlingame's major emission sectors.

City of East Palo Alto

The purpose of the City of East Palo Alto's CAP (City of East Palo Alto 2011) is to create a high-level guidance document and framework for actions the City can take to reduce GHG emissions. This CAP includes a summary of GHG emissions in 2005, a goal for emissions reductions, and a set of goals and measures to be implemented over the next several years to achieve GHG emission reductions. The emissions considered are those emitted in the community at large, as well as emissions from the City's municipal operations; also, emission reduction measures are provided for both the community and the municipal government's operations. To reach the reduction goal of 15 percent below 2005 levels by 2020, this CAP provides a list of prioritized emission reduction measures, each of which should be further developed, studied, and vetted independently before implementation. The GHG reduction measures and actions are structured around the four general categories of GHG emissions, as identified by the GHG inventory. They are energy use in buildings (commercial/industrial and residential), transportation and land use, waste, and municipal operations.

City of Menlo Park

The City of Menlo Park's CAP (City of Menlo Park 2009) includes a number of recommended strategies that are meant to complement and enhance strategies that are already underway, introduce new near- and medium-term strategies, and provide guidance on the continuation of strategies to assist Menlo Park in reaching its reduction targets into the future. A number of strategies to reduce emissions from municipal operations were identified, such as adding reflective roofing, installing photovoltaic panels on certain buildings, and replacing street lights with LEDs. Other strategies were identified that will need additional research on cost, payback, and/or emission reduction quantification before they are implemented, including improving the vehicle fleet's fuel efficiency and reducing idling from fleet vehicles. Additional community strategies were identified, including audit programs, water efficient landscaping, energy efficiency and renewable energy financing programs, and potentially limiting commercial vehicle idling.

City of Millbrae

The City of Millbrae has a number of programs in place to reduce GHG and is increasing these efforts through local and regional activities (City of Millbrae no date). Some of the City's initiatives include developing GHG inventories for municipal operations and communitywide, adopting GHG reduction goals of 15 percent by 2015 and 80 percent by 2050, reducing waste, conserving water, using compressed natural gas vehicles for the City's fleet, installing energy efficiencies in City facilities and LED lights in traffic lights, participating in the Spare the Air Program and notifications, planting trees annually for Arbor Day, providing rebates for installation of photovoltaic systems, using waste grease to provide energy at the Waste Water Treatment Plant, and implementing the Sustainable Food Service Ware Ordinance.

City of Redwood City

Redwood City's Community CAP sets a target of reducing GHG emissions by 15 percent from today's level by the year 2020 (City of Redwood City 2010). The CAP is organized into five sections:

- Building Community, which involves implementing a number of programs, activities, tools, and ideas for reducing energy and water use throughout Redwood City.
- Transportation and Land Use, which involves emphasizing alternative modes of transportation, the use of hybrid, electric, and biodiesel vehicles, and changes in transportation patterns.
- Built Environment, which is intended to meet the community's GHG emission reduction goals and stimulate job growth through efforts that make energy efficiency and water conservation standard practice in new and existing buildings in the community.
- Urban Ecology, which emphasizes projects such as tree plantings and community gardens to preserve neighborhood green spaces and strengthen a sense of community, while cultivating connections between residents and their natural environment.
- Waste Reduction and Recycling, which involves minimizing the volume of trash that enters landfills, thus conserving resources and protecting the environment from the negative impacts associated with waste disposal.

City of San Carlos

The City of San Carlos CAP (City of San Carlos 2009) provides energy use, transportation, land use, and solid waste strategies to bring San Carlos' GHG emissions levels to 15 percent below 2005 levels by 2020 and 35 percent below 2005 levels by 2030. The strategies to reduce GHG emissions are organized into 21 reduction measures with various components to each reduction measure. Measures are then separated into energy use, transportation and land use, and solid waste categories. This CAP will be updated to analyze new reduction targets and efforts. The General Plan accommodates the CAP update process by referencing sections of the CAP instead of concrete text to ensure that the City and its

planning resources are continuously up to date. Reduction measures are to be phased over 3 time periods for implementation: 2005 to 2010, 2010 to 2015, and 2015 to 2020.

City of San Mateo

The City of San Mateo's CAP (City of San Mateo 2015b) identifies the City's commitment to exceed the State of California target of 1990 emissions levels by 2020, implementing a key goal of the City's 2007 Sustainable Initiatives Plan. The General Plan interprets this goal as a 15 percent reduction below 2005 GHG emissions levels by 2020. As described in the General Plan, major strategies to achieve this target include existing local and regional programs, General Plan policies, and California State actions. This CAP compiles these efforts and integrates strategies from the City's multiple plans, drawing on the General Plan, the Sustainable Initiatives Plan, the Greenhouse Gas Emissions Reduction Program, the Climate Action Plan for Operations and Facilities, and local accomplishments to date. A significant portion of San Mateo's GHG reductions from the measures in this CAP will be achieved through efforts to substantially increase the amount of electricity in the community from renewable sources of energy.

Town of Colma

The Town of Colma's CAP (Town of Colma 2013) was developed collaboratively with a regional program that funded CAP development for participating jurisdictions. The resulting measures are outlined in the CAP and provide methods to meet the 15 percent GHG reduction target of AB 32. The CAP measures fall into the following categories: energy efficiency, water conservation and green building, planning and land use/increased opportunities for alternative transportation, recycling and waste reduction, municipal programs, and solar and renewable energy installations.

Town of Hillsborough

The Town of Hillsborough's CAP (Town of Hillsborough 2010) was developed in a phased approach for implementation to reduce emissions by 15 percent below current levels (as measured in 2005) by the year 2020 and 80 percent by the year 2050. The first phase, "High-Impact GHG Reduction Programs for Implementation Prior to 2012," provides recommendations that can be implemented in the near term to begin the necessary reductions in emissions. The second phase, "GHG Reduction Programs for Implementation 2012 to 2020," has been developed for implementation beyond 2012. Hillsborough's CAP has a considerable focus on residential energy efficiency because it provides the fastest and most economical means to reduce emissions and has the added advantage of providing residents cost savings. Several water conservation programs also are included in this CAP, as are education and promotion, waste reduction and recycling, and municipal operations programs.

11.2 Environmental Impacts and Mitigations Measures

11.2.1 Evaluation Concerns and Criteria

The environmental concerns are those identified below from the CEQA Guidelines and from public scoping. The public identified the following issues:

- Address impacts of GHG emissions and climate change

The focus in this chapter is on the use of equipment to perform all Program activities and the resulting emissions impacts to generation of GHGs. The CEQA Guidelines cover the issues from public scoping.

As described in Section 11.1.7, no promulgated standards of significance exist for GHG impacts established under CEQA for mobile sources such as mosquito and vector control activities. The PEIR addresses the following qualitative criteria that are used as standards of significance and are based on CEQA Guidelines Appendix G, Environmental Checklist Form, Section VII.

Would the project:

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
- Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

Determinations made with respect to significance criteria are documented in Sections 11.2.3 through 11.2.8. See Section 11.1.7.3.1 for a discussion of CEQA thresholds of significance for GHGs.

11.2.2 Evaluation Methods and Assumptions

As described in Section 11.1.3, operation of onroad fleet vehicles, offroad ATVs, watercraft, aircraft, portable equipment, and small equipment would result in GHG emissions in engine exhaust. Detailed lists of equipment, estimated usage, and emission calculations are provided in Appendix C (Air Quality and GHG Technical Report) with the additional equipment calculations provided as Attachment A to this appendix. Equipment lists and annual activity schedules were provided by the District. Emission calculations were performed using the most recent and applicable emission factors published by CARB (2008a) and USEPA (2011a, 2012b, 2014d).

Table 11-8 shows Program components applicability by percentage: surveillance, physical control, vegetation management, biological control, chemical control, or other nonchemical control. Table 11-9 shows land uses associated with selected components: residential, commercial, industrial, agricultural, and open space.

Table 11-8 San Mateo County Mosquito and Vector Control District's Selected Components Applicability

Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical
11%	0%	30%	21%	13%	24%

Sources: Appendix C, SMCMVCD

Table 11-9 Land Uses Associated with Selected Components for San Mateo County Mosquito and Vector Control District

Residential	Commercial	Industrial	Agricultural	Open Space
•	•	•		•

As described in Section 11.1.7, no promulgated standards of significance exist for GHG impacts established under CEQA for mobile sources such as mosquito and vector control activities. Thus, Program emissions are compared against existing GHG inventories for context. The existing Program activities are the basis for the quantitative evaluation and if compared strictly to existing activities at the time the NOP was published, the impact would be no change. Future Program activities would be similar and not result in substantial emission changes.

As described in Section 11.1.7.3, no promulgated standards of significance exist for GHG impacts established under CEQA for mobile sources such as mosquito and vector control activities. However, for evaluation purposes the estimated maximum annual Program emissions are compared to the 1,100 MT CO_2e per year significance threshold for projects that are not stationary sources, e.g., mosquito and vector control activities, as presumptive "land use" projects. The existing Program activities are the basis

for the quantitative evaluation and if compared strictly to existing activities at the time the NOP was published (May 25, 2012), the impact would be no change. Future Program activities would be similar and not result in substantial emission changes over existing conditions.

Tables 11-10 through 11-15 show estimated ongoing annual GHG emissions as CO2e by component. On the local level, the Program components combined "grand total" of 259 MT CO2e per year is below the presumptive 1,100 MT per year threshold and would be less than significant (LS) and would not be cumulatively considerable.

Table 11-10 Estimated Annual GHG Emissions for Surveillance Component for San Mateo County Mosquito and Vector Control District

CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
147.6	0.0084	0.0034	148.9

Sources: CARB 2008a; USEPA 2011a, 2012d

Table 11-11 Estimated Annual GHG Emissions for Physical Control Component for San Mateo County Mosquito and Vector Control District

	CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
Existing Program	3.3	0.0002	0.0001	3.3
Additional Equipment	0.84	0.00005	0.00002	0.85
Total	4.14	0.00025	0.00012	4.15

Sources: CARB 2008a; USEPA 2011a, 2012d

Table 11-12 Estimated Annual GHG Emissions for Vegetation Management Component for San Mateo County Mosquito and Vector Control District

	CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
Existing Program	393.2	0.0224	0.0092	396.5
Additional Equipment	2.0	0.255	0.105	2.0
Total	395.2	0.2774	0.1142	398.5

Sources: CARB 2008a; USEPA 2011a, 2012d

Table 11-13 Estimated Annual GHG Emissions for Biological Control Component for San Mateo County Mosquito and Vector Control District

CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
270.4	0.0154	0.0063	272.7

Sources: CARB 2008a; USEPA 2011a, 2012d

Table 11-14 Estimated Annual GHG Emissions for Chemical Control Component for San Mateo County Mosquito and Vector Control District

	CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
Existing Program	174.2	0.0099	0.0041	175.7
Additional Equipment	2.8	0.0008	0.0009	28.0
Total	177.0	0.0107	0.005	203.7

Sources: CARB 2008a; USEPA 2011a, 2012d

Table 11-15 Estimated Annual GHG Emissions for Other Nonchemical Control/Trapping Component for San Mateo County Mosquito and Vector Control District

CO_2 MT/year	CH_4 MT/year	N_2O MT/year	CO_2e MT/year
305.3	0.0174	0.0071	307.8

Sources: CARB 2008a; USEPA 2011a, 2012d

11.2.3 Surveillance Component

The Surveillance Component would be a continuation of existing activities currently practiced by the District using applicable techniques, equipment, vehicles, and watercraft. Surveillance involves monitoring mosquito and/or vector populations and habitat, their disease pathogens, and the human/vector interactions. Field counting/sampling and trapping are common mechanisms for surveillance. The environmental impact concerns are phrased as questions as follows for the Surveillance Component:

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

GHG emissions from the Surveillance Component would be similar to the average emissions shown in Table 11-10. The Surveillance Component would emit approximately 149 MT CO_2e per year, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Surveillance Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-1:** Based on estimated annual CO_2e emissions, the Surveillance Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted

GHG fees. Due to its small scale, the Surveillance Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions.

> **Impact GHG-2:** Based on the general inclusion of Surveillance Component emissions in the local and statewide GHG emission inventories, the Surveillance Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.4 Physical Control Component

The Physical Control Component would be a continuation of existing activities currently practiced by the District using applicable techniques, equipment, vehicles, and watercraft. Additional ditching in the future could involve the use of heavy equipment (and GHG emission are based on the use of a tractor for approximately 18 days a year for about 1 hour a day). This component involves managing vector habitat using source control and permanent control methods that do not use biological agents or chemical pesticides, such as ditch maintenance, debris removal in natural channels, and blockage of access points. The environmental impact concerns are phrased as questions as follows for the Physical Control Component:

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

GHG emissions from the Physical Control Component would be similar to the average emissions shown in Table 11-11. The Physical Control Component would emit approximately 3 MT CO_2e per year under the current program, and 4 MT CO_2e per year under the combined future program, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Physical Control Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-3:** Based on estimated annual CO_2e emissions, the Physical Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted GHG fees. Due to its small scale, the Physical Control Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions.

> **Impact GHG-4:** Based on the general inclusion of Physical Control Component emissions in the local and statewide GHG emission inventories, the Physical Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.5 Vegetation Management Component

The Vegetation Management Component would be primarily a continuation of existing activities currently practiced by the District using applicable techniques, equipment, vehicles, and watercraft, Future emissions also include the use of one tractor for approximately 42 days per year for about 1.6 hours per day and another tractor for approximately 3 days per day for about 1 hour per day, although a tractor could be used up to 3 days a year under future operations. Vegetation management is used to reduce the habitat value for mosquitoes and other vectors. The District uses hand tools and sometimes heavy equipment to remove vegetation primarily in aquatic habitats. The District may also apply herbicides to remove vegetation. The environmental impact concerns are phrased as questions as follows for the Vegetation Management Component:

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

GHG emissions from the Vegetation Management Component would be similar to the average emissions shown in Table 11-12. The Vegetation Management Component would emit approximately 397 MT CO_2e per year under the current program, and 399 MT CO_2e per year under the combined future program, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Vegetation Management Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-5:** Based on estimated annual CO_2e emissions, the Vegetation Management Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted GHG fees. Due to its small scale, the Vegetation Management Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions under either the current or future programs.

> **Impact GHG-6:** Based on the general inclusion of Vegetation Management Component emissions in the local and statewide GHG emission inventories, the Vegetation Management Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.6 Biological Control Component

The Biological Control Component would be a continuation of existing activities currently practiced by the District using applicable techniques, equipment, vehicles, watercraft, and aircraft. It currently involves the use of mosquito predators, specifically mosquitofish (*Gambusia affinis*), as they are the only commercially available biological control agents at this time. The environmental impact concerns are phrased as questions as follows for the Biological Control Component:

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

GHG emissions from the Biological Control Component would be similar to the average emissions shown in Table 11-13. The Biological Control Component would emit approximately 273 MT CO_2e per year, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Biological Control Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-7:** Based on estimated annual CO_2e emissions, the Biological Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted GHG fees. Due to its small scale, the Biological Control Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions.

> **Impact GHG-8:** Based on the general inclusion of Biological Control Component emissions in the local and statewide GHG emission inventories, the Biological Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.7 Chemical Control Component

The Chemical Control Component would be a continuation of existing activities currently practiced by the District using applicable techniques, equipment, vehicles, watercraft, and helicopters. It would be expanded to include additional equipment, specifically the use of up to three fixed-wing aircraft for adulticiding under the future program. It involves the application of herbicides, insecticides, and rodenticides to reduce vector populations. The environmental impact concerns are phrased as questions as follows for the Chemical Control Component:

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

GHG emissions from the Chemical Control Component would be similar to the average emissions shown in Table 11-14. The Chemical Control Component would emit approximately 176 MT CO_2e per year under the current program, and 204 MT CO_2e per year under the combined future program, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Chemical Control Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-9:** Based on estimated annual CO_2e emissions, the Chemical Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted GHG fees. Due to its small scale, the Chemical Control Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions.

> **Impact GHG-10:** Based on the general inclusion of Chemical Control Component emissions in the local and statewide GHG emission inventories, the Chemical Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.8 Other Nonchemical Control/Trapping Component

As applicable, the Other Nonchemical Control/Trapping Component would be the District conducting limited trapping activities using applicable techniques, existing equipment, and existing vehicles. An example of these types of activities would be trapping of rodents and/or yellow jackets. The equipment used would be supplemented with the use of traps should the District need to engage in live trapping of raccoons and skunks in the future. The environmental impact concerns are phrased as questions as follows for the Other Nonchemical Control/Trapping Component:

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

GHG emissions from the Other Nonchemical Control/Trapping Control Component would be similar to the average emissions shown in Table 11-15. The Other Nonchemical Control/Trapping Control Component would emit approximately 308 MT CO_2e per year, which is below the presumptive 1,100 MT per year threshold and would be less than significant (LS). Due to its small scale and GHG mitigations, the Other Nonchemical Control/Trapping Control Component would not individually affect the environment or impede the state's ability to meet its 2020 GHG emission reduction goal because the incremental cumulative impact would not be considerable.

> **Impact GHG-11:** Based on estimated annual CO_2e emissions, the Other Nonchemical Control/Trapping Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.

Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the greenhouse gas emissions?

On a statewide basis, agencies in California are in the process of implementing strategies to reduce GHG emissions pursuant to the Global Warming Solutions Act of 2006 (AB 32, Núñez, Chapter 488, Statutes of 2006), which requires that California reduce its statewide GHG emissions to 1990 levels by 2020. AB 32 required CARB to develop the Scoping Plan (2008b) in coordination with the CEC's Climate Action Team (2010). The Scoping Plan defines a comprehensive set of emission reduction measures such as energy efficiency, renewable energy, cap-and-trade, transportation measures, low-carbon fuels, and targeted GHG fees. Due to its small scale, the Other Nonchemical Control/Trapping Control Component would not conflict with state and local plans, policies, or regulations aimed at curbing GHG emissions.

Impact GHG-12: Based on the general inclusion of Other Nonchemical Control/Trapping Control Component emissions in the local and statewide GHG emission inventories, the Other Nonchemical Control/Trapping Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.

11.2.9 Public Education

Public education activities under the Existing Program would continue into the future under the Proposed Program with small modifications to equipment use that would not substantially affect GHGs. Therefore, there is no impact to applicable plans, policies, or regulations for reducing GHG emissions from public outreach activities.

11.2.10 Environmental Impacts Summary

Table 11-16 presents a summary of GHG impacts associated with the six technical components of the comprehensive Proposed Program (excluding public education) in comparison to existing conditions defined as existing GHG inventories as well as existing conditions as of May 25, 2012 (when the original NOP was released). The GHG impact callouts correspond to those in Sections 11.2.3 through 11.2.8. When the Existing Program activities are combined with future activities involving additional equipment use, the impacts presented are less than significant for the entire/comprehensive Proposed Program.

Similar to the air quality analysis in Section 10.2, the incremental changes associated with the expanded activities with additional equipment use in the future under the Physical Control, Vegetation Management, and Chemical Control Components are not substantial and do not result in any significant impacts.

Table 11-16 Summary of Greenhouse Gas Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Effects on GHG						
Impact GHG-1: Based on estimated annual CO2e emissions, the Surveillance Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	LS	na	na	na	na	na
Impact GHG-2: Based on the general inclusion of Surveillance Component emissions in the local and statewide GHG emission inventories, the Surveillance Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	LS	na	na	na	na	na
Impact GHG-3: Based on estimated annual CO2e emissions, the Physical Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	na	LS	na	na	na	na
Impact GHG-4: Based on the general inclusion of Physical Control Component emissions in the local and statewide GHG emission inventories, the Physical Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	na	LS	na	na	na	na
Impact GHG-5: Based on estimated annual CO2e emissions, the Vegetation Management Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	na	na	LS	na	na	na
Impact GHG-6: Based on the general inclusion of Vegetation Management Component emissions in the local and statewide GHG emission inventories, the Vegetation Management Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	na	na	LS	na	na	na

Table 11-16 Summary of Greenhouse Gas Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact GHG-7: Based on estimated annual CO2e emissions, the Biological Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	na	na	na	LS	na	na
Impact GHG-8: Based on the general inclusion of Biological Control Component emissions in the local and statewide GHG emission inventories, the Biological Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	na	na	na	LS	na	na
Impact GHG-9: Based on estimated annual CO2e emissions, the Chemical Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	na	na	na	na	LS	na
Impact GHG-10: Based on the general inclusion of Chemical Control Component emissions in the local and statewide GHG emission inventories, the Chemical Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	na	na	na	na	LS	na
Impact GHG-11: Based on estimated annual CO2e emissions, the Other Nonchemical Control/Trapping Control Component would not result in a cumulatively considerable amount of GHGs, and neither would the incremental contribution of the District. Impacts would be **less than significant** and no mitigation is required.	na	na	na	na	na	LS

Table 11-16 Summary of Greenhouse Gas Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact GHG-12: Based on the general inclusion of Other Nonchemical Control/Trapping Control Component emissions in the local and statewide GHG emission inventories, the Other Nonchemical Control/Trapping Control Component would not conflict with applicable plans, policies, or regulations for reducing GHG emissions. Impacts would be **less than significant** and no mitigation is required.	na	na	na	na	na	LS

LS = Less-than-significant impact
N = No impact
na = Not applicable
SM = Potentially significant but mitigable impact
SU = Significant and unavoidable impact

11.2.11 Mitigation and Monitoring

All impacts are less than significant (LS) for both the Existing Program and the future Program activities compared to existing conditions and require no mitigation.

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