DRAFT ENVIRONMENTAL IMPACT REPORT

Plan BayArea 2040

DRAFT EIR

SCH# 2016052041

APRIL 2017

2.5 CLIMATE CHANGE AND GREENHOUSE GASES

This section of the EIR quantitatively analyzes how implementation of the proposed Plan Bay Area 2040 may contribute to global climate change through greenhouse gas emissions related to transportation and land uses. In addition, the analysis qualitatively describes the potential impacts of sea level rise on the proposed regional land use patterns included in the Plan, as well as on the proposed transportation investment projects.

Comments on the Notice of Preparation included concerns regarding sea level rise, transportation improvements, the need to emphasize trip reduction measures and alternative modes of transportation, and maximizing overall greenhouse gas emissions reductions. These items are addressed in this section.

2.5.1 Environmental Setting

PHYSICAL SETTING

Global Climate Change

Climate is defined as the average statistics of weather, which include temperature, precipitation, and seasonal patterns such as storms and wind, in a particular region. Global climate change refers to the long term and irrevocable shift in these weather-related patterns. Using ice cores and geological records, baseline temperature and CO_2 data extends back to previous ice ages thousands of years ago. Over the last 10,000 years, the rate of temperature change has typically been incremental, with warming and cooling occurring over the course of thousands of years. However, scientists have observed an unprecedented increase in the rate of warming over the past 150 years, roughly coinciding with the global industrial revolution, which has resulted in substantial increases in greenhouse gas emissions (defined below) into the atmosphere. The anticipated impacts of climate change in California range from water shortages to inundation from sea level rise. Transportation systems contribute to climate change primarily through the emissions of certain greenhouse gases (CO_2, CH_4, and N_2O) from nonrenewable energy (primarily gasoline and diesel fuels) used to operate passenger, commercial and transit vehicles. Land use changes contribute to climate change through construction and operational use of electricity and natural gas, and waste production.

Climate modeling capabilities have been greatly enhanced in recent years allowing for the future range of climate change effects to be better understood. However, there are limitations to representing the anticipated changes at a downscaled or regional level. However, even if specifics are unknown, the global forecasted future trends will still apply at a local level.

The Intergovernmental Panel on Climate Change (IPCC) has reached consensus that human-caused emissions of greenhouse gases in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth's climate, known as global climate change or global warming. It is "extremely likely" that more than half of the observed increases in global average surface temperature from 1951 to 2010 were caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forces together (IPCC 2014:3, 5).

The IPCC predicts that the global mean surface temperature increase by the end of the 21st century (2081–2100) relative to 1986–2005, could range from 0.5 to 8.7 degrees Fahrenheit. Additionally, the IPCC projects that global mean sea level rise will continue during the 21st century, very likely at a faster rate than observed from 1971 to 2010. For the period 2081–2100 relative to 1986–2005, the rise will likely range from 10 to 32 inches (0.26 to 0.82 meters) (IPCC 2014:10, 13).

According to the California Energy Commission (CEC), accelerating global climate change has the potential to cause adverse impacts in the Bay Area, including but not limited to:

- *Water Supply:* Changes in local rainfall, salt water intrusion, sea water flooding the delta, and a reduced Sierra snowpack can all threaten the Bay Area's water supply.

- *Infrastructure*: Increased risks of flooding because of sea level rise, coastal erosion, more frequent and extreme storms, and stronger precipitation events may lead to damage, inoperability, or impairment of critical infrastructure such as wastewater treatment plants, sewage, power plants, and transportation. This would affect not only daily commutes and activities, but also emergency response.

- *Agriculture:* Changes in temperatures, more extreme heat days, and the earlier onset of spring may lead to suboptimal growing conditions for grapes and other agricultural products that significantly contribute to the Bay Area economy and tourism.

- *Ecosystems and Biodiversity:* With sea level rise, the Bay Area's coastal wetlands are threatened and cannot naturally move inland because of existing developments, thus destroying this important ecosystem. This threatens the region's freshwater fish species and may allow non-native species to thrive. Increased temperatures also result in increased fire risk.

- *Energy Demand, Supply, and Transmission:* Energy demand will increase as temperature extremes become more common. This could lead to rolling blackouts or other issues with the Bay Area's aging energy infrastructure.

- *Public Health:* Most Bay Area residences and businesses were not built with air conditioning to control temperatures on extreme heat days, which may lead to heat stroke. Higher temperatures also lead to worsened air quality and potentially the spread of diseases and pests. Increased incidence and severity of wildfires may also contribute to worsening air quality. These changes will disproportionately burden children, the elderly, and those with pre-existing health conditions (CEC 2012).

Greenhouse Gases

Gases that trap heat in the Earth's atmosphere are called greenhouse gases (GHGs). These gases play a critical role in determining the Earth's surface temperature. Part of the solar radiation that would have been reflected back into space is absorbed by these gases, resulting in a warming of the atmosphere. Without natural GHGs, the Earth's surface would be about 61 degrees cooler (Climate Action Team 2006, cited in MTC 2013). This phenomenon is known as the greenhouse effect. However, scientists have proven that emissions from human activities—such as electricity generation, vehicle emissions, and even farming and forestry practices—have elevated the concentration of GHGs in the atmosphere beyond naturally-occurring concentrations, enhancing the greenhouse effect and contributing to the larger process of global climate change. The six primary GHGs are:

- carbon dioxide (CO_2), emitted when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned;

- methane (CH_4), produced through the anaerobic decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, incomplete fossil fuel combustion, and water and wastewater treatment;

- nitrous oxide (N_2O), typically generated as a result of soil cultivation practices, particularly the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning;

- hydrofluorocarbons (HFCs), primarily used as refrigerants;

- perfluorocarbons (PFCs), originally introduced as alternatives to ozone depleting substances and typically emitted as by-products of industrial and manufacturing processes; and

- sulfur hexafluoride (SF_6), primarily used in electrical transmission and distribution.

Although there are other contributors to global warming, these six GHGs are identified by the U.S. Environmental Protection Agency (EPA) as threatening the public health and welfare of current and future generations (EPA 2009). GHGs have varying potential to trap heat in the atmosphere, known as global warming potential (GWP), and atmospheric lifetimes. GWP reflects how long GHGs remain in the atmosphere, on average, and how intensely they absorb energy. Gases with a higher GWP absorb more energy per pound than gases with a lower GWP, and thus contribute more to warming Earth. For example, one ton of CH_4 has the same contribution to the greenhouse effect as approximately 28 tons of CO_2; hence, CH_4 has a 100-year GWP of 28 while CO_2 has a GWP of 1. GWP ranges from 1 (for CO_2) to 23,500 (for SF_6). (IPCC 2014:731-737).

GWP is alternatively described as "carbon dioxide equivalents," or CO_2e. The parameter "atmospheric lifetime" describes how long the molecules will remain in the atmosphere. Atmospheric lifetimes of GHGs range from tens to thousands of years. All of these gases remain in the atmosphere long enough to become well mixed. The amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

California and Bay Area Greenhouse Gas Emissions

GHG emissions contributing to global climate change are attributable in large part to human activities associated with the electricity, transportation, industrial, commercial, residential, and agricultural/forestry sectors. The State of California alone produces about 2 percent of the entire world's GHG emissions, with major emitting sources including fossil fuel consumption from transportation (37 percent), electricity production (20 percent), industry (24 percent), agricultural and forestry (8 percent), residential (6 percent), and commercial (5 percent) (ARB 2016). California government is putting in place programs and legislation to reduce GHG emissions with the hope of delaying, mitigating, or preventing at least some of the anticipated impacts of global climate change on California communities.

Furthermore, local and regional agencies in the Bay Area have taken steps to measure, quantify, evaluate, and mitigate their contributions to GHG emissions and global climate change. For example, 67 cities and counties in the Bay Area have developed their own climate action plans and 103 have completed GHG emissions inventories (OPR 2016). Additionally, many cities, businesses, and municipal agencies are voluntary members of the Climate Action Registry, a private non-profit organization originally formed by the State of California that serves as a voluntary GHG registry to protect and promote early actions to reduce GHG emissions by organizations.

In 2017, the Bay Area Air Quality Management District (BAAQMD) updated a baseline inventory of GHG emissions for the year 2015 in the *Draft 2017 Clean Air Plan*. According to that inventory, 86.6 million tons of CO_2e ($MMTCO_2e$) were emitted in the Bay Area in 2015 (BAAQMD 2017). Table 2.5-1 and Table 2.5-2 show the emissions breakdown by pollutant and source.

Table 2.5-1 2015 Bay Area CO_2e Emissions by Pollutant

Pollutant	Percentage	CO_2e ($MMTCO_2e$ /Year)
Carbon Dioxide	90	78
Methane	3	3
Nitrous Oxide	2	2
HFC, PFC, SF_6	5	4
Regional Total	**100**	**87**

Note: $MMTCO_2e$ = million metric tons of carbon dioxide equivalent. Totals may not sum because of independent rounding.

Source: BAAQMD 2017: Table E

Table 2.5-2 2015 Bay Area CO_2e Emissions by Source

Source Category	Percentage	CO_2e ($MMTCO_2e$ /Year)
On and Off-Road Transportation	40	35
Stationary Sources	24	21
Electricity / Co-Generation[1]	18	16
Buildings[2]	11	10
Waste Management	3	2
High Global Warming Potential Gases	3	3
Agriculture	1	1
Regional Total	**100**	88

Note: $MMTCO_2e$ = million metric tons of carbon dioxide equivalent. Totals may not sum because of independent rounding.

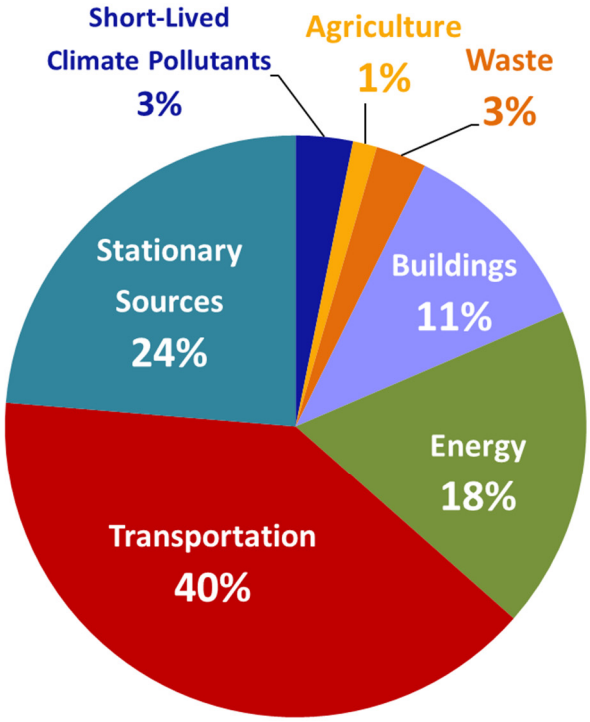
[1] Includes imported electricity emissions 2.7 $MMTCO_2e$

[2] Residential and commercial fuel use, excluding electricity

Source: BAAQMD 2017: Table F

The Bay Area's transportation sector alone contributes 40 percent of the CO_2e GHG emissions, followed by stationary sources (e.g., oil refineries and stationary fuel usage) (24 percent), electricity generation and co-generation (18 percent), buildings (11 percent), waste management (3 percent), high GWP gases (3 percent), and agriculture (1 percent). Bay Area emissions by sector are illustrated in Figure 2.5-1.

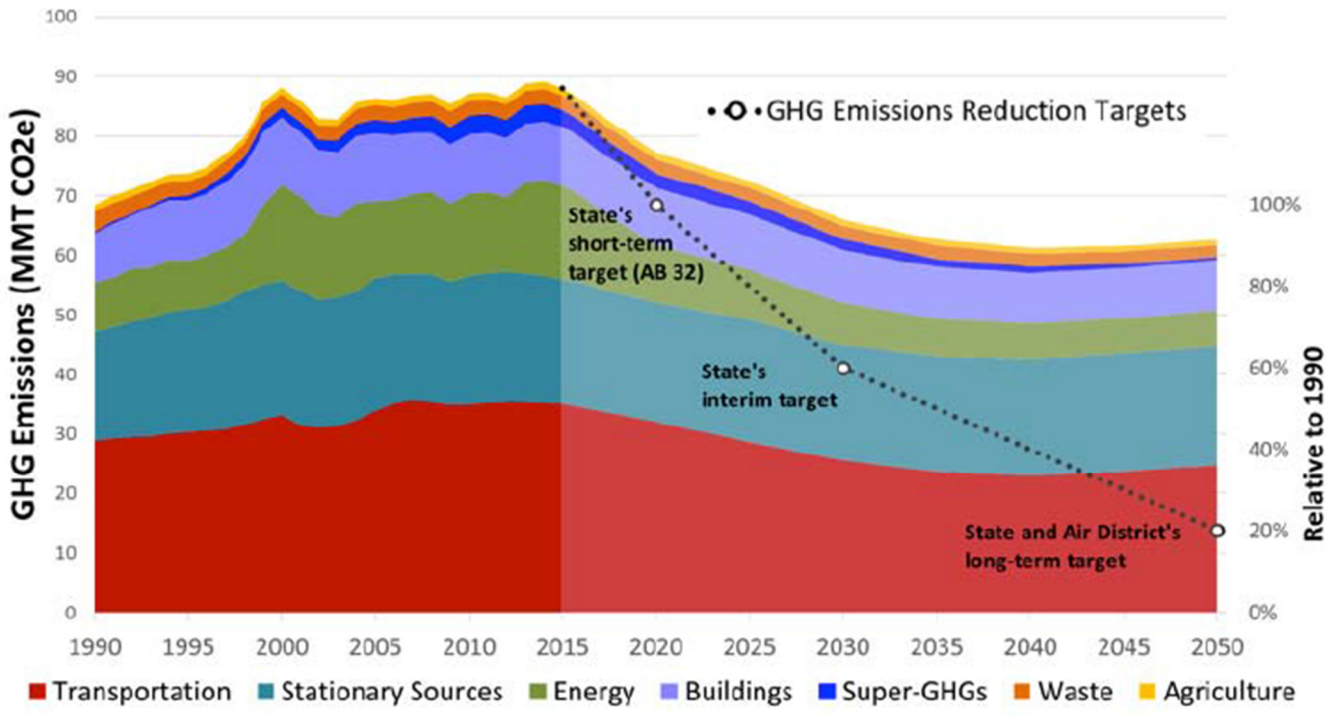
Figure 2.5-1
2015 Bay Area Greenhouse Gas Emissions by Source, as a Percent of Total



Source: BAAQMD 2017: Figure 3-6

Economic activity variations and the fraction of electric power generation in the region will cause year-to-year fluctuations in the emissions trends. Currently adopted policies and regulations would also affect future emission trends. Figure 2.5-2 shows the emission trends by major sources for the period of 1990 to 2050 alongside adopted GHG reduction targets.

Figure 2.5-2
Bay Area Greenhouse Gas Emissions Trends by Major Source from 1990 to 2050



Source: BAAQMD 2017: Figure 3-9

Sea Level Rise

Historical Data

Sea levels began rising globally at the end of the last ice age more than 10,000 years ago (USGS 2009, cited in MTC 2013). Data on ocean water levels is collected continuously from a worldwide network of more than 1,750 tidal gages, and new satellite-based sensors are extending these measurements. The data indicates that the global mean sea level is rising at an increasing rate, and sea level rise is already affecting much of California's coastal region, including the San Francisco Bay and its upper estuary (the Sacramento-San Joaquin Delta). Water level measurements from the San Francisco Presidio gage (CA Station ID: 9414290), indicate that mean sea level rose by an average of 0.08 ± 0.008 inches per year (reported as 2.01 ± 0.21 millimeters per year) from 1897 to 2006, equivalent to a change of about eight inches in the last century (Heberger et al. 2009).

According to California's Ocean Protection Council Science Advisory Team, future sea level rise projections should not be based on linear extrapolation of historic sea level observations. For estimates beyond one or two decades, linear extrapolation of sea level rise based on historic observations is considered inadequate and would likely underestimate the actual sea level rise because of expected non-linear increases in global temperature and the unpredictability of complex natural systems (California Climate Action Team 2013).

Projected Climate Conditions

Global and regional climate models can be used to project the range of estimated sea level rise rates based on emission scenarios and climate simulations. Climate models continue to be developed and improved, and many models have been extended into Earth System models by including the representation of biogeochemical cycles important to climate change (IPCC 2014: 743). Global climate models are based on well-established physical principles and have been demonstrated to reproduce observed features of recent climate and past climate changes. Global models provide information about climate response to various scenarios, but usually at a low resolution that does not provide the level of detail needed to make planning decisions at a local level.

On a regional scale (sub-continental and smaller), the confidence in model capability to simulate surface temperature is less than for the larger scale; however, there is high confidence that regional-scale surface temperature is better simulated now than at the time of the IPCC Fourth Assessment Report. A regional-based model can provide an evaluation of climate processes that are unresolved at the global model scale. Regional-based climate models that provide locally-relevant climate information are based on model output from global models, and the scale and resolution of the regional-based climate models vary widely depending on the original application and intent of the developed model.

Global Climate Projections

In order to evaluate climate change effects such as sea level rise as part of the IPCC Fifth Assessment Report, the IPCC developed future emission scenarios that differ based on varying combinations of economic, technological, demographic, policy, and institutional futures. Four emissions scenarios were developed and used by IPCC to represent a broad range of climate outcomes, and develop sea level rise projections. The scenarios, or Representative Concentration Pathways (RCP), document the projected future emissions, concentrations, and land-cover change projections.

The RCP 2.6 emissions scenario assumes very low greenhouse gas concentration levels, a scenario in which greenhouse gas emissions (and indirectly emissions of air pollutants) are reduced substantially over time. The RCP 4.5 emissions scenario is a stabilization scenario where the total change in energy in the atmosphere because of GHG emissions is stabilized before 2100 through implementation of a range of technologies and strategies for reducing greenhouse gas emissions. The RCP 6.0 emissions scenario is a stabilization scenario where the total change in energy in the atmosphere because of GHG emissions is stabilized after 2100 and assumes the implementation of a range of technologies and strategies for reducing greenhouse gas emissions. The RCP 8.5 emissions scenario is characterized by increasing greenhouse gas emissions over time leading to high greenhouse gas concentration levels (IAMC 2009).

Sea Level Rise Projections

The IPCC projects that global mean sea level rise will likely range from 10 to 32 inches (0.26 to 0.82 meters) for the period 2081–2100 relative to 1986–2005. It is very likely that by the end of the 21st century, sea level will rise in more than 95 percent of the ocean area worldwide. About 70 percent of the coastlines worldwide are projected to experience a sea level change within ±20 percent of the global mean. Based on current understanding, only the collapse of marine-based sectors of the Antarctic ice sheet could cause global mean sea level to rise substantially above the likely range during the 21st century (IPCC 2014: 13, 1140).

Sea Level Rise in San Francisco Bay

Overall sea level rise projections in the Bay Area were developed using two map sets. In coordination with the San Francisco Bay Conservation and Development Commission's (BCDC) Adapting to Rising Tides Sea Level Rise Analysis and Mapping (Rising Tides) study, Alameda, Contra Costa, Marin, San Mateo, and San Francisco counties developed county-specific analyses of sea level rise projections in 2015 and 2016 (BDBC 2015, BDBC 2016b, BDBC 2016a, San Francisco Public Utilities Commission 2016, County of Marin 2015). Sea level rise projections for all other counties were based on the National Oceanic and Atmospheric Administration (NOAA) Coastal Service Center's sea level rise inundation maps for the San Francisco Bay Area in 2012. Both maps depict sea level rise relative to a mean higher high water (MHHW) condition in the Bay. **Table 2.5-3 and Figure 2.5-3** present NOAA and BCDC sea level rise inundation information with 24 inches of sea level rise, including disconnected low-lying areas.

Table 2.5-3 Projected Midcentury (2050) Sea Level Rise Inundation Zone by County

County	Areas Inundated by Sea Level Rise[1] (acres)	Total County Area[2] (Million acres)	Percent Inundated
Alameda	28,300	472,000	6
Contra Costa	6,700	457,100	1
Marin	14,200	321,200	4
Napa	210	30,000	1
San Francisco	15,900	286,600	6
San Mateo	9,300	815,400	1
Santa Clara	12,100	479,400	3
Solano	68,000	526,300	13
Sonoma	27,300	1,008,200	3
Regional Total	**182,200**	**4,396,200**	**4**

Note: Based on 24-inch of sea level rise.
[1] Includes disconnected low-lying areas.
[2] Excludes existing bodies of water within county boundaries
Source: BCDC 2015, BCDC 2016b, BCDC 2016a, San Francisco Public Utilities Commission 2016, County of Marin 2016, NOAA 2012. Data compiled by Ascent Environmental 2017

San Francisco Bay Shoreline

The San Francisco Bay and adjacent Pacific coast shoreline is highly diverse, ranging from natural wetlands with limited inboard (or landward) development, to hardened shorelines with developments built up to, and beyond, the shoreline. The level of coastal flood protection and armoring along the shoreline varies based on the inboard land use, topographic conditions, and a site's exposure to extreme water levels and waves – both of which can lead to inland flooding and shoreline erosion. As sea level rises, the exposure to higher water levels and increasing wave hazards will increase along the shoreline, thereby increasing the likelihood for inland inundation and flooding. This section describes the existing shoreline characteristics of the nine Bay Area counties at a high level, using a shoreline categorization approach developed for the Rising Tides project

Shoreline Categories

The Rising Tides project categorized the highly varied and diverse shoreline in for the nine Bay Area Counties into eight categories based on their primary physical characteristics, functions and abilities to inhibit inland inundation. The categories include the following:

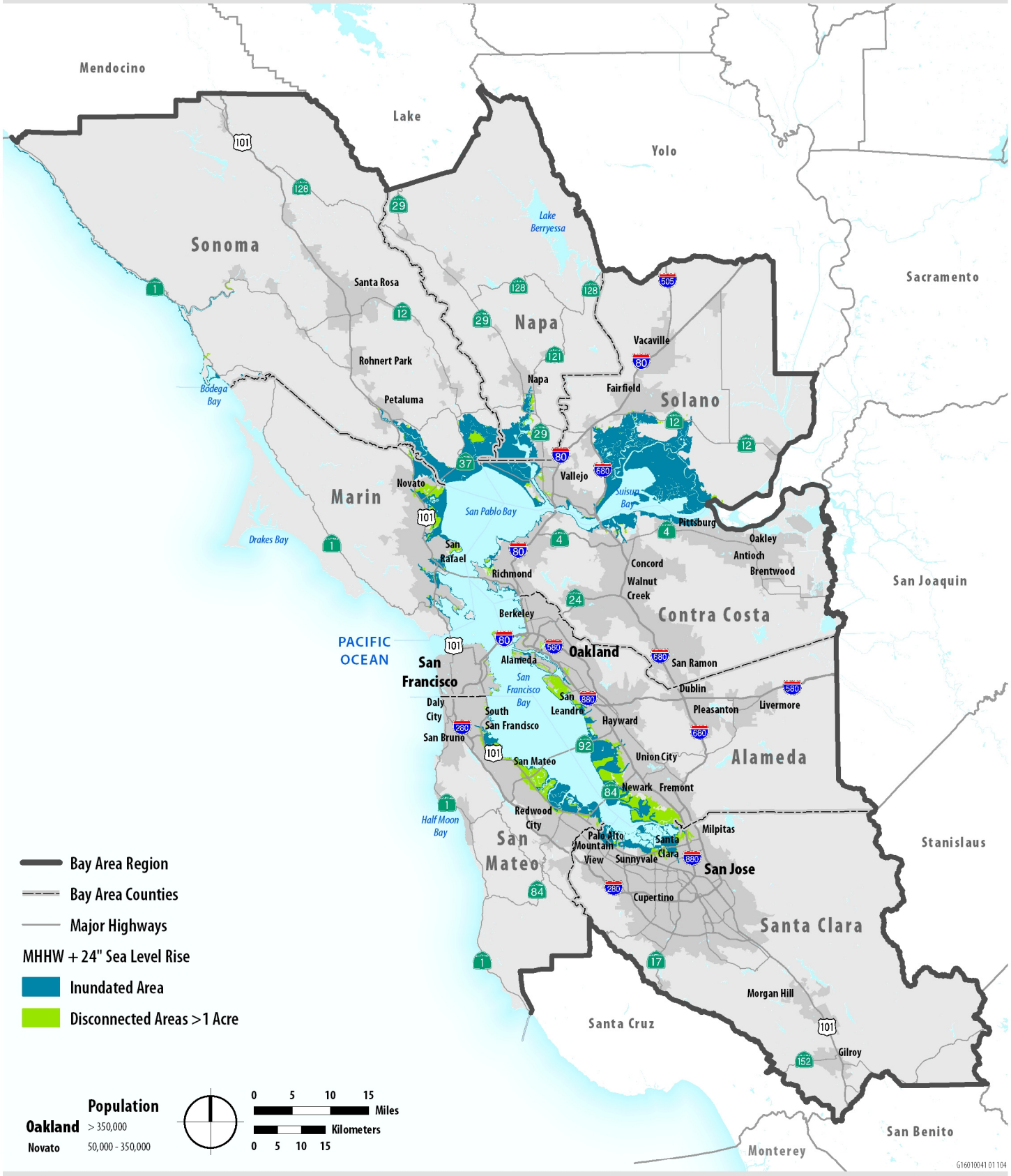
- **Engineered flood protection structures:** These structures are designed and built to protect inland areas from flooding, including from major storm events and extreme water levels that may also be accompanied by waves. This category includes both engineered levees and flood walls. Levees within this category have a Federal Emergency Management Agency (FEMA) accreditation date in the FEMA Midterm Levee Inventory Database or in information provided by the applicable County and cities stating that the structure has been engineered.

- **Non-engineered berms:** Non-engineered berms include other levees or levee-like structures that do not have current or previous FEMA accreditation. These features are similar in shape to a levee but do not provide a standard level of flood protection. They may still serve as a line of defense against flood hazards during storm events.

- **Embankments:** Embankments are typically an earthen slope within an inland area (e.g., channel banks upstream of the coastal shoreline) that transitions to flat or hilly inland areas. Unlike levees and berms, which have a crest and two slopes, embankments have only one slope. These barrier features do not provide a standard level of flood protection, but serve as a line of defense against flood hazards during storm events.

- **Shoreline protection structures**: These features share the same single-slope profile as embankments, but are Bay-facing, rather than inland. They generally abut development or a modification to the Bay shoreline.

Figure 2.5-3
24-Inch Sea Level Rise at Mean Higher High Water



Map Data Sources: Adapting to Rising Tides, San Francisco Bay Conservation and Development Commission (BCDC), 2015-2016; Metropolitan Transportation Commission (MTC), 2016; NOAA Coastal Services Center Sea Level Rise Data: 1-6 ft Sea Level Rise Inundation Extent, 2012; Tom Tom North America, 2015.

- **Transportation structures – major roads/rail:** These features were built for transportation purposes and do not provide a standard level of flood protection but can serve as a line of defense against flood hazards during storm events. Only major roads and rail lines were delineated for this assessment to evaluate potential hazards to these assets.

- **Natural shorelines/wetlands:** These features include tidal marshes along the edge of the Bay or within larger creek channels.

- **Natural shorelines or hills**: These features are areas where engineered flood protection or shoreline protection structures are absent, and no clear landward structure that provides a level of flood protection is visible.

- **Tide gates:** These structures are barriers that span creeks or channels but allow tidal flushing to occur, and they can provide a level of flood protection for upstream areas. Thirty-six tide gates in total were identified within the shoreline delineation for San Mateo County (BCDC 2015).

Figure 2.5-4 depicts the locations of the engineered levees and non-engineered berms within the low-lying areas in the Bay Area Region. This data set does not distinguish between engineered levees and non-engineered berms.

Air Quality and Public Health

The negative effects of climate change on air quality in the Bay Area will affect public health, largely through increasing levels of ozone and fine particulate matter (PM). These pollutants will increase through emissions from wildfires and more frequent and longer-lasting heat waves. The health effects of exposure to both ozone and particulate matter have historically been primarily associated with respiratory ailments, such as asthma and bronchitis. However, in recent years, many epidemiological studies have also been published linking exposure to these pollutants, especially PM, with serious cardiovascular illness, including arteriosclerosis, strokes, and heart attacks all of which can cause premature death. (Raun and Ensor 2012.)

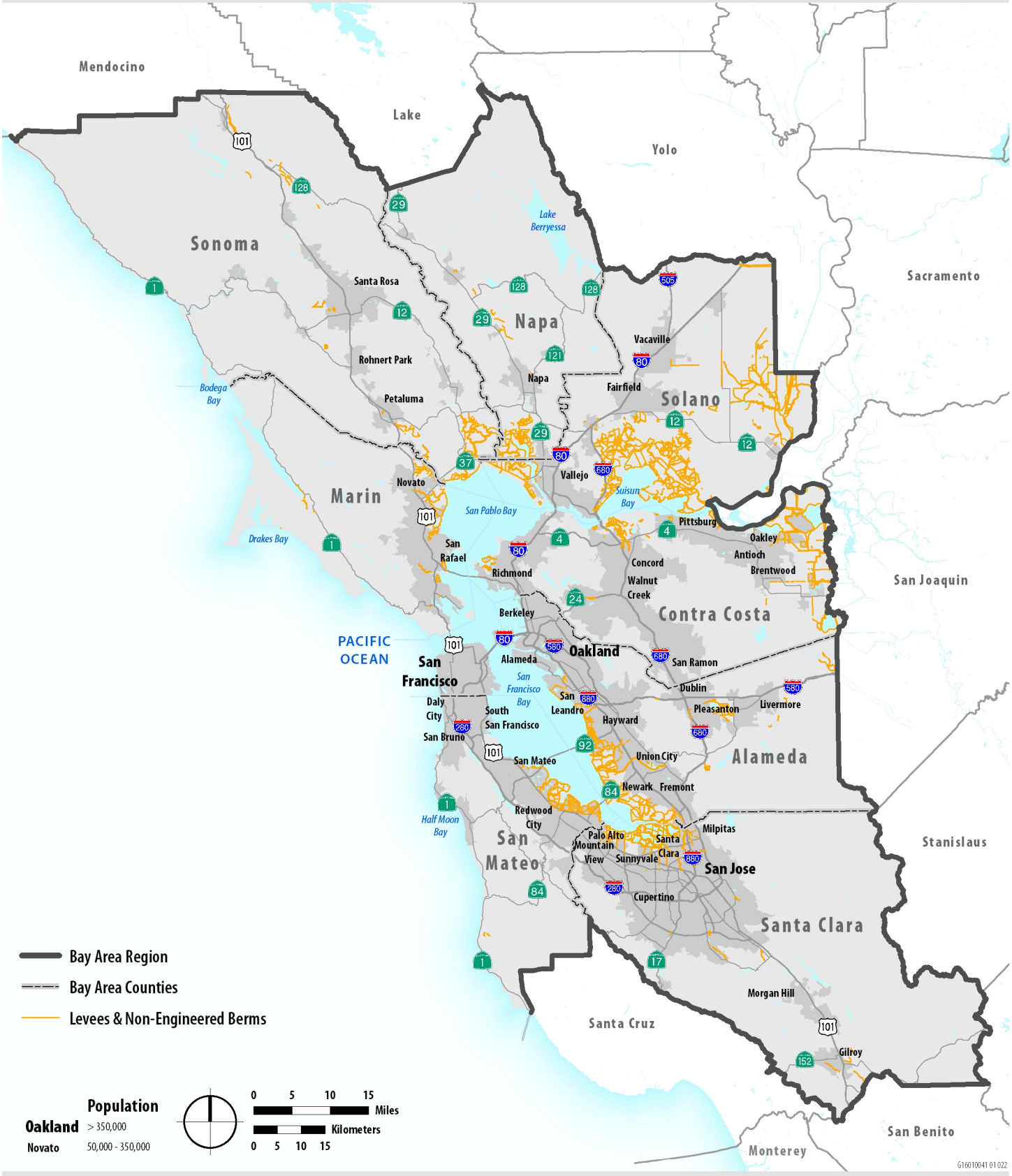
Exposure to higher levels of ozone and fine particulate matter tend to disproportionately affect the more vulnerable people in a population —children, the elderly, and the health-impaired. In addition, many people affected by poor air quality are also subject to socioeconomic conditions that make them less able to prepare for and cope with these effects of climate change.

Wildfires

Climate change is expected to increase the frequency and severity of wildfires in California by altering precipitation and wind patterns, changing the timing of snowmelt, and inducing longer periods of drought. In addition to the direct threat to human life and property, wildfires emit huge quantities of fine particles such as black carbon and can cause dramatic short-term spikes in pollution levels, greatly increasing population exposure to PM and other harmful pollutants.

According to the BAAQMD report, *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area*, the rash of wildfires that swept across California in late June 2008 caused ambient concentrations of ozone and PM to soar to unprecedented levels (BAAQMD 2012) A study found that the PM concentrations from these fires not only reached high levels, but that the PM they released was much more toxic than the PM more typically present in the California atmosphere (Wegesser et al. 2009). Smoke from wildfires can cause a variety of acute health effects, including irritation of the eyes and the respiratory tract, reduced lung function, bronchitis, exacerbation of asthma, and premature death. In addition to these health effects, wildfires also release immense quantities of carbon dioxide stored in trees and vegetation into the atmosphere. Therefore, to the extent that climate change increases wildfires, this will increase atmospheric concentrations of GHGs that contribute to climate change, establishing a feedback loop.

Figure 2.5-4
Levees and Non-Engineered Berms



Map Data Sources: Metropolitan Transportation Commission (MTC), 2016; National Flood Hazard Layer (NFHL), Federal Emergency Management Agency (FEMA), 2016; Tom Tom North America, 2015.

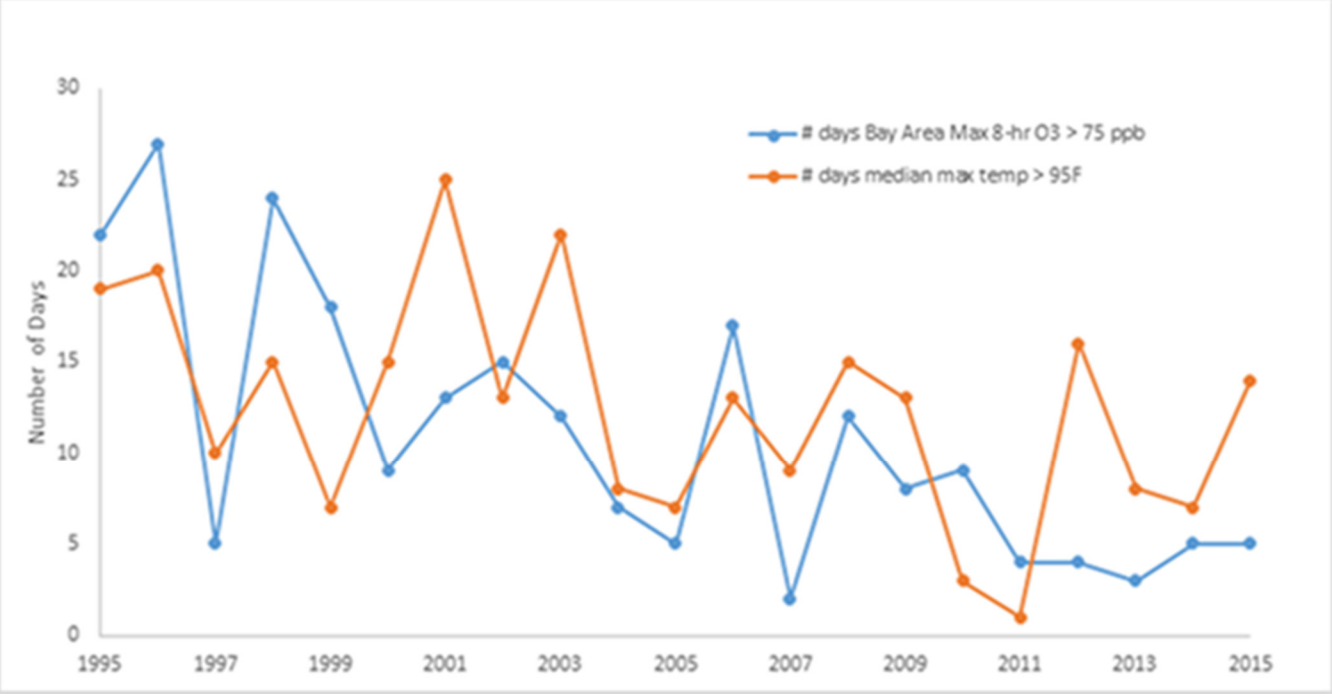
Heat

Rising temperatures because of climate change are likely to have negative effects on air quality and public health in the Bay Area. Ground level ozone—the primary component of smog—is formed through photo-chemical reactions among precursor pollutants. The most important of these precursor pollutants are oxides of nitrogen (NO_2) and volatile organic compounds (VOCs). Higher temperatures lead to greater evaporative emissions of VOCs from sources such as fuel storage tanks and motor vehicle fuel tanks, as well as greater emissions of VOCs from biogenic sources such as trees and vegetation. Increased demand for electricity to power air conditioners can also lead to higher emissions of ozone precursors from power plants. In addition to greater emissions of ozone precursors, ozone levels are also expected to increase because ozone formation is highly temperature-sensitive, increasing rapidly as temperatures rise above 90 degrees Fahrenheit. As the Bay Area experiences more extreme heat days, with higher temperatures during both the days and evenings, higher ozone levels will make it more difficult for the region to attain and maintain air quality standards.

Increasing amounts of ground level ozone pose a threat to human health. Breathing ozone can trigger a variety of health problems, such as asthma, bronchitis, impacts to lung function, and chest pains. Recent studies have linked premature death to even short-term exposure to ozone (Bell and Samet 2005; Levy and Sarnat 2005; Ito and Lippmann 2005). Certain segments of the population are less able to adapt to extreme weather events than others. The 2009 California Adaptation Strategy highlights "elderly, infants, individuals suffering from chronic heart or lung disease, persons with mental disabilities, the socially and/or economically disadvantaged, and those who work outdoors" as particularly vulnerable (CNRA 2009). According to a 2011 report by the Union of Concerned Scientists, increases in ozone levels induced by climate change in California could result in nearly 443,000 additional cases of serious respiratory illnesses. These and other health-related impacts could cost more than $729 million (in 2008 dollars) in 2020 alone (Union of Concerned Scientists 2011).

As shown in **Figure 2.5-5** the years in which the Bay Area has greater numbers of days exceeding the 8-hour ozone standard correlate very closely with years in which the region experiences higher temperatures.

Figure 2.5-5
Number of Days Exceeding the 8-Hour Ozone Standard and 99 Degree Weather[1]



Source: BAAQMD 2016. 1 Shows data from long-running monitoring sites to show long-term trends.

If higher temperatures lead to increased ozone formation for the reasons described above, this may erode the progress that the region has made over the past 50 years of regulatory action. BAAQMD's research indicates that, at the current rate of emissions control, the projected increase in ozone because of climate change from 2000 to 2050 would offset about 15 years of progress in reducing ambient ozone levels.

Urban Heat Islands

The high concentration of buildings, parking lots and roadways in urban areas create dry, hot microclimates, or "heat islands," which absorb more of the sun's heat than surrounding rural areas. As urban areas develop, paved and dark surfaces and impermeable structures replace natural vegetation and open spaces. According to EPA, on hot, sunny summer days, the sun can heat dry, exposed urban surfaces, such as roofs and pavement, to temperatures of 50 to 90 degrees Fahrenheit (27 to 50 degrees Celsius) hotter than the surrounding air, while more shaded and open surfaces—often in more rural surroundings—remain close to air temperatures (Berdahl and Bretz 1997, cited in EPA 2016). These impermeable, dark manmade surfaces also tend to retain heat longer after the sun goes down, thus limiting the ability of urban areas to cool off during periods of heat waves.

Urban heat islands have a direct impact on human health. In addition to contributing to direct health impacts from heat, such as heat stroke, heat islands also contribute to elevated ozone levels, which contribute to a range of cardio-respiratory ailments as described above. The Chicago heat wave of 1995 resulted in the deaths of over 700 people, many of whom were low income and/or elderly. According to the National Weather Service, heat is one of the leading weather-related killers in the United States (NOAA 2016).

Increased High Global Warming Potential Gases

Certain gases hold the potential to warm the climate at far greater levels than equivalent amounts of carbon dioxide. Certain HFCs, PFCs, and SF_6 have "global warming potential," ranges from 140 to 23,500 times that of CO_2. The greatest source of HFCs, and the greatest source of any high GWP gas, is leakage from refrigeration, heat pumps and air conditioning equipment. However, the total emissions of high GWP gases in CO_2 equivalents generally accounts for a small percentage, about 2 percent, of global anthropogenic GHG emissions (IPCC 2014:46).

2.5.2 Regulatory Setting

FEDERAL

Federal Clean Air Act

The federal Clean Air Act (CAA) of 1970, amended in 1977 and 1990 (42 USC 7506(c)), was enacted for the purposes of protecting and enhancing the nation's air resources to benefit public health. In 1971, the CAA required the EPA to set National Ambient Air Quality Standards that establish emission limits for certain pollutants. In 2009, EPA signed two findings related to GHGs. First, EPA found that current and project concentrations of CO_2, CH_4, N_2O, HFCs, PFCs, and SF6 would threaten public health and welfare of current and future generations. Second, EPA found that mobile vehicles contribute to GHG pollution which threaten public health and welfare. (EPA 2017.)

Global Change Research Act (1990)

In 1990, Congress passed and the President signed Public Law 101-606, the Global Change Research Act. The purpose of the legislation was: "…to require the establishment of a United States Global Change Research Program aimed at understanding and responding to global change, including the cumulative effects of human activities and natural processes on the environment, to promote discussions towards international protocols in global change research, and for other purposes." To that end, the Global Change Research Information Office was established in 1991 to serve as a clearinghouse of information. The Act requires a report to Congress every four years on the environmental, economic, health and safety consequences of climate change; however, the first and only one of these reports to date, the *National Assessment on Climate Change*,

was not published until 2000. In February 2004, operational responsibility for GCRIO shifted to the U.S. Climate Change Science Program.

Energy Policy Act of 1992 (EPAct)

The Energy Policy Act of 1992 (EPAct) was passed to reduce the country's dependence on foreign petroleum and improve air quality. EPAct includes several parts intended to build an inventory of alternative fuel vehicles (AFVs) in large, centrally fueled fleets in metropolitan areas. EPAct requires certain federal, state, and local government and private fleets to purchase a percentage of light duty AFVs capable of running on alternative fuels each year. In addition, financial incentives are also included in EPAct. Federal tax deductions will be allowed for businesses and individuals to cover the incremental cost of AFVs. States are also required by the act to consider a variety of incentive programs to help promote AFVs.

Energy Policy Act of 2005

The Energy Policy Act of 2005 provides renewed and expanded tax credits for electricity generated by qualified energy sources, such as landfill gas; provides bond financing, tax incentives, grants, and loan guarantees for clean renewable energy and rural community electrification; and establishes a federal purchase requirement for renewable energy.

Energy Independence and Security Act of 2007

The Energy Independence and Security Act of 2007 was intended to move the U.S. toward greater energy independence and security. This energy bill increases the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard requiring fuel producers to use at least 36 billion gallons of biofuel in 2022. It also tightens the Corporate Average Fuel Economy (CAFE) standards that regulate the average fuel economy in the vehicles produced by each major automaker.

National Fuel Efficiency Policy

On May 7, 2010, the U.S. Department of Transportation and EPA jointly issued national fuel efficiency and GHG emissions standards for model year 2012-2016 passenger vehicles and light duty trucks. The National Highway Traffic Safety Administration (NHTSA) issued CAFE standards for model year (MY) 2012-2016 passenger cars and light trucks under the Energy Policy and Conservation Act and Energy Independence and Security Act and EPA issued national GHG emissions standards under the federal Clean Air Act. These joint GHG and fuel economy standards represent the first phase of the National Program to improve fuel economy and reduce GHG emissions from U.S. light-duty vehicles. Starting with 2012 model year vehicles, the rules require automakers to improve fleet-wide fuel economy and reduce fleet-wide GHG emissions by approximately five percent every year. It is expected that the regulations will result in a 2016 fleet average of 35.5 mpg. These standards are expected to conserve about 1.8 billion barrels of oil and reduce nearly a billion tons of GHG emissions over the lives of the vehicles covered.

In 2012, NHTSA and EPA proposed draft language to extend the National Program (coordinated GHG and fuel economy standards) for model year 2017 through model year 2025. The proposed CAFE standards are projected to require, on an average industry fleet-wide basis for cars and trucks combined, 40.3 to 41.0 miles per gallon (mpg) in model year 2021, and 48.7-49.7 mpg in model year 2025. EPA's proposed GHG standards, which are consistent with NHTSA's CAFE standards, are projected to require 163 grams/mile of CO_2 in model year 2025.

On August 28, 2014, EPA and NHTSA finalized this new national program that would reduce GHG emissions and improve fuel economy for all new cars and trucks sold in the U.S. EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act. This proposed national program allows automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both Federal programs and the standards of California and other states. While this program will increase fuel economy to the equivalent of 54.5 miles per gallon for cars and light-duty trucks by Model Year 2025, additional phases are being developed by NHTSA and EPA that address GHG emission standards for new medium- and heavy-duty trucks (NHTSA 2014).

STATE REGULATIONS

Assembly Bill 1493 (Chapter 200, Statutes of 2002)

Assembly Bill (AB) 1493 (Pavley) amended Health and Safety Code sections 42823 and 43018.5 requiring the California Air Resources Board (ARB) to develop and adopt regulations that achieve maximum feasible and cost-effective reduction of GHG emissions from passenger vehicles, light-duty trucks, and other vehicles used for noncommercial personal transportation in California. The regulations prescribed by AB 1493 took effect on January 1, 2006, and apply only to 2009 and later model year motor vehicles.

In September 2004, pursuant to AB 1493, ARB approved regulations to reduce GHG emissions from new motor vehicles. Under the new regulations, one manufacturer fleet average emission standard is established for passenger cars and the lightest trucks, and a separate manufacturer fleet average emission standard is established for heavier trucks. The regulations took effect on January 1, 2006 and set near-term emission standards, phased in from 2009 through 2012, and mid-term emission standards, to be phased in from 2013 through 2016 (referred to as the Pavley Phase I rules). For model years 2017 through 2025, ARB has adopted the National Fuel Efficiency Policy standards as previously described (ARB 2012). ARB established the Advanced Clean Cars program in 2012 to work with manufacturers to develop vehicle technologies, such as zero emission vehicles, that would meet both the adopted GHG and criteria air pollutant standards.

Executive Order S-3-05 (Gov. Schwarzenegger, June 2005)

Executive Order S-3-05 was signed on June 1, 2005. The Order recognizes California's vulnerability to climate change, noting that increasing temperatures could potentially reduce snow pack in the Sierra Nevada, which is a primary source of the State's water supply. Additionally, according to this Order, climate change could influence human health, coastal habitats, microclimates, and agricultural yield. The Order set the GHG reduction targets for California: by 2010, reduce GHG emissions to 2000 levels; by 2020 reduce GHG emissions to 1990 levels; by 2050 reduce GHG emissions to 80 percent below 1990 levels.

The Order directs the Secretary of the California Environmental Protection Agency to coordinate oversight of efforts made to achieve these targets with other state agencies and, like all executive orders, the Order has no binding legal effect on regional agencies, such as MTC and ABAG, which are outside of the California Executive Branch. MTC and ABAG may voluntarily consider the emissions reduction targets and other provisions of the Order, but MTC and ABAG play no formal role in the Order's implementation.

A recent California Appellate Court decision, *Cleveland National Forest Foundation v. San Diego Association of Governments* (November 24, 2014) Cal.App.4th, further examined the executive order and concluded it should be viewed as having the equivalent force of a legislative mandate for specific emissions reductions. The case has been accepted for review by the California Supreme Court, and therefore is not currently considered a precedent.

California Global Warming Solutions Act of 2006 (AB 32 and SB 32)

Assembly Bill (AB) 32, the California Global Warming Solutions Act (Health and Safety Code Section 38500 et seq.), was signed in September 2006. The Act requires the reduction of statewide GHG emissions to 1990 levels by the year 2020. This change, which is estimated to be a 25 to 35 percent reduction from current emission levels, will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. The Act also directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources and address GHG emissions from vehicles. ARB has stated that the regulatory requirements for stationary sources will be first applied to electricity power generation and utilities, petrochemical refining, cement manufacturing, and industrial/commercial combustion. The second group of target industries will include oil and gas production/distribution, transportation, landfills and other GHG-intensive industrial processes.

On December 11, 2008, ARB adopted its *Climate Change Scoping Plan* (Scoping Plan), which functions as a roadmap of ARB's plans to achieve GHG reductions in California required by AB 32 through subsequently enacted regulations. The Scoping Plan contains the main strategies California will implement to reduce CO_2e

emissions by 174 MMT, or approximately 30 percent, from the State's projected 2020 emissions level of 596 MMT CO_2e under a "business-as-usual" scenario. The Scoping Plan also breaks down the amount of GHG emissions reductions ARB recommends for each emissions sector of the State's GHG inventory. The Scoping Plan's recommended measures were developed to reduce GHG emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put the State on a path to meet the long-term goal of reducing California's GHG emissions by 2050 to 80 percent below 1990 levels.

In May 2014, ARB released and has since adopted the First Update to the Climate Change Scoping Plan to identify the next steps in reaching AB 32 goals and evaluate the progress that has been made between 2000 and 2012 (ARB 2014a:4, 5). According to the update, California is on track to meet the near-term 2020 GHG limit and is well positioned to maintain and continue reductions beyond 2020 (ARB 2014a:ES-2). The update also reports the trends in GHG emissions from various emission sectors.

On September 8, 2016, Governor Brown approved SB 32 (Pavley, Chapter 249, Statutes of 2016), which added a 2030 target to the Global Warming Solutions Act of 2006. SB 32 requires that statewide GHG emissions are reduced to 40 percent below 1990 levels by 2030. This bill was tied to passage of a companion bill, AB 197, described below.

On January 20, 2017, ARB released its Draft 2017 Climate Change Scoping Plan Update (2017 Draft Scoping Plan Update), which lays out the framework for achieving the 2030 reductions as established in EO B-30-15, SB 32, and AB 197. The 2017 Draft Scoping Plan Update identifies the GHG reductions needed by emissions sector to achieve a statewide emissions level that is 40 percent below 1990 levels before 2030. Many of the programs require statewide action, promulgated through regulation, and are outside the ability of sub-state jurisdictions to implement on their own accord. This is important to recognize in terms of GHG emissions efficiency and attaining GHG targets. The ability to attain targets will not only rely on transportation strategies, (e.g., the SCS), but also on land use strategies implemented by local cities and counties (e.g., qualified GHG reduction plans) and controls and actions tied to economy-wide changes promulgated by the State.

Examples listed in the 2017 Draft Scoping Plan Update include:

- reliance on SB 350 targets of providing 50 percent of the State's electricity via renewable resources (this is largely accomplished by actions of utilities);
- attaining 18 percent reduction in carbon intensity of fuels (Low Carbon Fuel Standard);
- vehicle fleet mix that includes 4.2 million zero-emission vehicles (ZEV) by 2030 and similar changes in urban buses and light- and heavy-duty trucks;
- regulations that reduce short-lived GHGs;
- deployment of 100,000 ZEV freight vehicles by 2030;
- reduction of refinery GHG emissions by 20 percent;
- continuation (past 2020) of the Cap- and Trade-Program; and
- reduction in VMT by implementation of SB 375 (i.e., this SCS) and other strategies intended to reduce VMT (ARB 2017:ES4,ES5).

Some of these programs have already been initiated and others will require legislative or regulatory action by the State. In addition, and as mentioned above, the 2017 Draft Scoping Plan states that local governments (e.g., cities and counties) play an important role in achieving the State's long-term GHG goals because they have broad influence, and sometimes-exclusive authority, over activities that enable or thwart uptake of

policies that contribute to significant direct and indirect GHG emissions. These actions include community-scale planning and permitting processes, discretionary actions, local codes and ordinances, outreach and education efforts, and municipal operations. ARB states that to achieve the 2030 target, local governments are essential partners and their action is required to complement and support State-level actions. ARB also acknowledges that without land use decisions from local governments that allow more efficient use and management of land use, longer-term targets cannot be met. ARB recommends that local jurisdictions develop sufficiently detailed and adequately supported GHG reduction plans (including climate action plans [CAPs]) that look holistically at GHG emissions and local strategies to support statewide limits.

Assembly Bill 197

Governor Brown signed AB 197 (Garcia, Chapter 250, Statutes of 2016) on September 8, 2016. AB 197 creates a legislative committee to oversee ARB and requires ARB to take specific actions when adopting plans and regulations pursuant to SB 32 (described below) related to disadvantaged communities, identification of specific information regarding reduction measures, and information regarding existing greenhouse gases at the local level.

Senate Bill 1368 (Chapter 598, Statutes of 2006)

Senate Bill (SB) 1368, signed in September 2006, required the California Public Utilities Commission (PUC) to establish a GHG emissions performance standard for "baseload" generation from investor-owned utilities by February 1, 2007. The CEC was required to establish a similar standard for local publicly-owned utilities by June 30, 2007. The legislation further required that all electricity provided to California, including imported electricity, must be generated from plants that meet or exceed the standards set by the PUC and the CEC. In January 2007, the PUC adopted an interim performance standard for new long-term commitments (1,100 pounds of CO_2 per megawatt-hour), and in May 2007, the CEC approved regulations that match the PUC standard.

Executive Order S-01-07 (Gov. Schwarzenegger, January 2007)

In January 2007, Executive Order S-01-07 established a Low-Carbon Fuel Standard. The Order calls for a statewide goal to be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 ("2020 Target"), and that a Low Carbon Fuel Standard (LCFS) for transportation fuels be established for California. Further, it directs ARB to determine if an LCFS can be adopted as a discrete early action measure pursuant to AB 32, and if so, to consider the adoption of an LCFS on the list of early action measures required to be identified by June 30, 2007, pursuant to Health and Safety Code Section 38560.5. The LCFS applies to all refiners, blenders, producers or importers ("Providers") of transportation fuels in California, will be measured on a full fuels cycle basis, and may be met through market-based methods by which Providers exceeding the performance required by an LCFS shall receive credits that may be applied to future obligations or traded to Providers not meeting the LCFS.

In June 2007, ARB approved the LCFS as a Discrete Early Action item under AB 32 and, in April 2009, ARB approved the new rules and carbon intensity reference values with the new regulatory requirements taking effect in January 2011. The standards require providers of transportation fuels to report on the mix of fuels that they provide and demonstrate that they meet the LCFS intensity standards annually. This is accomplished by ensuring that the number of "credits" earned by providing fuels with a lower carbon intensity than the established baseline (or obtained from another party) is equal to or greater than the "deficits" earned from selling higher intensity fuels.

In December 2011, the U.S. District Court for the Eastern District of California issued three rulings against the LCFS including a requirement for ARB to abstain from enforcing the LCFS. In April 2012, the Ninth Circuit granted ARB's motion for a stay of the injunction while it continued to consider ARB's appeal of the lower court's decision. Consequently, ARB re-adopted the LCFS regulation in September 2015, and the changes went into effect on January 1, 2016. The program establishes a strong framework to promote the low carbon fuel adoption necessary to achieve the Governor's 2030 and 2050 greenhouse gas goals.

Executive Order B-16-2012

Executive Order B-16-2012 directs State entities to support and facilitate the rapid commercialization of zero-emission vehicles. The order outlines benchmarks for 2015, 2020, and 2025 related to establishing infrastructure to support and accommodate zero-emission vehicles, helping get zero-emission vehicles to market and on the road, and increasing their use for public transportation and public use, among others. It also establishes a goal of an 80 percent reduction of greenhouse gas emissions from the transportation sector in California as compared to 1990 levels by 2050. This Executive Order also explicitly states that it "is not intended to, and does not create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its agencies, departments, entities, officers, employees, or any other person."

Senate Bill 375 (Chapter 728, Statutes of 2008)

Senate Bill (SB) 375, adopted September 30, 2008 helps meet the AB 32 goals of reducing emissions from cars and light duty trucks. SB 375 requires regional planning agencies to include a Sustainable Communities Strategy (SCS) in their regional transportation plan (RTP) that demonstrates how the region could achieve GHG emissions reductions set by ARB through integrated land use and transportation planning. Local governments retain control of land use planning authority; however, SB 375 amended the California Environmental Quality Act (Pub. Resources Code § 21000 et seq.) to ease environmental review of specific types of developments that are anticipated to reduce emissions. Plan Bay Area is the integrated SCS and RTP for the San Francisco Bay Area, consistent with SB 375.

California's Energy Efficiency Standards for Residential and Nonresidential Buildings

Known by the shorthand name of "Title 24," this policy was established in 1978 in response to a legislative mandate to reduce California's energy consumption. Title 24 is updated periodically to allow for incorporation of new energy efficiency technologies and methods. The standards are updated on an approximately three-year cycle to allow consideration and possible incorporation of new energy efficient technologies and methods. All buildings for which an application for a building permit is submitted on or after January 1, 2017 must follow the most recent update, the 2016 standards (CEC 2015). Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases GHG emissions. The CEC Impact Analysis for California's 2016 Building Energy Efficiency Standards estimates that the 2016 Standards are 28 percent more efficient than the previous 2013 standards for residential buildings and 5 percent more efficient for non-residential buildings (CEC 2015).

California Green Building Standards Code (2016), California Code of Regulations Title 24, Part 11

California's green building code, referred to as "CalGreen," was developed to provide a consistent approach to green building within the State. Taking effect in January 2016, the most recent version of the Code lays out the minimum requirements for newly constructed residential and nonresidential buildings to reduce GHG emissions through improved efficiency and process improvements. It also includes voluntary tiers to further encourage building practices that improve public health, safety and general welfare by promoting the use of building concepts which minimize the building's impact on the environment and promote a more sustainable design. Local jurisdictions are required to adopt the CalGreen provisions. CalGreen is complimentary with California Energy Code, Title 24, Part 6, which continues to regulate energy efficiency in buildings.

Senate Bill 1 (Chapter 132, Statutes of 2006)

The "Million Solar Roofs" legislation sets a goal of installing 3,000 megawatts of new solar capacity by 2017 to move the State toward a cleaner energy future and help lower the cost of solar systems for consumers. The Million Solar Roofs program is a ratepayer-financed incentive program aimed at transforming the market for rooftop solar systems by driving the cost down over time. It provides up to $3.3 billion in financial incentives that decline over time.

Executive Order S-13-08

Governor Schwarzenegger signed California Executive Order (EO) S-13-08 on November 14, 2008, to address the potential impacts of global climate change, including sea level rise. The order emphasizes the need for

timely planning to mitigate and adapt to the potential effects of sea level rise on the State's resources. As a result, any State agency planning construction projects in areas vulnerable to future sea level rise must evaluate and reduce the potential risks and increase resiliency, to the extent feasible. Planning must consider a range of sea level rise scenarios for 2050 and 2100.

Executive Order B-30-15

On April 20, 2015 Governor Edmund G. Brown Jr. signed Executive Order B-30-15 to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The Governor's executive order aligns California's GHG reduction targets with those of leading international governments such as the 28-nation European Union which adopted the same target in October 2014. California's new emission reduction target of 40 percent below 1990 levels by 2030 will make it possible to reach the ultimate goal of reducing emissions 80 percent under 1990 levels by 2050. This is in line with the scientifically established levels needed in the U.S. to limit global warming below 2 °C - the warming threshold at which there will likely be major climate disruptions such as super droughts and rising sea levels according to scientific consensus. SB 32, discussed previously, legislatively implements the targets in this executive order.

State of California Sea Level Rise Guidance Document

EO S-13-08 directs the California Natural Resources Agency, in coordination with other state agencies and the National Academy of Sciences, to assess sea level rise for the Pacific Coast and create official sea level rise estimates for state agencies in California, Oregon and Washington. The assessment and official estimates are provided within the State of California Sea-Level Rise Guidance Document.

The State of California Sea Level Rise Interim Guidance Document contains eight recommendations for incorporating sea level rise into project planning:

- use the ranges of SLR presented in the June 2012 National Research Council report on Sea Level Rise for the Coasts of California, Oregon, and Washington as a starting place and select SLR values based on agency and context-specific considerations of risk tolerance and adaptive capacity;
- consider timeframes, adaptive capacity, and risk tolerance when selecting estimates of SLR;
- consider storms and other extreme events;
- coordinate with other state agencies when selecting values of SLR and, where appropriate and feasible, use the same projections of SLR;
- future SLR projections should not be based on linear extrapolation of historic sea level observations;
- consider changing shorelines;
- consider predictions in tectonic activity; and
- consider trends in relative local mean sea level.

The interim guidance document is expected to be updated regularly, to keep pace with scientific advances associated with sea level rise.

California Climate Adaptation Strategy

In response to EO S-13-08, the California Natural Resources Agency released the California Climate Adaptation Strategy (CAS) in 2009. The strategy proposes a comprehensive set of recommendations designed to inform and guide State agencies in their decision-making processes as they begin to develop policies to protect the State, its residents, and its resources from a range of climate change impacts, including sea level rise. The CAS presents recommendations for seven sectors, including Ocean and Coastal Resources and Transportation and Energy Infrastructure.

CAS recommendations specific to Ocean and Coastal Resources emphasize hazard avoidance, adaptation planning, and collaboration with local governments to address sea level rise. The CAS directs State agencies, in general, not to plan, develop, or build any new significant structure in a location requiring significant protection from sea level rise, storm surges, or coastal erosion during the expected life of the structure. The strategy notes that the most risk-averse approach for minimizing the adverse effects of sea level rise and storm activities is to carefully consider new development within areas vulnerable to inundation and erosion. The CAS also recommends that all State agencies prepare sea level rise adaptation plans, guidance, and criteria, as appropriate. The strategy directs State agencies to coordinate with any other agencies with jurisdiction over the coastal zone, (e.g., BCDC, the California Coastal Commission), local governments, and regional organizations on regional adaptation planning. The CAS also recommends that State agencies encourage local governments to adopt policies on setbacks, buffer areas, clustered coastal development, and engineering solutions, among others.

Within the Transportation Energy Infrastructure sector, the CAS specifically directs Caltrans to incorporate climate change vulnerability assessment planning tools, policies, and strategies into existing transportation and investment decisions. The strategy also instructs Caltrans to develop guidelines to establish buffer areas and setbacks to avoid risks to structures within projected "high" future sea level rise or flooding inundation zones.

Caltrans Guidance on Incorporating Sea Level Rise

Pursuant to EO S-13-08 and the California Sea Level Rise Interim Guidance Document, in May 2011 Caltrans released guidance on incorporating sea level rise into planning and decision making with respect to transportation projects. Caltrans' guidance recommends first determining if sea level should be incorporated into project planning, based on the project location and level of risk. A screening process with ten criteria guides the assessment of whether to incorporate sea level rise: design life, redundancy/alternative route(s), anticipated travel delays, evacuations/emergencies, traveler safety, expenditure of public funds, scope of project, effect on non-state highways, and environmental constraints. If the screening determines that sea level rise should be incorporated into project planning, the next step is to estimate the degree of potential impact and assess alternatives for preventing, mitigating and/or absorbing the impact. Caltrans uses the statewide sea level rise estimates presented in the California Sea Level Rise Interim Guidance Document for different years (2030 through 2100) to determine target sea level rise values; Caltrans directs projects with a life that extends to 2030 or earlier not to assume impacts from sea level rise. Having identified target sea level rise values for a project, Caltrans then lays out steps for implementation, including conducting more technical studies of inundation and subsidence and determining any adverse effects on facility functions and operations (e.g., from erosion, exposure to salt water), necessary adaptation measures, and the costs of mitigation.

California Department of Public Health Guidance on Integrating Public Health into Climate Action Planning

In February of 2012, the California Department of Public Health released a guidance document, *Climate Action for Health: Integrating Public Health into Climate Action Planning*. This document introduces key health connections to climate change mitigation strategies, and suggestions for where these fit into a local climate action plan or general plan. The guidance document also provides a number of examples of strategies taken from actual climate action plans that integrate public health objectives, with policy efforts to improve community health and reduce GHG emissions. The information provided is advisory, voluntary, and educational. The document includes specific policy recommendations for transportation and land use planning, including incorporation of green space and tree canopy to mitigate urban heat islands, and healthy siting of housing, schools and health care facilities to avoid major air quality impacts.

Coastal Act

The California Coastal Act of 1976 directs the California Coastal Commission (Coastal Commission) to protect and enhance the State's coastal resources. The Coastal Commission has planning, regulatory, and permitting authority over all development within the coastal zone, whose landward boundary varies with location. The Act

governs coastal hazards for new development, mandating that it minimize risks to life and property in areas of high flood. New development must be located such that it will not be subject to erosion or stability hazard over the course of its design life, and construction of protective devices (e.g., seawalls, revetment) that substantially alter natural land forms along bluffs and cliffs are not permitted (Section 30253).

The Coastal Commission's mandate extends to climate change, including sea level rise; however, the agency is currently assessing how best to address sea level rise and other challenges resulting from climate change. The Coastal Commission partners with local governments to form Local Coastal Programs (LCPs), transferring the power to regulate development within the coastal zone to cities and counties. Within the Bay Area, all of San Mateo, San Francisco, Marin, and Sonoma counties, along with the cities of Daly City, Pacifica and Half Moon Bay have certified LCPs. Any changes in the Coastal Commission's policies and/or regulations with respect to sea level rise may ultimately require revisions to LCPs.

REGIONAL COORDINATION

In the Bay Area, the Bay Area Regional Collaborative (BARC) coordinates the regional planning efforts of ABAG, BAAQMD, BCDC, and MTC. Current BARC efforts are focused on the following five major tasks:

1. Completing Resiliency report related to the Sustainable Communities Strategy;

2. Integrating climate-planning documents;

3. Preparing to develop comprehensive regional adaptation plan;

4. Providing strategic leadership to key institutions and collaborative efforts addressing climate change in the Bay Area; and

5. Galvanizing resources and increase visibility of Bay Area regional agencies' climate initiatives.

Past projects completed as a result of the BARC collaborative efforts includes the Bay Area Climate and Energy Resilience Strategy to provide guidance on how to include protecting the Bay Area's economy, public health, infrastructure and ecosystems from the effects of climate change, and development of a Regional Sea Level Rise Adaptation Strategy.

REGIONAL AND LOCAL REGULATIONS

San Francisco Bay Plan

The BCDC is charged with the protection, enhancement, and responsible use of the San Francisco Bay. The agency's jurisdiction includes the Bay itself, all land within 100 feet of the Bay shoreline, salt ponds, managed wetlands and certain waterways named in the Commission' law. BCDC guides uses of the Bay and its shoreline through policies set forth in the McAteer-Petris Act, the Suisun Marsh Preservation Act, the San Francisco Bay Plan, originally adopted in 1968, and the Suisun Marsh Protection Plan, originally adopted in 1977. In October 2011, BCDC amended its Bay Plan sea level rise policies and added new climate change findings and policies to the Bay Plan with the adoption of Amendment No. 1-08.

The policies included in the Bay Plan amendment aim to protect existing and planned development from sea level rise while preserving public access to the Bay and ecosystems. New large shoreline projects must assess the risks of sea level rise and storms, based on the best available estimates of sea level rise. Large projects that could experience risks to public safety, e.g., flooding, must be designed to cope with flood levels expected at the midcentury and have an adaptive strategy for the end of century, depending on the life of the project. The new policies encourage projects whose benefits outweigh the risks of flooding—specifically, those that reduce carbon emissions by locating jobs and housing near public transportation. Projects may place fill in the Bay to protect existing and planned development from flooding and erosion, provided that a number of

provisions are met to minimize flood risks (e.g., shoreline setbacks, elevation above flood levels) and avoid, minimize and mitigate impacts to Bay resources. Shoreline protection projects (e.g., levees, sea walls) and public access must be designed to withstand the effects of sea level rise and storms. The new policies also encourage habitat preservation and enhancement in undeveloped areas subject to flooding. Finally, the Bay Plan directs BCDC to collaborate with other agencies and the public to create a regional strategy that addresses and adapts to sea level rise.

Local Climate Action Plans

Consistent with ARB recommendations, several Bay Area jurisdictions have completed community emissions inventories (103), and 67 jurisdictions have finalized and adopted community climate action plans, as shown in Table 2.5-4. It is noted that there are also jurisdictions that have drafted or are in the process of drafting climate actions plans, which are not included in Table 2.5-4.

Table 2.5-4 Bay Area Cities with Completed GHG Emissions Inventories or Climate Action Plans

Jurisdiction	Completed Community Emissions Inventory	Finalized and Adopted Community Climate Action Plan
Alameda County	X	X
Alameda	X	X
Albany	X	X
Berkeley	X	X
Dublin	X	X
Emeryville	X	X
Fremont	X	X
Hayward	X	X
Livermore	X	X
Newark	X	X
Oakland	X	X
Piedmont	X	X
Pleasanton	X	X
San Leandro	X	X
Union City	X	X
Contra Costa County	X	X
Antioch	X	X
Brentwood	–	–
Clayton	–	–
Concord	X	-
Danville	X	X
El Cerrito	X	X
Hercules	X	–
Lafayette	X	–
Martinez	X	X
Moraga	X	X
Oakley	X	–
Orinda	X	–

Table 2.5-4 Bay Area Cities with Completed GHG Emissions Inventories or Climate Action Plans

Jurisdiction	Completed Community Emissions Inventory	Finalized and Adopted Community Climate Action Plan
Pinole	X	–
Pittsburg	X	–
Pleasant Hill	–	–
Richmond	X	–
San Pablo	X	X
San Ramon	X	X
Walnut Creek	X	X
Marin County	X	X
Belvedere	X	X
Corte Madera	X	X
Fairfax	X	X
Larkspur	X	X
Mill Valley	X	X
Novato	X	X
Ross	X	X
San Anselmo	X	X
San Rafael	X	X
Sausalito	X	X
Tiburon	X	X
Napa County	X	-
American Canyon	X	–
Calistoga	X	X
Napa	X	X
St. Helena	X	–
Yountville	X	–
San Francisco	X	X
San Mateo County	X	X
Atherton	X	–
Belmont	X	–
Brisbane	X	X
Burlingame	X	X
Colma	X	X
Daly City	X	X
East Palo Alto	X	X
Foster City	X	-
Half Moon Bay	–	–
Hillsborough	X	X
Menlo Park	X	X

Table 2.5-4 Bay Area Cities with Completed GHG Emissions Inventories or Climate Action Plans

Jurisdiction	Completed Community Emissions Inventory	Finalized and Adopted Community Climate Action Plan
Millbrae	X	–
Pacifica	X	X
Portola Valley	X	–
Redwood City	X	X
San Bruno	X	–
San Carlos	X	X
San Mateo	X	X
S. San Francisco	X	–
Woodside	X	X
Santa Clara County	X	X
Campbell	–	–
Cupertino	X	X
Gilroy	X	X
Los Altos	X	X
Los Altos Hills	X	–
Los Gatos	X	–
Milpitas	X	X
Monte Sereno	–	–
Morgan Hill	X	–
Mountain View	X	X
Palo Alto	X	X
San Jose	X	X
Santa Clara	X	X
Saratoga	X	–
Sunnyvale	X	X
Solano County	X	X
Benicia	X	X
Dixon	X	–
Fairfield	X	X
Rio Vista	X	–
Suisun City	X	–
Vacaville	X	–
Vallejo	X	X
Sonoma County	X	X
Cloverdale	X	–
Cotati	X	–
Healdsburg	X	–
Petaluma	X	–

Table 2.5-4 Bay Area Cities with Completed GHG Emissions Inventories or Climate Action Plans

Jurisdiction	Completed Community Emissions Inventory	Finalized and Adopted Community Climate Action Plan
Rohnert Park	X	–
Sebastopol	X	–
Santa Rosa	X	X
Sonoma (city)	X	–
Windsor	X	–
Regional Total	**103**	**67**

Source: OPR 2016, Ascent Environmental 2016

Brief descriptions of selected adopted GHG reduction plans (e.g., CAPs) are included below.

Alameda County Climate Action Plans

The County of Alameda has adopted two climate action plans addressing specific county-wide concerns. Both plans seek to achieve a goal of 15 percent GHG reductions by 2020.

Alameda County (Unincorporated Areas) Climate Action Plan

The Alameda County (Unincorporated Areas) Community Climate Action Plan addresses reduction of greenhouse gas emissions in the unincorporated areas of Alameda County. These communities include Ashland, Castro Valley, Cherryland, Fairview, Hayward Acres, San Lorenzo, Sunol, and Rural East County. The Plan identifies a series of 37 local programs and policy measures related to transportation, land use, building energy, water, waste, and green infrastructure. The Plan identifies a total potential reduction in community-wide emissions by more than 15 percent by the year 2020. The Plan was approved by the Board of Supervisors on February 4, 2014.

Alameda County Climate Action Plan for Government Services and Operations

The Alameda County Climate Action Plan for Government Services and Operations was adopted in 2010. The Board of Supervisors adopted 16 Commitments to Climate Protection that provide overarching vision, a goal of 15 percent GHG reductions by 2020, and the Climate Action Plan, which includes 80 recommended actions to achieve the identified goal.

Contra Costa Climate Action Plan

On December 26, 2012, a Draft Climate Action Plan was completed for Contra Costa County and released by the Department of Conservation and Development for public review and comment. On December 15, 2015, the Climate Action Plan was approved by the Board of Supervisors. The Climate Action Plan identifies specific measures on how the County can achieve a GHG reduction target of 15% below baseline levels by the year 2020. In addition to reducing GHG, the Climate Action Plan includes proposed policies and actions to improve public health and provide additional community benefits, and it lays the groundwork for achieving long-term greenhouse reduction goals for 2020 and 2035.

Marin County Greenhouse Gas Reduction Plan

Adopted in October 2006, the Marin County Greenhouse Gas Reduction Plan identifies an emissions inventory and reduction target. It includes a range of CO_2 reduction measures to reduce GHG emissions to 15 to 20 percent below 1990 levels by the year 2020 for internal government and 15 percent countywide. Measures are organized in the categories of building energy use, transportation, waste management, and land use.

Climate Action Plan for San Francisco

Adopted in 2004, the Climate Action Plan for San Francisco: Local Actions to Reduce Greenhouse Gas Emissions includes an emissions inventory of community-wide and municipal operations and a reduction target of 20 percent below 1990 levels by 2012. With "business as usual," greenhouse gas emissions are predicted to rise to 10.8 million tons per year in 2012. The 20 percent reduction target would reduce San

Francisco's overall GHG emissions to 7.2 million tons per year by 2012. As of 2010 San Francisco had achieved citywide emission reductions of 14.5 percent from 1990 levels. The Climate Action Plan includes several actions and next steps related to transportation, energy, renewable energy and solid waste. San Francisco further adopted GHG emissions reduction goals including 20 percent reduction below 1990 levels for 2012, 25 percent by 2017, 40 percent by 2025 and 80 percent by 2050.

Sonoma County Community Climate Action Plan

Adopted in October 2008, the Sonoma County Community Climate Action Plan includes an emissions inventory and several solutions designed to reach its goal of reducing greenhouse gas (GHG) emissions to 25 percent below 1990 levels by 2015. Strategies are related to electricity and natural gas, transportation and land use, agriculture and forests, and solid waste.

The Climate Action Plan finds that implementation of all major quantified solutions will reach about 22 percent below 1990 levels, which is about 37 percent below business as usual (multiple solutions are not yet quantified).

County of Solano Climate Action Plan

Adopted in 2011, the County of Solano Climate Action Plan communitywide GHG emissions reduction goal of 20 percent below 2005 levels by 2020. The Climate Action Plan addresses both municipal and communitywide emissions for the unincorporated County. The Climate Action Plan recommends 31 measures and 94 implementing actions that the community can take to reduce both emissions and communitywide contributions to global climate change. Measures and actions are related to statewide reductions, agriculture, energy and efficiency, transportation and land use, waste reduction and recycling, and water conservation.

County Sea Level Rise Programs

San Francisco Sea Level Rise Action Plan

In March 2016, City and County of San Francisco released its *Sea Level Rise Action Plan* to identify actions that San Francisco can take now and in the near future to meet the challenge of sea level rise.

Goals of the San Francisco Sea Level Rise Action Plan include the following:

- a resilient city that is adaptable to the impacts of SLR, and recognizes and protects physical, economic, and social value;
- communities that understand and are reassured by a comprehensive response to SLR, and are mobilized and empowered to support efforts over the long term;
- interagency and regional collaboration and partnerships that are coordinated, transparent, and focused on delivering implementable and innovative solutions for a resilient future for San Francisco and the Bay Area region;
- capacity building that enables leadership and staff to implement good solutions; and
- a Citywide SLR Adaptation Plan that can serve as a local and global model.

This plan addresses the immediate and long-term threats of sea level rise to San Francisco shoreline through development of a comprehensive understanding of the threat of sea level rise and to creating a decisive plan of action. In general, the San Francisco Sea Level Rise Action Plan recommends one or a combination of three options to address SLR: accommodate (raise or waterproof assets in place), protect (create natural or engineered barriers, such as wetlands or levees), or retreat (relocate sensitive assets to low-risk areas and/or transition high-risk areas to lower-risk uses) (City of San Francisco 2016).

Solano County Sea Level Rise Strategic Program

In June 2011, Solano County released its Sea Level Rise Strategic Program (SLRSP) to address climate change and associated sea level rise at the local level. As directed by the County's General Plan, the SLRSP investigates the potential effects of sea level rise on Solano County, including specific properties and resources, and presents protection and adaptation strategies. The SLRSP considers two inundation scenarios: 16 inches by midcentury and 55 inches by the end of the century. According to their analysis, sea level rise is expected to inundate 130 square miles in Solano County by midcentury, including approximately 27 miles of total roadway (Interstate highways, State highways and local roadways) and eight miles of railway. By the end of the century, sea level rise will inundate 163 square miles of land, 80 miles of total roadway, and 15 miles of railway.

Major roads and highways, along with railways, in the County are considered to be highly sensitive and vulnerable to the effects of sea level rise, with low adaptive capacity. Residential, industrial, and commercial developments are also all highly sensitive and vulnerable to sea level rise, although the adaptive capacity of these uses is low-to-medium, given the ability for residents and businesses with resources to pursue alternative locations. For all new transportation infrastructure and development, the SLRSP recommends designing projects to tolerate periodic flooding and providing for new development that can be adapted or relocated. New development in areas prone to flooding from sea level rise should be minimal. The SLRSP notes the difficulty in determining adaptive strategies for transportation infrastructure, as they will be developed based on future vulnerability and risk analyses specific to each asset. However, it specifically recommends collaborating with MTC and Caltrans on adaptation planning for affected roadways.

Marin Ocean Coast Sea Level Rise Vulnerability Assessment

The Marin Ocean Coast Sea Level Rise Vulnerability Assessment Public Review Draft was released in October 2015. This Vulnerability Assessment for Marin County's ocean coast describes the vulnerability of parcels and buildings, transportation networks, utilities, working lands, natural resources, recreational activities, emergency services, and historic and archaeological resources; and community profiles highlighting vulnerable assets. Each profile details key issues, geographic locations, existing policies, and other economic, environmental, equity, and management considerations related to sea level rise vulnerability. SLR scenarios were based on SLR projections for California adopted by the National Research Council in 2012.

The key findings of this assessment are based on five sea level and storm combinations representing near-term, medium-term, and long-term futures. In the coastal zone, over 10 percent of buildings are vulnerable at the low end of the long-term scenario (scenario 4, 40 inches with a 100-year storm), and 20 percent are vulnerable at the high end of the long-term scenario (scenario 5, 80 inches with a 100-year storm) (Marin County 2015).

City and County General Plans

Marin Countywide Plan

The Marin Countywide Plan (November 2007), effectively the County's general plan, includes goals, policies, and implementing programs that address climate change and the risks of sea level rise in Marin County.

The Natural Systems and Agriculture Element includes a section on Atmosphere and Climate, including the following goal and policies, which are supported by implementing programs:

GOAL AIR-4: Minimization of Contributions to Greenhouse Gases. Prepare policies that promote efficient management and use of resources in order to minimize greenhouse gas emissions. Incorporate sea level rise and more extreme weather information into the planning process.

- **Policy AIR-4.1 Reduce Greenhouse Gas Emissions.** Adopt practices that promote improved efficiency and energy management technologies; shift to low-carbon and renewable fuels and zero emission technologies.

- **Policy AIR-4.2 Foster the Absorption of Greenhouse Gases.** Foster and restore forests and other terrestrial ecosystems that offer significant carbon mitigation potential.

Goal AIR-5: Adaptation to Climate Change. Adopt policies and programs that promote resilient human and natural systems in order to ease the impacts of climate change.

- **Policy AIR-5.1 Determine Marin-Specific Climate Change.** Participate in research that examines the effects of climate change on human and natural systems in Marin.

- **Policy AIR-5.2 Prepare Response Strategies for Impacts.** Prepare appropriate response strategies that aid systems in adapting to climate change based on sound scientific understanding of the potential impacts.

In terms of sea level rise, the Plan's Environmental Hazards Element includes policies to minimize flooding, including evaluating the potential for sea level rise when processing development applications (Policy EH-3.3). Additional policies specifically address the risk of sea level rise by directing the County to amend its Development Code to incorporate construction standards consistent with Bay Plan policies for areas subject to increased flooding from sea level rise (Implementing Program EH-3.k) and limit new construction or require elevated buildings and infrastructure in areas subject to sea level rise (Implementing Program EH-3.n). The Environmental Hazards Element also seeks to limit the repair, replacement, and construction of coastal seawalls and erosion barriers to protect against sea level rise (Implementing Program EH-3.l) and pursue funding for levee reconstruction in areas threatened by sea level rise (Implementing Program EH-3.o).

The Marin Countywide Plan's Natural Systems and Agriculture Element specifically states the goal of incorporating sea level rise into the planning process (GOAL AIR-4) and adopting policies and programs to adapt to climate change (GOAL AIR-5). More specific policies seek to assess the effects of sea level rise on property and infrastructure (Implementing Program AIR-5.b) and prepare response strategies in coordination with BCDC, the Coastal Commission, and other relevant agencies, including limiting development on coastal wetlands (Implementing Program AIR-5.c). The Natural Systems and Agriculture Element also calls for the establishment of criteria for setbacks to buffer existing and historic baylands from development, including the possible implications of future sea level rise (Implementing Program BIO-5.a) and the identification of baylands that could provide protection from sea level rise (GOAL BIO-5, Implementing Program BIO-5.i).

Contra Costa County General Plan

The Contra Costa County General Plan (January 2005) includes several policies that address sea level rise. The general plan specifically notes the flood hazards for islands in the Sacramento-San Joaquin Delta. The Safety Element requires that buildings in urban development near the shoreline and in flood-prone areas be protected from flood dangers, including from sea level rise (Policy 10-41). New housing must be sited above the highest water level expected during the life of the project or protected by levees (Policy 10-42). The County must review flooding policies annually to incorporate new scientific data on sea level rise and amend the policies as necessary (Policy 10-44).

Napa County General Plan

The Napa County General Plan (June 2008) addresses climate change – including the risk of sea level rise—and sustainable practices for environmental health related to water, energy conservation, air pollutant, greenhouse gas emissions, clean energy generation, and similar issues in its Conservation Element. Goals, policies, and action items specific to climate change and greenhouse gases include:

Goal CON-15: Reduce emissions of local greenhouse gases that contribute to climate change.

- **Policy CON-65:** The County shall support efforts to reduce and offset greenhouse gas (GHG) emissions and strive to maintain and enhance the County's current level of carbon sequestration functions through the following measures:

  - Study the County's natural, agricultural, and urban ecosystems to determine their value as carbon sequesters and how they may potentially increase.

- Preserve and enhance the values of Napa County's plant life as carbon sequestration systems to recycle greenhouse gases.

- Perpetuate policies in support of urban-centered growth and agricultural preservation preventing sprawl.

- Perpetuate policies in support of alternative modes of transportation, including transit, paratransit, walking, and biking.

- Consider GHG emissions in the review of discretionary projects. Consideration may include an inventory of GHG emissions produced by the traffic expected to be generated by the project, any changes in carbon sequestration capacities caused by the project, and anticipated fuel needs generated by building heating, cooling, lighting systems, manufacturing, or commercial activities on the premises. Projects shall consider methods to reduce GHG emissions and incorporate permanent and verifiable emission offsets.

- Establish partnerships with experts, trade associations, non-governmental associations, and community and business leaders to support and participate in programs related to global climate change. [Implemented by Action Items CON CPSP-1 and 2]

- **Policy CON-74:** The County shall evaluate new technologies for energy generation and conservation and solid waste disposal as they become available, and shall pursue their implementation as appropriate in a manner consistent with the principle of adaptive management. This evaluation shall include review of promising technological advances which may be useful in decreasing County greenhouse gas (GHG) emissions, increase in renewable energy that is generated locally, and review of the County's success in meeting targets for GHG emission reductions. [Implemented by Action Item CON CPSP-4]

- **Policy CON-75:** The County shall work to implement all applicable local, state, and federal air pollution standards, including those related to reductions in GHG emissions. [Implemented by Action Item CON CPSP-6]

Action Item CON CPSP-1: The County shall develop a greenhouse gas (GHG) emissions inventory measuring baseline levels of GHGs emitted by County operations through the use of electricity, natural gas, fossil fuels in fleet vehicles and County staff commute trips, and shall establish reduction targets. [Implements Policy CON-65]

Action Item CON CPSP-2: The County shall conduct a GHG emission inventory analysis of all major emission sources in the County by the end of 2008 in a manner consistent with Assembly Bill 32, and then seek reductions such that emissions are equivalent to year 1990 levels by the year 2020. Development of a reduction plan shall include consideration of a "green building" ordinance and other mechanisms that are shown to be effective at reducing emissions. [Implements Policy CON-65]

Action Item CON CPSP-3: The County shall conduct an audit within the next five years of County facilities to evaluate energy use, the effectiveness of water conservation measures, production of GHGs, use of recycled and renewable products and indoor air quality to develop recommendations for performance improvement or mitigation. The County shall update the audit periodically and review progress towards implementation of its recommendations. [Implements Policy CON-67]

Action Item CON CPSP-5: The County shall quantify increases in locally generated energy between 2000 and 2010, and establish annual numeric targets for local production of "clean" (i.e., minimal GHG production) energy by renewable sources, including solar, wind, biofuels, waste, and geothermal. [Implements Policy CON-70]

In terms of sea level rise, the plan establishes the goal of maintaining and improving marshland habitat in the County's southern portion. Specific policies direct the County to monitor the effects of sea level rise on

marshlands, wetlands, agriculture, and the economy and to modify practices through adaptive management, when necessary (Policy CON-31-e, Policy CON-73).

Solano County General Plan

The Solano County General Plan includes several goals, policies, and implementation programs to address climate change. In addition, the plan includes a table that identifies a range of policies from related to other issues addressed throughout the plan (such as community form, Energy Efficiency Transportation Water Management, etc.) that are related to addressing climate change. Specific climate change policies include:

- **Policy HS.G-5:** Recognize the multiple functions of the natural environment for safety, recreation, protection from climate changes, and economic uses.
- **Policy HS.G-6:** Increase awareness of the effect humans have on the environment and encourage individuals and organizations to modify habits and operations that cause degradation to the environment and contribute to climate change.
- **Policy HS.G-7:** Prepare for and adapt to the effects of climate change.
- **Policy HS.P-53:** Evaluate the potential effects of climate change on Solano County's human and natural systems and prepare strategies that allow the County to appropriately respond and adapt.
- **Policy HS.I-57:** Comply with all federal and/or state GHG emission reduction targets to reduce the County's contribution to global climate change. The plan should include strategies to reduce vehicle miles traveled, energy consumption, and other sources of GHGs within the county. This should be done in conjunction with the County's Climate Action Plan found in HS.I-73.
- **Policy HS.I-73:** Develop and adopt a climate action plan for Solano County. It is the intent of Solano County to coordinate and seek participation from all cities in preparation of a countywide baseline study and in preparation and implementation of the CAP.

Sonoma County General Plan 2020

In 2005, Sonoma County and all of its Cities pledged to measure and reduce their greenhouse gas emissions by 25 percent below 1990 levels by 2015. The Sonoma County General Plan, adopted in 2008 and updated in 2013, includes the following policies and objectives related to GHG emissions (in addition to polices related to energy efficiency and green development):

Objective OSRC-14.4: Reduce greenhouse gas emissions by 25 percent below 1990 levels by 2015.

- **Policy OSRC-14g:** Develop a GHG Emissions Reduction Program, as a high priority, to include the following:
  - a methodology to measure baseline and future VMT and GHG emissions;
  - targets for various sectors including existing development and potential future development of commercial, industrial, residential, transportation, and utility sources;
  - collaboration with local, regional, and State agencies and other community groups to identify effective greenhouse gas reduction policies and programs in compliance with new State and federal standards;
  - adoption of development policies or standards that substantially reduce emissions for new development;
  - creation of a task force of key department and agency staff to develop action plans, including identified capital improvements and other programs to reduce GHGs and a funding mechanism for implementation; and

- monitoring and annual reporting of progress in meeting emission reduction targets.

- **Policy OSRC-14i:** Manage timberlands for their value both in timber production and offsetting GHG emissions.

Objective OSRC-16.1: Minimize air pollution and GHG emissions.

2.5.3 Impact Analysis

The climate change impact analysis assesses the potential for significant adverse impacts related to GHG emissions, plan consistency, and impacts of sea level rise. The effects of the environment (such as sea level rise) on a project are generally outside the scope of CEQA, as concluded recently by the California Supreme Court (see California Building Industry Association v. Bay Area Air Quality Management District [2015] 62 Cal.4th 369, 377 ["we conclude that agencies generally subject to CEQA are not required to analyze the impact of existing environmental conditions on a project's future users or residents. But when a proposed project risks exacerbating those environmental hazards or conditions that already exist, an agency must analyze the potential impact of such hazards on future residents or users."]). Changes to the CEQA Guidelines to reflect this decision are in process by the State, but have not been adopted. The impacts discussed in this section related to sea level rise are effects of preexisting environmental hazards on structures that would be built under the proposed Plan's projected land use development and the population located within the Plan area, which may fall into the category of impacts of "existing environmental conditions on a project's future users or residents." An analysis of these impacts is included herein for disclosure purposes.

SIGNIFICANCE CRITERIA

The following significance criteria are based on CEQA Guidelines Appendix G, as well as the thresholds used in the EIR for the 2013 Plan Bay Area, and professional judgment. Under these criteria, implementation of the proposed Plan would have a potentially significant adverse impact if the Plan would:

Criterion 1: Fail to reduce per capita passenger vehicle and light duty truck CO_2 emissions by seven percent by 2020 and by 15 percent by 2035 as compared to the 2005 baseline, per SB 375.

Criterion 2: Result in a net increase in direct and indirect GHG emissions by 2040 when compared to existing conditions.

Criterion 3: Substantially conflict with the goal of SB 32 to reduce statewide GHG emissions to 40 percent below 1990 levels by 2030.

Criterion 4: Substantially conflict with any local plans or policies adopted to reduce emissions of GHGs.

Criterion 5: Result in a net increase in transportation projects within areas projected to be regularly inundated by sea level rise by midcentury.

Criterion 6: Result in an increase in land use development within areas projected to be regularly inundated by sea level rise by midcentury.

METHOD OF ANALYSIS

Global Warming Potential Factors

To stay consistent with BAAQMD's 2015 GHG inventory for the Bay Area, 100-year timeframe GWP factors from the IPCC Fifth Assessment Report (FAR) were applied to calculate CO_2e. Under FAR, CH_4 and N_2O are

considered to have GWP factors of 34 and 298, respectively (IPCC 2014). Also, to simplify the analysis, only CO_2, CH_4, and N_2O emissions were considered. Other GHGs were considered to be negligible.

Construction Emissions

GHG emissions from operation of construction equipment can vary depending on the level of activity, the specific operations taking place, the equipment being operated, and other factors. A qualitative analysis of potential GHG emissions from construction activity associated with projected land use development and proposed transportation projects was conducted. At the program level of analysis, it is not possible to quantify the amount of emissions expected from implementation of the proposed Plan because of variability in the extent of construction based on site conditions throughout the Bay Area, and the fact that project details needed to conduct such an analysis are not and cannot be known at this level of analysis. However, the level of GHG emissions from the construction of any one project or all projects combined would be primarily dependent on the quantity, age, and fuel type of the equipment and the duration of their operation at the construction site or in the region. This analysis identifies the measures, or best management practices (BMPs), that must be implemented for an individual construction project to have less than significant impacts. Thus, should implementing agencies adopt feasible mitigation measures for each construction project resulting from the proposed Plan, impacts associated with construction activity on local and regional air quality would be less than significant.

Operational Emissions

Land use Emissions

To compare operational GHG emissions from land use under existing conditions to those forecasted under the Plan buildout, the analysis assumes that the net change in emissions between existing conditions and buildout would be equivalent to emissions from the operation of:

- New land uses built between 2015 and 2040 using 2040 emission factors, minus
- Existing land uses that would be removed between 2015 and 2040 using 2015 emission factors.

Existing land uses that are removed are expected to be replaced by denser residential and commercial land use development. The net change in land uses anticipated under the Plan is identified in **Table 2.2-5**.

Emissions from the operation of forecasted development under the proposed Plan were calculated using default model assumptions in the California Emissions Estimator Model (CalEEMod) Version 2016.3.1 as well as county- and region-specific emission factors (CAPCOA 2016a). Land use-related emissions included in this analysis consist of CO_2, CH_4, and N_2O emissions from a range of direct and indirect sources comprised of:

- natural gas combustion for heating and cooking (e.g., furnaces, water heaters, stoves, and hearths);
- fuel use in landscaping equipment;
- indirect electricity generation for buildings, water and wastewater treatment, and water conveyance; and
- methane emissions from regular disposal of solid waste in landfills.

Emissions from natural gas use, landscaping equipment, water use, and waste emissions were calculated using default assumptions within CalEEMod. Emissions from hearths were based on current BAAQMD rules and CalEEMod default emission factors. As of November 2016, BAAQMD prohibits any wood-burning devices, such as wood-burning fireplaces or stoves, from being installed in new construction under BAAQMD Regulation 6 Rule 3 Section 6-3-306. Thus, it was assumed that any new development would not operate wood-burning stoves and any new fireplaces would use natural gas instead of wood. The distribution of fireplaces included in new residential units was based on default CalEEMod assumptions for single and multi-family units.

Emissions from electricity generation for new land uses were estimated based on emission factors from Pacific Gas and Electric (PG&E) forecasts, local Community Choice Aggregation (CCA) programs, and the Renewable Portfolio Standard and SB 350 targets for the State's renewable energy mix (PG&E 2015). **Table 2.5-5** below shows the emission factors used to estimate the emissions from electricity use within each County and for the

existing and proposed Plan buildout years, 2015 and 2040, respectively. These emission factors are based on the CCA program or utility that best represent the emissions associated with the electricity purchased in a county. Not all CCA programs, especially those adopted by cities, may be reflected in these emission factors.

Table 2.5-5 Electricity Emission Factors

County/Counties	Applicable CCA Program or Utility	Year	Percent Renewable Mix	lb CO_2e/MWh[1]
Marin and Napa	MCE	2015	50%	300
		2040	80%	120
Sonoma	Sonoma Clean Power	2015	36%	380
		2040	50%	300
San Francisco	Clean Power SF	2015	27%	440
		2040	50%	300
San Mateo	Peninsula Clean Energy	2015	27%	440
		2040	75%	150
Santa Clara	Silicon Valley Clean Energy	2015	27%	440
		2040	90%	60
Contra Costa, Alameda and, Solano	PG&E Default[2]	2015	27%	440
		2040	50%	300

Notes: CCA = Community Choice Aggregation, MCU = Marin Clean Energy, SF = San Francisco, PG&E = Pacific Gas and Electric, MWh = megawatt-hour, lb CO_2e = pounds of carbon dioxide equivalent

[1] Based on CO_2, CH_4, and N_2O emission factors using global warming potentials from IPCC's Fifth Annual Report (IPCC 20147). CO_2 emission factors for CCA programs and 2040 calendar years based combining PG&E's non-renewable factor with the reported renewable mix. The PG&E non-renewable factor – 596 lb CO_2/MWh – was calculated from PG&E's reported emission factor and renewable mix for 2014 (435 lb CO_2/MWh with a 27 percent renewable mix). CH_4 and N_2O emission factors were calculated using the same approach, but with emission factors from EPA's eGRID2012 summary tables for CAMX region, which assumes a renewable factor of 27.3 percent. (EPA 2015)

[2] 2015 emission factors based on PG&E reports for the 2014 calendar year.

Source: PG&E 2015, PGE2017, MCE 2015, MEA 2012, SCP 2016, PCE 2017, SVCE 2016, EPA 2015, IPCC 2014

The energy intensity rates (e.g., therms per 1,000 square feet) for new land uses built between 2015 and 2040 were assumed to meet 2016 Title 24 standards. Although new construction built between 2015 and 2017 would be subject to 2013 Title 24 standards, it was assumed that future standards would exceed 2016 Title 24 standards, and the application of 2016 standards to all new construction is a conservative approach. The State is considering adoption of ZNE building energy efficiency standards, but those standards are not yet adopted (CEC 2013b). By default, version 2016.3.1 of CalEEMod applies the 2013 Title 24 standards to new construction. CalEEMod energy rate defaults were adjusted in CalEEMod to match 2016 Title 24 standards based on the percentage improvements over the previous standards estimated by the California Energy Commission (CEC). Based on CEC estimates, this analysis assumes that residential and nonresidential buildings compliant with 2016 Title 24 standards would consume 28 percent and 5 percent (respectively) less energy (electricity and natural gas combined) from lighting, heating, cooling, ventilation, and water heating than residential and nonresidential buildings compliant with 2013 Title 24 standards (CEC 2015a, CEC 2015b).

Energy intensity rates for land uses removed between 2015 and 2040 were assumed to have CalEEMod's "historical" energy intensity rates. This assumes that areas from which the land uses would be removed would be redeveloped to accommodate the anticipated new development under the Plan. These represent energy usage rates reflecting 2005 Title 24 standards (CAPCOA 2016b: 31). This means that any land uses that once operated in 2015 and is anticipated to no longer operate in 2040 are assumed to have used energy at "historical" energy intensity rates. The changes in land use under 2015 and 2040 conditions under the proposed Plan are summarized in **Table 2.2-5** in Section 2.2, "Air Quality."

Motor Vehicle Emissions

Motor vehicle, or mobile source, emissions were calculated using MTC's travel demand forecasting model, Travel Model One, and mobile source emission factors developed by ARB. Travel Model One produces

forecasts of travel behavior and vehicle activity. Travel Model One has been extensively reviewed by federal and State agencies and refined in connection with the application to air quality analyses of various kinds. Key model outputs for use in air quality analyses include total daily vehicle trips, vehicle miles of travel (VMT), and distribution of VMT by speed. This information was then used to determine total emissions from transportation activity in the Bay Area using motor vehicle emission factors from ARB's Emission Factor (EMFAC) model.

Vehicle activity projections are correlated to changes in demographic, housing, and socioeconomic factors. As shown in **Table 2.2-6,** between 2015 and 2040, the Bay Area is projected to add about 1.9 million people (a 26 percent increase) and 688,000 jobs (a 17 percent increase). Based on expected future growth, the total vehicles miles traveled would increase by 21 percent, which means that VMT is projected to grow at a slightly slower rate than population, but at a faster rate than jobs in the region. This can be attributed to the anticipated job growth in current major employment centers such as San Francisco and Silicon Valley, consistent with current trends. Recent trends have also shown rapid job growth concurrent with slow housing growth (MTC 2017). MTC anticipates that, outside of major employment centers, residential development would occur at a faster rate than employment to help fulfill unmet demand, resulting in a faster increase in regional VMT than employment. This is mostly because of more people commuting to major employment centers outside where they live, than to jobs within their city of residence.

MTC used EMFAC2014 to calculate the CO_2 emissions from motor vehicle sources. Because the emissions model is based on travel demand forecast model outputs, it accounts for the projected land use development as well as transportation projects outlined in the proposed Plan. The emissions model also accounts for the effects of congestion (changes in average vehicle speeds) on CO_2 emissions. A detailed description of EMFAC2014 is included in Section 2.2, "Air Quality," and a detailed description of the MTC travel demand forecasting model is included in Section 2.1, "Transportation." MTC then prepared an "off-model" calculation to account for MTC's Climate Initiatives Program's CO_2 reduction estimates. This program includes grants to test innovative GHG emission reduction strategies, tax incentives to encourage car/van pooling, incentives to migrate to more electric vehicle use, and other strategies aimed at reducing GHG emissions. Detailed information on how the policy reductions were calculated and details on the assumed implementation year for each policy are included in MTC's supplemental report available at http://2040.planbayarea.org/reports.

The analysis conducted for Criterion 1 focuses on consistency with SB 375 and AB 32's 2020 goals pertaining to CO_2 emissions related to the operation of passenger vehicles and light duty trucks. Impact 2.5-1 addresses Criterion 1 using a conservative approach where emissions exclude reductions in mobile source emissions because of the implementation of Pavley regulations and LCFS, as required per SB 375. Although EMFAC2014 is the most recent available model, the EMFAC2014 emission outputs were converted to EMFAC2007 equivalents by applying an adjustment methodology in accordance with ARB staff's guidance and consultation. This was done to ensure per-capita vehicle emissions are reduced by the same intensity intended by the SB 375 targets, which were also calculated using EMFAC2007 (see Appendix D).

For Criterion 2, the analysis incorporates operational land use and mobile source emissions. Unlike Criterion 1, transportation emissions are modeled solely using EMFAC2014, which improves upon EMFAC2007 and EMFAC2011 with updated emission factor data and incorporation of various GHG reduction policies. The analysis for this criterion also compares the mobile source emissions under the proposed Plan with the emissions reduction benefits from Scoping Plan provisions such as for Pavley fuel efficiency standards, the Advanced Clean Cars program, and truck and bus rules. Application of LCFS are anticipated to reduce emission levels even further in 2020 and 2040; however, EMFAC2014 does not include LCFS reductions in its calculations, and thus, the effect of LCFS on emissions were not included in this analysis.

EMFAC2014 no longer accounts for the LCFS because the additional emissions reductions under LCFS would only affect the emissions from the production of fuels rather than emissions from the vehicle exhaust at the tailpipe. For all pollutants, EMFAC only accounts for emissions related to the direct operation of on-road vehicles, including exhaust and tire and break wear. Thus, ARB determined that LCFS would not substantially reduce tailpipe emissions and thereby removed the regulation from EMFAC2014 estimates (ARB 2014b).

The methods described above related to EMFAC modeling follow the direction from ARB related to the use of these models for this plan cycle.

The methods also comply with the CBE Settlement Agreement component that the analysis of direct and indirect total on-road transportation GHG emission over the planning period must include disclosure of the total amount of emissions, with and without reductions achieved from state -wide reduction programs under AB 32 (Scoping Plan, Pavley, etc.) (see Table 1.2-2 in Section 1.2, "Project Description").

Consistency with Greenhouse Gas Reduction Policies and Plans

The assessment for Criterion 3 evaluates the proposed Plan's likelihood to impede implementation of longer term (post-2020) policies and plans, including SB 32, 2040 targets, local CAPs, and other applicable GHG reduction plans and policies.

SB 32 calls for a statewide reduction of GHG emissions to 40 percent below 1990 levels by 2030. Because SB 32 includes a target in 2030, which is along the trajectory toward IPCC goal of reducing GHG emissions by 80 percent below 1990 levels by 2050 (the same goal as Executive Order S-03-05), this analysis assumes that the proposed Plan would be consistent with 2050 targets if it is consistent with SB 32 at the regional level. Although individual local government efforts could exceed or fall short of the target to meet the statewide GHG reduction goals, at the regional level it is assumed that the proposed Plan would be consistent with SB 32 if area GHG emissions from the proposed Plan are also reduced to 40 percent below 1990 levels by 2030.

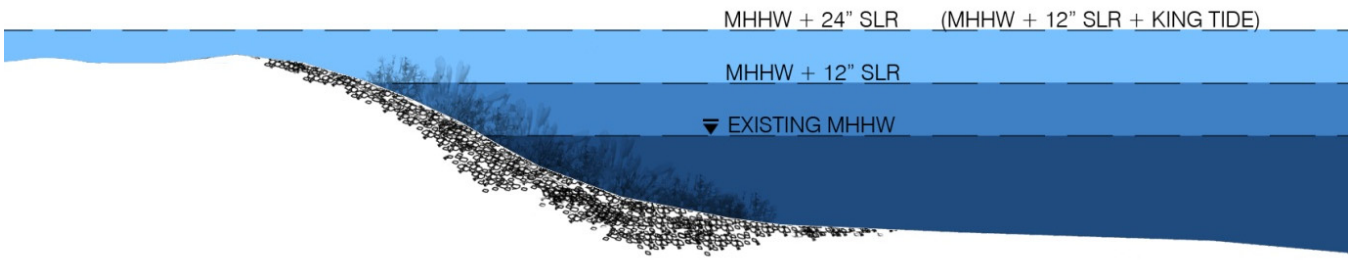
Sea Level Rise

The sea level rise analysis provides a program-level assessment of generalized potential impacts associated with future sea level rise in the San Francisco Bay Area utilizing the inundation mapping produced by 1) the San Francisco Bay Conservation and Development Commission (BCDC) using the Adapting to Rising Tides (Rising Tides) methodology and 2) NOAA for the Sea Level Rise and Coastal Flooding Impacts Viewer. Rising Tides data was available for Alameda, Contra Costa, Marin, San Mateo, and San Francisco counties. Sea level rise for all other counties was modeled using NOAA data. Potential midcentury (e.g., 2050) sea level rise conditions were selected for this analysis, rather than 2040 conditions, as most sea level rise projections are associated with midcentury and end-of-century conditions. Rising Tide and NOAA's inundation maps depict sea level rise on top of MHHW conditions, which are a good approximation of the highest "average" daily tidal inundation an area could be subjected to under future conditions. However, extreme high tides occur that are higher than MHHW. The most well-known extreme high tide condition in San Francisco Bay is often referred to as a "King Tide." King Tide is a colloquial term that refers to the especially high tide conditions that happen only a few times a year. In San Francisco Bay and along the California coast, King Tides generally occur during the winter months.

King Tides can be 12 (or more) inches higher than MHHW; therefore, the inundation of low-lying areas around the Bay observed during a King Tide event is often used as a real-world illustration of the areas around the Bay that would be subjected to regular, daily inundation by midcentury with sea level rise. In other words, the extent of inundation that occurs during an existing King Tide event could be used as a surrogate for the future, regular inundation extent that would be observed with 12 inches of sea level rise relative to MHHW.

The sea level rise impact analysis considers the inundation extent associated with 24 inches of sea level rise at MHHW, as presented within Rising Tide reports and NOAA's Sea Level Rise and Coastal Flooding Impacts Viewer and in **Figure 2.5-3.** This extent of inundation is used as a surrogate for 12 inches of sea level rise at midcentury, coupled with a King Tide event. This scenario was selected as it represents a level of future inundation by Bay waters that could be expected to occur multiple times each year, particularly during the winter months when King Tides typically occur, even in the absence of extreme coastal storm surge events. For the purposes of this assessment, this level of inundation is considered "regular inundation" by sea level rise. **Figure 2.5-6** presents the relationship of these different scenarios for illustrative purposes.

Figure 2.5-6
Comparative Inundation by Scenario



Source: AECOM 2012

The transportation projects footprint and land use growth footprint are analyzed by county and TPA, based upon their location relative to inundation areas presented in **Figure 2.5-3**. For Criterion 4 transportation projects located entirely or partially within the inundated areas are identified. For linear transportation projects, such as highway projects, the length of the projects within the inundated area is calculated relative to the total length of the projects (presented as the percent within the inundation zone). For non-linear projects (such as facility projects), it is assumed that the project is 100 percent within the inundation zone.

Along with the areas subject to potential future inundation, **Figure 2.5-3** displays low-lying hydraulically disconnected areas—these are areas with ground elevations below the projected future sea level rise water surface elevations, but they are not inundated, as they do not have a direct hydraulic connection to the Bay. In other words, these areas are protected from inundation by levees, embankments, or other topographic features. Although the transportation projects within these low-lying areas are not projected to be within the sea level rise inundation zone, based on existing levels of protection, they remain at risk of inundation if an existing structure fails or is not properly maintained into the future.

Similarly, for Criterion 5, the land use growth footprint that intersects the inundated areas and the low-lying, hydraulically-disconnected areas are identified by county and TPA to estimate the potentially-impacted land use development changes within the region. Information provided by county includes both incorporated and unincorporated areas in the county. Because the exact location of new residential and non-residential land uses within growth areas and TPAs is uncertain, the impact on land use development is determined by the portion of growth areas and TPAs, by area, that would be inundated by sea level rise under midcentury conditions.

Multiple uncertainties are inherent in the sea level rise impact analysis, beyond the uncertainties associated with the projected rate of sea level rise anticipated to occur by midcentury. The inundation mapping used for the analysis is intended as a planning-level tool to illustrate the potential for inundation and coastal flooding under future conditions. The maps are based on model outputs and do not account for all potential factors or future conditions such as erosion, subsidence, future construction or shoreline protection upgrades, or other changes to San Francisco Bay or the region that may occur in response to sea level rise.

IMPACTS AND MITIGATION MEASURES

Because GHG emissions are global in nature and regulatory targets are defined at the state and regional level, this analysis considers only the cumulative effects of implementation of the proposed Plan. Further, modeling of passenger vehicle and light duty truck emissions accounts for both forecasted land use development (increase in households and jobs) and transportation projects; therefore, projected land use development and transportation projects are addressed together for each impact.

While GHG emissions are evaluated regionally, and by county for effects associated with the land use growth footprint, the impacts associated with sea level rise vary throughout the region depending on the inland topography and the existing shoreline protection structures. Therefore, sea level rise analysis evaluates the impacts at the local scale. Regional impacts are essentially the culmination of localized impacts throughout the region. Each of the affected transportation projects is evaluated individually. The impacts associated with land-use development are also evaluated spatially at the local scale, with impacts presented at the county level.

Impact 2.5-1: Implementation of the proposed Plan could fail to reduce per capita passenger vehicle and light duty truck CO_2 emissions by seven percent by 2020 and by 15 percent by 2035 as compared to the 2005 baseline, per SB 375.

Impact of Changes in Projected Land Use and Transportation Projects

The proposed Plan would result in implementation of transportation projects and the Climate Initiatives Program, the latter of which would reduce emissions from cars and light duty trucks. As shown in Table 2.5-6, strategies associated with MTC's Climate Initiatives Program, which are part of the proposed Plan, are expected to reduce vehicle trips and, subsequently, on-road passenger vehicle emissions by 3,600 $MTCO_2$ per day in 2020, by 7,900 $MTCO_2$ per day in 2035, and by 7,700 $MTCO_2$ per day in 2040.

Table 2.5-6 Plan Bay Area 2040 Climate Policy Initiatives and Reductions

Strategy	2020		2035		2040	
	Daily Reductions (tons CO_2)	Annual Reductions (tons CO_2)[1]	Daily Reductions (tons CO_2)	Annual Reductions (tons CO_2)[1]	Daily Reductions (tons CO_2)	Annual Reductions (tons CO_2)[1]
Commuter Benefits Ordinance	-300	-90,000	-330	-99,000	-340	-102,000
Trip Caps	-120	-36,000	-690	-207,000	-860	-258,000
Regional Electric Vehicle Charger Network	-250	-75,000	-1,190	-357,000	-1,290	-387,000
Feebate Program	0	0	-680	-204,000	-450	-135,000
Vehicle Buyback Program	0	0	-360	-108,000	-230	-69,000
Targeted Transportation Alternatives	-950	-285,000	-1,600	-480,000	-1,580	-474,000
Car Sharing	-1,710	-513,000	-1,930	-579,000	-1,900	-570,000
Smart Driving	0	0	-680	-204,000	-670	-201,000
Vanpool Incentives	-60	-18,000	-170	-51,000	-170	-51,000
Employer Shuttles	-160	-48,000	-160	-48,000	-160	-48,000
Bike Infrastructure	-20	-6,000	-50	-15,000	-50	-15,000
Bike Share	-20	-6,000	-20	-6,000	-20	-6,000
Total	**-3,600**	**-1,080,000**	**-7,860**	**-2,358,000**	**-7,720**	**-2,316,000**

Note: Figures may not sum because of independent rounding. Estimates calculated using EMFAC2014, adjusted to EMFAC2007 equivalents based on ARB guidance.

[1] Emissions are annualized by multiplying by 300 to take account for the fact that there is less traffic on weekends. A ratio of 1.00:1.02 was applied to all EMFAC2014 generated CO_2 estimates for conversion to CO2E.

Source: MTC 2017

Table 2.5-7 shows the change in daily and per-capita car and light duty truck CO_2 emissions between 2005 and future years. Emissions are expected to decline over time with and without the Climate Initiatives Program. With the Climate Initiatives Program, the proposed Plan is expected to result in a 14.3 percent decline in per-capita emssions from 2005 to 2020, and a 15.5 percent decline in per capita CO_2 emissions from 2005 to

2035, exceeding the SB 375 targets of seven and 15 percent, respectively. As a result, the proposed Plan also meets AB 32 targets for per-capita car and light duty CO_2 emissions. (As described in Impact 2.5-3, the overall plan would fully attain AB 32 targets.) This decline is attributable to numerous factors, most importantly the integrated land use and transporation stratgies reflected in the proposed Plan in which the land use pattern focuses growth in higher-density locations near transit services. This compact approach to growth allows more efficient use of the existing transportation infrasturcture. The land use development pattern is described in greater detail in Section 1.2, "Project Description."

Table 2.5-7 SB 375 Target Analysis of Passenger Vehicle and Light Duty Truck CO_2 Emissions[1]

Year	Population	VMT	Modeled GHG Emissions (tons CO_2/day)	Climate Policy Initiatives Reduction relative to 2005 (tons CO_2/day)	Emissions per Capita (lb CO_2)[2]	Percent Reduction in Per Capita CO_2 Emissions Relative to 2005[2]	
						Proposed Plan with Climate Initiatives Program	SB 375 Target
2005	6,979,000	149,164,000	63,500	0	18.2	0	NA
2020	7,890,000	164,346,000	65,200	-3,600	15.6	-14.3	-7%
2035	9,076,000	185,930,000	77,700	-7,900	15.4	-15.5%	-15%
2040	9,561,000	191,529,000	80,200	-7,700	15.2	-16.7%	NA

Note: "—" = not applicable, lb = pound, CO_2 = carbon dioxide, NA = not available, SB = Senate Bill, VMT = vehicle miles travelled
[1] Estimates calculated using EMFAC2014, adjusted to EMFAC2007 equivalents based on ARB guidance.
[2] Figures may not sum because of independent rounding.
Source: MTC 2017

As noted, per the requirements of SB 375, this analysis does not include emissions reductions associated with Pavley, LCFS standards, and any other Scoping Plan provisions adopted since 2007, which are expected to further reduce CO_2 emissions and result in a decrease in total CO_2 emissions over time. Because the proposed Plan would reduce per capita passenger vehicle and light duty truck CO_2 emissions by over seven percent by 2020 and by over 15 percent by 2035 as compared to 2005 baseline, per SB 375, there would be a less-than-significant impact (LS).

Conclusion

Because implementation of the projected development projects under the proposed Plan woud reduce per capita passenger vehicle and light duty truck CO_2 emissions by over seven percent by 2020 and by over 15 percent by 2035 as compared to 2005 baseline, per SB 375, there would be **less-than-significant (LS)** impact. No mitigation measures are required.

Mitigation Measures

None required.

Impact 2.5-2: Implementation of the proposed Plan could result in a net increase in direct and indirect GHG emissions in 2040 when compared to existing conditions.

Impact of Changes in Projected Land Use and Transportation Projects

Construction Emissions

Construction-related GHG emissions from implementation of both projected land use development and transportation projects would contribute to GHG emissions, but would not likely result in a net increase in GHG emissions under the proposed Plan. Construction activity tends to be temporary in nature and would be expected to occur throughout the proposed Plan's implementation period through 2040 because of the various land use and transportation projects that could be constructed. The level of GHG emissions from construction activity would depend on the type and scale of projects being constructed under the Plan. Because of the project-specific nature of construction emissions, quantitative construction estimates are not included in this assessment.

However, generally, GHGs could be generated from a variety of activities and emission sources (e.g., exhaust emissions from off-road construction equipment, material delivery trips, and construction worker-commute trips). These emission types and associated levels fluctuate greatly depending on the particular type, number, and duration of usage for the varying equipment. The site preparation phase typically generates the most substantial emission levels because of the on-site equipment and ground-disturbing activities associated with grading, compacting, and excavation. Site preparation equipment and activities typically include backhoes, bulldozers, loaders, and excavation equipment (e.g., graders and scrapers). Although detailed construction information is not available at this time, the types of projects generally result in a couple hundred to a couple thousand metric tons of GHGs on a yearly basis, but as mentioned above these would not be expected to result in an increase because of the large magnitude in reduction for overall emissions.

Operational Emissions

As explained in Section 1.2, "Project Description," the proposed Plan provides a strategy for accommodating projected household and employment growth in the nine-county Bay Area by 2040 as well as a transportation investment strategy for the region. The projected development would increase indirect and direct GHG emissions from building electricity and natural gas use, water use, wastewater treatment, waste generation, and landscaping equipment. However, improved building energy efficiency standards and increased renewable energy sources for electricity would reduce future GHG emissions from new land use. An overview of GHG emissions related to land use projects is shown in **Table 2.5-8,** by land use type and source, and **Table 2.5-9**, by county.

Operational GHG emissions from projected development were determined based on existing and forecasted single family and multifamily occupied housing units and existing and forecasted jobs by sector. As shown in **Table 2.5-8**, GHG emissions from the net change in land uses would result in a net increase of 1.5 $MMTCO_2e$ in the Plan area.

Table 2.5-8 New Change in Annual Land Use GHG Emissions by GHG Source

Land Use/GHG Source	Net Change in Activity 2015-2040	Activity Units	Net Change in $MTCO_2e$/year between 2015-2040
Single-Family Residential			
Electricity	1,238,800	MWh/year	138,500
Natural Gas[2]	4,489,200	MMBTU/year	241,300
Multi-Family Residential (Low/Mid-Rise)			
Electricity	1,508,200	MWh/year	129,800
Natural Gas[2]	4,074,400	MMBTU/year	218,800
Multi-Family Residential (High Rise)			
Electricity	640,000	MWh/year	64,300
Natural Gas[2]	1,562,200	MMBTU/year	83,900
		Residential Subtotal[1]	**876,500**
Office			
Electricity	1,835,000	MWh/year	115,700
Natural Gas[2]	1,992,900	MMBTU/year	107,000
Retail			
Electricity	-161,300	MWh/year	-36,400
Natural Gas[2]	-79,700	MMBTU/year	-2,300
Industrial			
Electricity	-287,000	MWh/year	-55,800
Natural Gas[2]	-328,800	MMBTU/year	-18,000
		Non-Residential Subtotal[1]	**219,500**

Table 2.5-8 New Change in Annual Land Use GHG Emissions by GHG Source

Land Use/GHG Source	Net Change in Activity 2015-2040	Activity Units	Net Change in $MTCO_2e$/year between 2015-2040
All Land Uses in Plan Area			
Electricity	4,773,600	MWh/year	356,200
Natural Gas[2]	11,710,000	MMBTU/year	630,600
Water and Wastewater[3]	95,700	MG/year	130,200
Waste	475,100	tons	290,200
Hearths[4]	NA[5]	NA[5]	48,300
Landscaping	NA[5]	NA[5]	7,900
		Regional Total[1]	**1,464,400**

Note: Activity and emissions estimates modeled using CalEEMod v. 2016.3.1. NA = not available, MWh = megawatt hour, MMBtu = one million British thermal units, MG = million gallons, $MTCO_2e$ = metric tons of carbon dioxide equivalent.

[1] Figures may not sum because of independent rounding.
[2] Does not include natural gas from hearths (e.g., fireplaces).
[3] Includes indoor and outdoor water use.
[4] Emissions from hearths are based on natural gas hearths only.
[5] CalEEMod Version 2016.3.1 does not output hearths and landscaping activity.

Source: MTC 2017, Data compiled by Ascent Environmental 2017

Table 2.5-9 Net Change in Annual Land Use GHG Emissions by County[1]

County	County/GHG Source	Net Change in Activity 2015-2040	Activity Units	Net Change in $MTCO_2e$/year between 2015-2040
Alameda	Electricity	904,700	MWh/year	118,000
	Natural Gas[2]	2,984,100	MMBTU/year	162,100
	Other[3]	-	-	104,800
			Alameda Total	384,800
Contra Costa	Electricity	678,000	MWh/year	90,900
	Natural Gas[2]	1,647,000	MMBTU/year	88,400
	Other[3]	-	-	74,600
			Contra Costa Total	254,000
Marin	Electricity	17,300	MWh/year	630
	Natural Gas[2]	87,900	MMBTU/year	4,700
	Other[3]	-	-	2,200
			Marin Total	7,600
Napa	Electricity	70,600	MWh/year	3,600
	Natural Gas[2]	126,600	MMBTU/year	6,800
	Other[3]	-	-	5,600
			Napa Total	16,000
San Francisco	Electricity	564,600	MWh/year	73,500
	Natural Gas[2]	1,492,300	MMBTU/year	80,100
	Other[3]	-	-	63,100
			San Francisco Total	216,700
San Mateo	Electricity	559,800	MWh/year	32,500
	Natural Gas[2]	1,382,400	MMBTU/year	74,200
	Other[3]	-	-	51,700
			San Mateo Total	158,400

Table 2.5-9 Net Change in Annual Land Use GHG Emissions by County[1]

County	County/GHG Source	Net Change in Activity 2015-2040	Activity Units	Net Change in $MTCO_2e$/year between 2015-2040
Santa Clara	Electricity	1,693,300	MWh/year	1,100
	Natural Gas[2]	3,055,200	MMBTU/year	164,000
	Other[3]	-	-	138,100
			Santa Clara Total	303,200
Solano	Electricity	161,600	MWh/year	21,400
	Natural Gas[2]	504,600	MMBTU/year	27,100
	Other[3]	-	-	20,200
			Solano Total	68,700
Sonoma	Electricity	123,900	MWh/year	14,600
	Natural Gas[2]	430,000	MMBTU/year	23,100
	Other[3]	-	-	17,500
			Sonoma Total	55,200
Regional Total				**1,464,400**

Note: Activity and emissions estimates modeled using CalEEMod v. 2016.3.1. "–" = not applicable, GHG = greenhouse gas, MWh = megawatt hour, MMBtu = one million British thermal units, $MTCO_2e$ = metric tons of carbon dioxide equivalent

[1] Figures may not sum because of independent rounding.
[2] Does not include natural gas from hearths (e.g., fireplaces).
[3] Includes emissions from hearths, water use, wastewater treatment, solid waste generation, and landscaping equipment.

Source: Data compiled by Ascent Environmental 2017

The proposed Plan would result in the operation of new transportation projects, as well as the Climate Initiatives Program, aimed at reducing GHG emissions from mobile sources. Overall, as a result of the growing number of residents and jobs in the region, total on-road transportation GHG emissions would be expected to increase over time if no standards were put in place. However, this analysis incorporates implementation of Pavley regulations over the life of the proposed Plan. As shown in Table 2.5-10, when these standards are considered, overall on-road vehicle GHG emissions decline by 36 percent for passenger vehicles. Because Pavley standards only affect passenger vehicles, regardless of the standard, emissions would decline by 21 percent for buses and by seven percent for "Other Vehicles." Emissions from trucks, accounting for 20 percent of total GHG emissions in 2015, are anticipated to increase by 20 percent between 2015 and 2040. Despite this increase, the annual GHG emissions from all mobile sources with reductions from MTC's Climate Initiatives Program are expected to decrease by over 8 $MMTCO_2e$ from 2015 to 2040 under the proposed Plan, a 35 percent decline. Pavley regulations also contribute a reduction of 9 $MMTCO_2e$ relative to a 2015 baseline without Pavley regulations. As discussed above, CARB removed LCFS from the 2014 EMFAC model.

Table 2.5-10 Existing and Forecasted Annual Transportation GHG Emissions by Vehicle Source ($MTCO_2e$)[1]

Emissions Source	2015 Baseline	2040 Proposed Plan	Change from Existing[1]	Percent Change from Existing[2]
Without Pavley Regulations				
Passenger Vehicles	19,358,000	23,418,000	4,060,000	21%
Trucks	4,484,000	5,361,000	877,000	20%
Buses	599,000	475,000	-124,000	-21%
Other Vehicles	122,000	113,000	-9,000	-7%
MTC Climate Initiatives Program	0	-2,350,000	-2,350,000	–
Total (without Pavley regulations)	**24,563,000**	**27,01,000**	**2,454,000**	**10%**

Table 2.5-10 Existing and Forecasted Annual Transportation GHG Emissions by Vehicle Source ($MTCO_2e$)[1]

Emissions Source	2015 Baseline	2040 Proposed Plan	Change from Existing[1]	Percent Change from Existing[2]
With Pavley Regulations				
Passenger Vehicles	18,222,000	11,715,000	-6,507,000	-36%
Trucks	4,484,000	5,361,000	877,000	20%
Buses	599,000	475,000	-124,000	-21%
Other Vehicles	122,000	113,000	-9,000	-7%
MTC Climate Initiatives Program	0	-2,350,000	-2,350,000	–
Total (with Pavley regulations) [1]	**23,427,000**	**15,314,000**	**-8,113,000**	**-35%**
Emission Reductions because of Pavley regulations	**1,136,000**	**11,703,000**	**10,567,000**	–

Notes: $MTCO_2e$ = metric tons of carbon dioxide equivalent, MTC = Metropolitan Transportation Commission, "—" = not applicable

[1] Estimates calculated using EMFAC2014. MTC applied a ratio of 1.00:1.02 to all EMFAC2014 generated CO_2 estimates for conversion to CO_2e. Emissions were annualized by multiplying by 300 to take account for the fact that there is less traffic on weekends.

[2] Figures may not sum because of independent rounding.

Source: MTC 2017

A breakdown of mobile emissions by county was not conducted because of the global nature of GHG emissions (and because transportation emissions may originate in separate counties while passing through other counties). Thus, emissions are only reported on a regional basis, with respect to mobile sources.

Changes in land use and transportation activity under the proposed Plan would result in a net reduction of 6.6 $MMTCO_2e$, or 13 percent, from 2015 to 2040, as shown in **Table 2.5-11**. Therefore, there would be a less than significant (LS) impact.

Table 2.5-11 Annual GHG Emissions from Projected Land Use and Transportation Sources ($MTCO_2e$/year)[1]

Sources	2015	2040	Net Change in $MTCO_2e$/year between 2015-2040	Percent Change in $MTCO_2e$/year between 2015-2040
Land Use	28,140,0002	29,604,4003	1,464,400	5%
Transportation	23,427,0004	15,314,0004	-8,113,000	-35%
Regional Emissions Total	**51,567,000**	**44,918,400**	**-6,648,600**	**-13%**

Note: $MTCO_2e$ = metric tons of carbon dioxide equivalent

[1] Figures may not sum because of independent rounding.

[2] Based on emissions from electricity consumption, building energy usage (e.g., natural gas, propane), and waste management emissions from BAAQMD's 2015 Bay Area GHG Inventory (BAAQMD 2017:Table3-2).

[3] Calculated by adding net change to 2015 values. Calculations assume residential and non-residential land uses built between 2015 and 2040 would be built to 2016 building energy efficiency standards.

[4] Calculated by MTC using EMFAC2014.

Source: BAAQMD 2017, MTC 2017, Data compiled by Ascent Environmental 2017

Conclusion

Because implementation of the proposed Plan would result in a net reduction in GHG emissions in 2040 when compared to existing conditions, this impact is **less than significant (LS)** and no mitigation measures are required.

Mitigation Measures

None required.

Impact 2.5-3: Implementation of the proposed Plan could substantially conflict with the goal of SB 32 to reduce statewide GHG emissions to 40 percent below 1990 levels by 2030.

Impact of Changes in Projected Land Use and Transportation Projects

The proposed Plan would provide a strategy for accommodating projected household and employment growth in the Plan area by 2040 as well as a transportation investment strategy for the region. As discussed under Impact 2.5-2, anticipated reductions in mobile source GHG emissions would be greater than new GHG emissions from projected development resulting in a net reduction in GHG emissions. As shown in Table 2.5-11, the land use and transportation emissions under the Plan would be reduced by 13 percent from 2015 to 2040. Although this reduction would meet AB 32 targets, it would not meet 2030 targets under SB 32, which would require a reduction of 41 percent in GHG emissions between 2015 and 2030, which is equivalent to the formal target of achieving 40 percent below 1990 levels by 2030. This equivalency is explained further below.

To estimate whether the anticipated net GHG reductions under the proposed Plan would achieve the 2030 target under SB 32, the estimated reductions under Impact 2.5-2 are compared to the 2015 transportation emissions developed by MTC and the estimated 2015 land use emissions from the 2015 Bay Area GHG inventory, developed by BAAQMD in 2017 and shown in Table 2.5-1 and 2.5-2 (BAAQMD 2017). The 2015 inventory is the most recent available inventory for the region.

To estimate a GHG reduction target relative to 2015 that is consistent with SB 32 goals, a comparison was made between the State's 1990 and 2014 GHG inventories (2014 is the latest inventory and is used as a surrogate for 2015 values). According to ARB's estimate of California's GHG inventory, the State emitted approximately 431 million $MTCO_2e$ ($MMTCO_2e$) in 1990 and 442 $MMTCO_2e$ in 2014, a two percent increase (ARB 2016). Based on the available data and assumptions described, above, under Method of Analysis, a reduction of 40 percent below 1990 levels would be approximately equivalent to a reduction of 41 percent below 2015 levels; and, two percent below 2015 levels would be equivalent to 1990 conditions. In 2015, land use and transportation accounted for 52 $MMCO_2e$ in the Bay Area (BAAQMD 2017, MTC 2017). Consequently, the proposed Plan would need to achieve 21 $MMTCO_2e$ in reductions from land use and transportation between 2015 and 2030 (52 $MMCO_2e$ x 41 percent = 21 $MMCO_2e$) to be consistent with SB 32 and subsequently, would place the proposed Plan along the trajectory needed to meet the 2050 target identified under S-03-05. As shown in Table 2.5-11, the proposed Plan would only achieve a reduction of 7 $MMTCO_2e$ from 2015 land use and on-road transportation emissions. Table 2.5-12 below presents these calculations.

Table 2.5-12 Calculation of GHG Reductions and Targets from Land use and Transportation relative to 1990 and 2015 levels

Year	Bay Area Transportation and Land Use Emissions with Targets ($MTCO_2e$/year)	Percent over 1990 Levels	Reductions needed from 1990 ($MTCO_2e$/year)	Reductions needed from 2015 ($MTCO_2e$/year)	Reductions from Proposed Plan ($MTCO_2e$/year)	Additional Reductions Needed from 2015
1990	50,555,900[1]	0%	NA	NA	NA	NA
2015	51,567,000[2]	2%	NA	NA	NA	NA
2030	30,333,500	-40%[3]	20,222,400	21,233,500	NA	NA
2040	20,222,400	-60%[4]	30,333,500	31,344,600	6,648,600	24,696,000
2050	10,111,200	-80%[5]	40,444,700	41,455,800	6,648,600	34,807,200

[1] Calculated assuming a 2% increase between 1990 and 2015, based on statewide trends
[2] Based on land use emissions from BAAQMD's 2017 Clean Air Plan and transportation estimates from MTC.
[3] Reflects the SB32 Target
[4] Interpolated target between 2030 and 2050.
[5] Reflects B-30-15 Target.
Source: Compiled by Ascent Environmental in 2017 with data from BAAQMD 2017 and MTC 2017

In further consideration of long term goals, to remain on a trajectory toward the IPCC goals of GHG emissions of 80 percent below 1990 levels by 2050, the proposed Plan would need to achieve a target of reduction in

2040 of 60 percent below 1990 GHG levels (2030 = 40 percent below, 2040 = 60 percent below, 2050 = 80 percent below 1990 GHG levels). This would require a reduction, based on full attainment of growth projections, to 32 $MMCO_2e$ in 2040 (52 $MMCO_2e$ x 62 percent = 32 $MMCO_2e$).

MTC /ABAG, in developing the land use and transportation strategy for the Bay Area, has demonstrated that its proposed Plan has been designed to reduce potential GHG emissions as required under SB 375 (see Impact 2.5-1). In effect, MTC/ABAG has taken responsibility for the land use component of feasible GHG reduction. As explained in Section 2.5.1, the ability to meet the 2030 target (and, subsequently, the 2040 target) is tied, in large part, to statewide actions mandated by new legislation or regulations that are anticipated to emerge from the 2017 Scoping Plan Update (to be finalized in late June). This was the same issue that faced achievement of AB 32's far less aggressive 2020 targets (1990 GHG emissions level by 2020), and these goals are expected to be achieved, in large part, because of State legislation and regulation. For instance, the state-mandated Renewable Portfolio Standard (RPS) requires that all utilities provide 50 percent of their electricity via renewable (non GHG-producing) sources by 2030, which reduces GHG emissions in all areas of the state. The existing Cap-and- Trade program, which is set to expire in 2020, allows large GHG emitters (such as oil refineries and power plants) to achieve major emissions reductions through regulatory actions that set a cap over GHG emissions allowances, and provide for regulated purchase of offsets (funding solar farms, high speed rail, other actions) that reduce GHG emissions. This program will require State legislative action that, if passed, would substantially reduce GHG emissions past 2020 in all economic sectors, and help (along with other programs) achieve 2030 goals and beyond. Because these regulations are under development, they cannot be relied upon as part of this analysis to demonstrate compliance with the 2030 targets in the Bay Area. Importantly, this is not unique to the Bay Area; all MPO's in California are faced with the same challenge. Thus, without sufficient State legislation and regulation, attainment of 2030 goals is extremely difficult. In addition, as discussed above, ARB recommends GHG reduction plans be developed by local jurisdictions (e.g., cities and counties) to reduce land use-related emissions. This would be a potentially significant (PS) impact.

Conclusion

MTC/ABAG has developed a land use and transportation strategy that meets SB 375 goals and places the Bay Area on a downward trajectory in GHG emissions, which sets it on a path toward meeting longer-term GHG reduction goals. There are no additional land use strategies available to feasibly bridge the gap between the proposed Plan GHG emissions and 2030 (and beyond) targets. This is not unique to MTC/ABAG; all MPOs in California are faced with this same challenge. In the absence of State and local jurisdictional action (e.g., new State regulations, city and county GHG reduction plans targeted to 2030 and beyond) it is not possible to demonstrate compliance with the SB 32 GHG reduction targets. The development of GHG reduction plans is advocated in the State's draft 2017 Scoping Plan as a means to attain 2030 GHG targets. Thus, while the proposed Plan would not impede the possibility of attaining the longer-term (2030 and 2050) targets, even more aggressive GHG reduction actions, such as local implementation of GHG reduction plans, would be needed to conform to these longer-term targets. Therefore, the proposed Plan may conflict with an applicable plan, policy, or regulation adopted to reduce emissions of GHGs. This impact is considered **potentially significant (PS)**. Mitigation Measure 2.5-3 would reduce emissions from forecasted land use-related growth.

Mitigation Measures

2.5-3 Consistent with the recommendations in the Draft 2017 Scoping Plan, implementing agencies and/or project sponsors shall implement measures, where feasible and necessary based on project- and site-specific considerations that include, but are not limited to:

- MTC and ABAG, in partnership with the BAAQMD, shall work with the counties and cities in the Bay Area to adopt qualified GHG reduction plans (e.g., CAPs). The CAPs can be regional or adopted by individual jurisdictions, so long as they meet the standards of a GHG reduction program as described in CEQA Guidelines Section 15183.5. At the regional level, the cumulative emissions reduction of individual CAPs within the region or a regional CAP should demonstrate an additional Bay Area-wide reduction of 24 $MMTCO_2e$ from land uses and on-road transportation compared with projected 2040 emissions levels already expected to be achieved by the Plan. (This is based on the 2015 Bay Area land use and on-road transportation emissions of 52 $MMTCO_2e$, an interpolated statewide GHG reduction target of 60 percent

below 1990 levels by 2040, and a two percent increase in statewide emissions between 1990 and 2015). The CAP(s) should also show a commitment to achieving a downward trajectory in emissions post-2040 to meet statewide goals of reducing GHG emissions by 80 percent below 1990 levels by 2050, per S-03-05.

These reductions can be achieved through a combination of programs, including ZNE in new construction, retrofits of existing buildings, incentivizing and development of renewable energy sources that serve both new and existing land uses, and other measures so long as the overall 32 $MMTCO_2e$ reduction (by 2040) can be demonstrated. This target can be adjusted if statewide legislation or regulations would reduce GHG emissions, so long as a trajectory to achieve this target in the Bay Area is maintained.

Implementation of CAPs in the region would help to reduce both GHG and area source emissions from the land use projects that would be constructed under the Plan, as well as reducing GHG emissions from existing uses. However, this may require installation of renewable energy facilities on houses and businesses, construction of community-serving facilities such as small-scale solar farms, or other actions. These additional facilities, if needed, could require in additional land conversion, resulting in similar environmental impacts associated with land use development described throughout this EIR.

Significance after Mitigation

Mitigation, via CAPs for individual jurisdictions, or other programs, including retrofitting existing buildings, installing renewable energy facilities that replace reliance on fossil-fuel power in the region, alterations in the vehicle fleet (toward more non-fossil fuel-powered vehicles) and other measures would be required to meet the goals needed to attain the 2030 targets. Thus, compliance with the CAP measure, throughout the Bay Area, is needed to assure mitigation to a less than significant level (LS-M).

However, there is no assurance that this level of mitigation would be accomplished throughout the Bay Area. Additional regulatory action that results in substantial GHG reductions throughout all sectors of the State economy and based on State-adopted regulations would likely be needed to attain such goals, and they are beyond the feasible reach of MTC/ABAG and local jurisdictions. The 2017 Scoping Plan Update being prepared by ARB is the first step toward regulatory action that could help attain 2030 goals.

Moreover, MTC/ABAG cannot require local implementing agencies to adopt the above mitigation measure, and it is ultimately the responsibility of a lead agency to determine and adopt mitigation. Even with full implementation of the mitigation measure, forecasted emissions would not be reduced to target levels under SB 32. Therefore, this impact would be **significant and unavoidable (SU)**.

Impact 2.5-4: Implementation of the proposed Plan could substantially conflict with local plans or policies adopted to reduce emissions of GHGs.

Impact of Changes in Projected Land Use and Transportation Projects

Projected development facilitated by the proposed Plan is not expected to conflict with any climate action plans and General Plans of cities and counties located in the jurisdiction of MTC/ABAG, or any local regulations adopted with the intent to reduce GHG emissions. The Regulatory Setting, above, describes the plans, policies, and regulations relevant to the proposed Plan that are related to the reduction of GHG emissions.

Local CAPs or GHG reduction plans are adopted in an effort to comply with the goals set for local governments in ARB's Scoping Plan and are therefore designed to support the same State-mandated goals and targets for GHG reduction outlined above. It is ultimately local jurisdictions that have authority to determine if land use development projects are consistent with local plans. MTC and ABAG do not have jurisdiction in approval of development within the region.

The proposed Plan does not address all of the potential reduction measures, goals, and GHG targets that are identified in local CAPs, general plans, and other plans that address climate change; each locality will set targets based on state, regional, or local conditions. Further, not all plans will have the same reduction goals and implementation measures because they account for various local factors and considerations (see Table

2.5-4 in the Regulatory Setting for a list of local jurisdictions with GHG inventories and adopted CAPs). The proposed Plan identifies a compact land use pattern that is paired with targeted transportation investments to identify an efficient system that results in reductions to per capita and overall GHG emissions. However, some variations may exist on the local level. For instance, the proposed Plan's focused growth pattern may not support an individual jurisdiction's efforts to meet its GHG target by constraining growth. While some variations may exist between the proposed Plan and specific local CAPs, these variations would need to be assessed at the local level. On a whole, it is expected that local CAPs and the proposed Plan would be complimentary efforts towards the reduction of GHG emissions in line with State goals and mandates.

Therefore, the proposed Plan is not expected to substantially conflict with local climate action or GHG reduction plans, and the impact is considered to be **less than significant (LS)**. No mitigation is required.

Mitigation Measures

None required.

Impact 2.5-5: Implementation of the proposed Plan could result in a net increase in transportation projects within areas projected to be regularly inundated by sea level rise by midcentury.

Impacts of Changes in Projected Land Use

Implementation of the proposed Plan would provide a strategy for accommodating projected household and employment growth in the Plan area by 2040. The resultant placement of land uses within areas regularly projected to be inundated by sea level rise is addressed in Impact 2.5-5. As described below, this would be a potentially significant (PS) impact.

Impacts of Transportation Projects

Approximately 510 acres associated with 50 transportation projects under the proposed Plan are located, partially or wholly, within areas projected to be regularly inundated (i.e., inundated multiple times each year) by sea level rise by midcentury, as shown in **Table 2.5-13**. The full list of transportation projects that are located within or partially within areas projected to be regularly inundated (i.e., inundated multiple times each year) by sea level rise by midcentury is provided in Appendix E. Any increase in transportation projects within the sea level rise inundation zone is considered a significant impact.

Table 2.5-13 Proposed Transportation Projects within Midcentury Sea Level Rise Inundation Zone

County	Inundated Acres
Alameda	50
Contra Costa	1
Marin	30
Napa	1
San Francisco	100
San Mateo	160
Santa Clara	160
Solano	2
Sonoma	<1
Regional Total	**510**

Notes: Number less than 1 are shown as "<1." Whole numbers have been rounded (between 0 and 10 to the nearest whole number, between 11 and 999 to the nearest 10, between 1,000 and 1,000,000 to the nearest 100, over 1,000,000 to the nearest 1,000). Figures may not sum because of independent rounding.
Inundation calculations are based on based on MTC GIS files identifying transportation project locations. The projects were mapped to the best of MTC's ability based on the information submitted by the project sponsor. The exact project locations may change as the projects are further developed.
Source: MTC 2017, NOAA 2012, data compiled by Ascent Environmental 2017

Conclusion

Because the proposed Plan would result in portions of some transportation projects being constructed in areas projected to be inundated by sea level rise, this impact is considered **potentially significant (PS)**. Mitigation measures 2.5-4(a) through 2.5-4(c) are outlined below.

Mitigation Measures

Implementing agencies and/or project sponsors shall implement measures, where feasible and necessary based on project- and site-specific considerations that include, but are not limited to:

2.5-4(a) MTC and ABAG shall continue coordinating with BCDC, in partnership with the Joint Policy Committee and regional agencies and other partners, to conduct vulnerability and risk assessments for the region's transportation infrastructure. These assessments will build upon MTC and BCDC's Adapting to Rising Tides studies focused in several Bay Area counties. Evaluation of regional and project-level vulnerability and risk assessments will assist in the identification of the appropriate adaptation strategies to protect transportation infrastructure and resources, as well as land use development projects, that are likely to be impacted. The *Adaptation Strategies* (see Appendix F of this Draft EIR) includes a list of potential adaptation strategies that can mitigate the impacts of sea level rise. In most cases, more than one adaptation strategy will be required to protect a given transportation projector land use development project, and the implementation of the adaptation strategy will require coordination with other agencies and stakeholders. As MTC and ABAG conduct vulnerability and risk assessments for the region's transportation infrastructure, the *Adaptation Strategies* should serve as a guide for selecting adaptation strategies, and should be expanded as additional strategies are identified.

2.5-4(b) Implementing agencies and/or project sponsors shall implement measures, where feasible and necessary based on project- and site-specific considerations that include, but are not limited to, coordination with BCDC, Caltrans, local jurisdictions (cities and counties), and other transportation agencies to develop Transportation Asset Management Plans that consider the potential impacts of sea level rise over the life cycle of threatened assets.

2.5-4(c) Implementing agencies shall require project sponsors to incorporate the appropriate adaptation strategy or strategies to reduce the impacts of sea level rise on specific local transportation and land use development projects, where feasible, based on project- and site-specific considerations. Potential adaptation strategies are included in the *Adaptation Strategies* (see Appendix F of this Draft EIR).

Significance after Mitigation

Any increase in transportation projects within the area projected to be inundated by sea level rise is considered significant. Selection and implementation of appropriate mitigation measures and adaptation strategies may reduce the impact associated with sea level rise to less than significant on a project-by-project basis. The appropriate adaptation strategies would be selected as part of the future project-level analysis and planning. At this time, sufficient detail is not available to identify which adaptation strategy or strategies would be the most effective for each individual transportation project. In addition, successful implementation of the mitigation measures and adaptation strategies requires participation by other agencies and stakeholders.

This EIR includes a range of adaptation strategies to guide local jurisdictions, regional agencies, and transportation agencies in identifying strategies that are appropriate for transportation and development projects that may experience regular future inundation by sea level rise.

To the extent that an individual project adopts and implements all feasible mitigation measures described above, the impact would be less than significant with mitigation (LS-M).

Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measures described above, to address site-specific conditions. However, MTC/ABAG cannot require local implementing agencies to adopt the above mitigation

measures, and it is ultimately the responsibility of a lead agency to determine and adopt mitigation. Therefore, this impact remains **significant and unavoidable (SU)**.

Impact 2.5-6: Implementation of the proposed Plan could result in an increase in land use development within areas regularly inundated by sea level rise by midcentury.

Impact of Changes in Projected Land Use

Implementation of the proposed Plan would result in projected development across the region, some of which could occur within areas regularly inundated by sea level rise. **Table 2.5-14** shows the percent of the land use growth footprint that would be regularly inundated by sea level rise by midcentury.

Table 2.5-14 Land Use Growth Footprint within the Projected Midcentury Sea Level Rise Inundation Zone by Region, County, and TPAs

County	Sub-Area	Inundated Area (acres)	Total (acres)	Percent Inundated
Alameda	County Total	70	7,400	<1%
	Within TPAs	30	3,900	<1%
Contra Costa	County Total	40	8,100	<1%
	Within TPAs	<1	1,200	<1%
Marin	County Total	40	420	10%
	Within TPAs	3	100	3%
Napa	County Total	<1	920	<1%
	Within TPAs	<1	<1	<1%
San Francisco	County Total	50	2,900	2%
	Within TPAs	50	2,800	2%
San Mateo	County Total	280	2,800	10%
	Within TPAs	40	1,400	3%
Santa Clara	County Total	210	9,500	2%
	Within TPAs	80	5,000	2%
Solano	County Total	10	3,200	<1%
	Within TPAs	<1	30	2%
Sonoma	County Total	<1	2,300	<1%
	Within TPAs	<1	270	<1%
Regional Total	**Plan Area**	**700**	**37,500**	**2%**
	Within TPAs	**210**	**14,800**	**1%**

Notes: Number less than 1 are shown as "<1." Whole numbers have been rounded (between 0 and 10 to the nearest whole number, between 11 and 999 to the nearest 10, between 1,000 and 1,000,000 to the nearest 100, over 1,000,000 to the nearest 1,000). Figures may not sum because of independent rounding.

TPA = transit priority AREA

Source: MTC 2016, BCDC 2015, NOAA 2012, data compiled by Ascent Environmental 2017

Impact of Transportation Projects

Implementation of the proposed Plan would result in the development of transportation projects, which are addressed in Impact 2.5-4. As described above, this would be a potentially significant (PS) impact.

Conclusion

As shown in **Table 2.5-14,** the proposed Plan would result in an increase of nearly 700 acres of projected land uses to be located in areas that would be regularly inundated by sea level rise by midcentury. This impact is considered **potentially significant (PS)**. Mitigation measures 2.5-4(a) and 2.5-4(b) are outlined for Impact 2.5-5.

Mitigation Measures

Implement Mitigation Measures 2.5-4(a) and 2.5-4(b) under Impact 2.5-4.

Significance after Mitigation

Any increase in projected land use development within areas projected to be regularly inundated by sea level rise is considered a significant impact. Selection and implementation of the appropriate mitigation measures and adaptation strategies could reduce the impact associated with sea level rise to a less-than-significant level. However, the appropriate adaptation strategies would be selected as part of future project-level analysis and planning. At this time, sufficient detail is not available to identify which adaptation strategy or strategies would be the most effective at protecting the projected land use development within the sea level rise inundation zone. In most cases, regional strategies that protect large developed areas would be the most effective at protecting the affected development, but successful implementation of regional adaptation strategies requires participation by other agencies and stakeholders.

This EIR includes a range of adaptation strategies to guide local jurisdictions, regional agencies, and transportation agencies in identifying strategies that are appropriate for transportation and projected development that may experience regular future inundation by sea level rise.

To the extent that an individual project adopts and implements all feasible mitigation measures described above, the impact would be less than significant with mitigation (LS-M).

Projects taking advantage of CEQA Streamlining provisions of SB 375 (Public Resources Code sections 21155.1, 21155.2, and 21159.28) must apply the mitigation measures described above, to address site-specific conditions. However, MTC/ABAG cannot require local implementing agencies to adopt the above mitigation measures, and it is ultimately the responsibility of a lead agency to determine and adopt mitigation. Further, there may be instances in which site-specific or project-specific conditions preclude the reduction of all project impacts to less-than-significant levels. For purposes of a conservative analysis, therefore, this impact remains **significant and unavoidable (SU)** for this program-level review.

California Office of Emergency Services. 2017. Cal OES Internet Home for Governments & Tribal. Available: http://www.caloes.ca.gov/for-governments-tribal. Accessed: March 16, 2017.

3.1 Alternatives

None

3.2 CEQA Required Conclusions

Lake County. 2008. Lake County General Plan. Available: http://www.co.lake.ca.us/Assets/CDD/2008+General+Plan+Final+Version/2008+General+Plan+Docs/Cover+and+Table+of+Contents.pdfAccessed: April 2017.

Mendocino County. 2009. Mendocino County General Plan. Chapter 1: Introduction. Available: http://www.co.mendocino.ca.us/planning/pdf/fGPU_01_Introduction.pdf. Accessed: April 2017.

Merced County. 2011. Merced County General Plan. Part 1: General Plan Overview. Available: https://www.co.merced.ca.us/pdfs/planning/generalplan/2030sections/mcgpu_2030gp_part_i_gp_overview_pcrd_2011_06_14.pdfAccessed: April 2017.

Sacramento County. 2016. Sacramento County General Plan Available: http://www.per.saccounty.net/PlansandProjectsIn-Progress/Documents/General%20Plan%202030/2030%20General%20Plan%20Adopted%2011.9.11_sm.pdf. Accessed: April 2017.

San Benito County. 2015. San Benito County General Plan. Available: http://cosb.us/wp-content/uploads/Adopted-2035-GPU.pdf. Accessed: April 2017.

San Joaquin County. 2010. San Joaquin County General Plan. Volume 1. Available: https://www.sjgov.org/commdev/cgi-bin/cdyn.exe/handouts-planning_GP-V1-I?grp=handouts-planning&obj=GP-V1-IAccessed: April 2017.

Santa Cruz County. 1994. Santa Cruz County General Plan.. Chapter 1: introduction Available: http://www.sccoplanning.com/Portals/2/County/userfiles/106/GP%20Chapter%201.pdf. Accessed: April 2017.

Stanislaus County. 2015 Stanislaus County General Plan. Introduction. Available: http://www.stancounty.com/planning/pl/gp/current/gp-introduction.pdf. Accessed: April 2017.

County of Yolo. Yolo County General Plan. 2009. Chapter 1: Introduction and Administration. Available: http://www.yolocounty.org/home/showdocument?id=14470. Accessed: April 2017.