

18.0 GLOBAL CLIMATE CHANGE

Issues: *The City may be affected by global climate change due to its physical effects (sea level rise, coastal bluff erosion, effects on water supply, etc.). The growth projected under Plan Santa Barbara would also incrementally contribute to global climate change due to increased emissions of greenhouse gases (GHGs) such as carbon dioxide. State law requires the City to address these long-range issues by:*

- *Vigorously implementing measures to reduce GHGs, such as expansion of successful programs to reduce vehicle trips, vehicle miles traveled and associated fuel consumption, and measures to conserve energy use in buildings; and*
- *Taking measures to protect people and property from the physical effects of global climate change such as coastal bluff retreat and coastal flooding, through additional shoreline management and other adaptive management programs.*

Global climate change is recognized by the United Nations, the U.S. Federal government, and the State of California as a significant issue with potential to adversely affect the planet's environment and public health, safety, and welfare. State legislative and regulatory directives (summarized below in Section 18.4, *Greenhouse Gas Evaluation Approach*) require City analysis of global climate change effects as part of Environmental Impact Reports (EIRs), and City actions to reduce greenhouse gases (GHGs) and plan for adaptation to global climate change.

Global climate change refers to substantial changes in measures of climate over time, such as average temperature, precipitation, and wind patterns (California Office of Planning and Research [OPR] 2008). This includes both changes due to natural variability and as a result of human activity (Intergovernmental Panel on Climate Change [IPCC]¹ 2007). The IPCC has determined that most of the observed increase in average global temperature since the mid-20th century is very likely due to human-generated GHG concentrations.

GHGs include carbon dioxide (CO₂), methane, nitrous oxide, and ozone in the atmosphere, as well as water vapor². These gases absorb infrared radiation reflected from the Earth's surface and release it as heat, which maintains the temperature of our planet (i.e., "the Greenhouse Effect"). The Greenhouse Effect is essential to maintaining Earth's habitability; however, changes in the abundance of GHGs alter the amount of energy in the climate system and introduce many potential effects. Although natural fluctuations in climate are known to occur, it is extremely unlikely that the global climate change observed over the past 50 years can be due to known natural causes alone (IPCC 2007).



Santa Barbara's waterfront and beaches may be subjected to inundation and flooding from sea level rise within the next 50 to 100 years.

¹ The IPCC was founded in 1988 by the United Nations Environment Programme and the World Meteorological Organization and is responsible for compiling the knowledge on climate change documented in thousands of scientific publications worldwide in an objective manner.

² State law defines GHG to include the following: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health and Safety Code, section 38505(g)).

Global atmospheric concentrations of GHGs have increased markedly as a result of human activities since the start of the Industrial Revolution (approximately 1750), and now far exceed values observed for thousands of years prior to the Industrial Revolution. The increase in atmospheric CO₂ concentration is believed to be primarily due to fossil fuel combustion and land-use changes (e.g., deforestation, desertification, urban sprawl), while increases in methane and nitrous oxide are thought primarily due to agricultural expansion and intensification. Over the last 250 years, the concentration of CO₂ in the atmosphere has increased 35 percent from a pre-industrial value in 1750 of 280 parts per million (ppm) to 379 ppm in 2005. More recently, global annual CO₂ emissions from fossil fuel combustion have increased by an average of over 12 percent over the period from the early 1990s to 2005 (IPCC 2007).

Key issues related to climate change include potential changes in water supply, increased fire risk, sea level rise, increased flood hazards, public health issues, changes in fisheries and other biological resources, and increased demands on State and City budgets.

The relationship between global climate change and the *Plan Santa Barbara* General Plan policy amendments and growth projections is discussed below in two contexts: the potential effects of global climate change on the City (discussed below in Section 18.1, *Climate Change Effects on the City*), and the potential for City growth and policies to incrementally contribute to global climate change through the generation of GHGs (discussed below in Section 18.5, *Future Citywide Greenhouse Gas Emissions*).

18.1 Climate Change Effects on the City

Based on regional models and available worldwide data, global climate change has the potential to adversely affect California and the city of Santa Barbara over the long-term in a variety of ways, many of which are not yet well understood. Key issues include potential changes in water supply, increased fire hazards, sea level rise, increased flood hazards, public health issues, impacts to fisheries and other biological resources, and increased demands on State and City budgets to address operations, maintenance, and capital improvements.

The potential effects of global climate change on the City are discussed in the individual impact sections of this document. A summary overview of potential global climate change effects on the City is provided below, drawn from the analysis in these other sections.

The facts and analyses in this section are based on data and research provided by recognized authorities on global climate change, including the Intergovernmental Panel on Climate Change (IPCC), California Air Resources Board (CARB), and the Governor's Office of Planning and Research (OPR).

Climate is generally addressed or modeled on a global or regional basis, and difficulties remain in reliably simulating and attributing observed temperature changes at smaller scales (IPCC 2007). As a result, the effects of global climate change on smaller geographic areas such as California or the City are typically grouped into Western U.S. regional models or assessments. However, recent literature does address current and future trends in California. A report released by the State in March 2009 provides analysis for coastal regions for a projected sea level rise of approximately 4.6 feet by the year 2100 (California Climate Change Center [CCCC] 2009). No focused studies of smaller areas such as the Central Coast are yet available.

However, the timing of global climate change effects is not clearly known. Over the last 100 years, global climate change has been identified as having reduced Sierra Nevada snow pack by 10 percent, caused sea levels to rise by an average of 7 inches off California, and decreased average flows in many rivers while increasing flooding (DWR 2005). However, it is unclear how closely events such as the 1986-1991 drought or recent local fires are linked to global climate change. In addition, it remains unclear if events such as further sea level rise will require substantial direct public or private adaptive actions by 2030, or whether planning and establishing programs and financing mechanisms to address potential future adverse effects of global climate change would suffice. In any event, addressing sources of increased CO₂ and other GHGs contributing to global climate change will be required under State law.



Previous droughts have resulted in dry reservoirs and water rationing.

18.1.1 Water Supply

California's water supply is derived from a combination of statewide and local sources, including surface runoff from the Sierra Nevada and local mountains, groundwater, and the Colorado River Basin. For the State as a whole, water supply sources are generally over-allocated, with long-term demand potentially exceeding physical or legal capacity (DWR 2009).

Over the past century, water sources in the southwestern U.S. have been subject to earlier peak streamflow due to earlier snowmelt, a decreased proportion of precipitation falling as snow, decreased mountain snowpack, decreased annual precipitation, increased frequency of heavy precipitation events, and increased periods of drought (IPCC 2008).

Scientific evidence indicates that global climate changes will likely stress existing water systems (DWR 2009). Although average global rainfall is projected to increase, California's variety of climates make uniform projections difficult. Further, annual rainfall in California is expected to decrease under reasonable worst case model projections (California Climate Action Team 2009). Even in areas where wetter winters are projected, snowfall is expected to decrease, and earlier snowmelt and runoff would reduce the runoff of water during the late spring and summer, thereby reducing water storage and the amount of water available for public use. Stream inflows to major reservoirs are projected to decline before mid-century (DWR 2009).

The City's three major existing water sources are the Santa Ynez River Watershed (Lake Cachuma, Gibraltar Reservoir, and Mission Tunnel), the State Water Project (SWP), and groundwater (City of Santa Barbara 2005). The yields from all of these sources have the potential to be affected and potentially reduced by projected changes in rainfall patterns, increasing temperatures, and potentially sea level rise associated with global climate change (Refer to Section 15.0, Public Utilities for more information about the City's water supply.)

Santa Ynez River Watershed

No micro-scale climate models or specific projections have yet modeled the effect of global climate change on stream flow and associated yield of long-term water supplies from coastal watersheds such as the Santa Ynez

River. Most research on the effect of global climate change on water supply has focused on major reservoirs that are supplied by snowmelt and runoff from the Sierra Nevada Mountains.

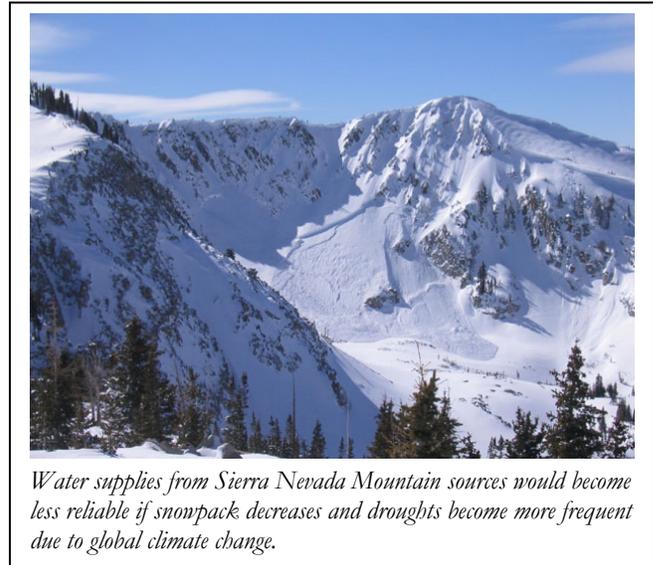
However, as discussed above, regional models indicate that rainfall patterns in the southwest and California will be substantially affected by global climate change. The most likely change in the Santa Barbara area is a shift to more extreme weather patterns, with rain occurring in infrequent major precipitation events, and longer, dryer summers. These trends could increase variability in streamflows within the Santa Ynez River watershed. Average temperatures and occurrences of heat waves are projected to increase, both of which could increase water demand and decrease supply through reduced stream flow and greater evaporation.

Extended dry periods can affect water supplies and the storage capacity of the Santa Ynez River watershed, which supplies 88 percent of the City's water supply.

State Water Project

The SWP, managed by the California Department of Water Resources (DWR), provides at least part of the water supply for approximately 60 percent of California's residents, and provides flood control, power generation, recreational opportunities, and habitat enhancement for fish and wildlife (Wilkinson 2002).

In the late spring and early summer, higher elevation snowpack in the Sierra Nevada melts and flows into the Sacramento/San Joaquin River Delta where it is diverted to the SWP to supply southern California with much of its water (Wilkinson 2002). Surface water is imported into the Central Coast region through the SWP's Coastal Branch Aqueduct, which could provide up to 20 percent (3,300 acre-feet per year [AFY]) of the City's water supply when available (DWR 2005; City of Santa Barbara 2005).



Water supplies from Sierra Nevada Mountain sources would become less reliable if snowpack decreases and droughts become more frequent due to global climate change.

The State has initiated a major planning effort to address the effects of global climate change on both regional and local water supplies (DWR 2009). One of the resultant studies takes into account the effects of global climate change on SWP exports to southern California, with the exception of potential sea level rise impacts on the Sacramento Delta. The DWR authors concluded that annual exports from the Delta are expected to be reduced by approximately 7 to 10 percent by 2050 and by 21 to 25 percent by the end of the century.

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Deliveries of SWP water could be reduced by more than 50 percent during a critical drought period (City of Santa Barbara 2005). During the last extended statewide drought that ended in 1991, SWP deliveries were reduced by approximately 70 percent (Wilkinson 2002). Further, recent modeling (e.g., Howat and Tulaczyk 2005; Rauscher et al 2008) suggests that projected changes in rainfall patterns and reductions in Sierra snowpack of 25 to 40 percent by 2050 will require major operational changes for the SWP and local water delivery systems³, in order to deal with the increased variability in supply. Such changes would be required to maintain the ability of these systems to meet water delivery requirements under changing climatic conditions.

³ Changes could include additional storage capacity through groundwater banking, State Water Project Delta Conveyance project, etc.

Groundwater

Groundwater supplies currently available to the City consist of approximately 16,000 AFY of available storage in the Santa Barbara Groundwater Basin, with an annual safe yield of approximately 1,400 AFY (City of Santa Barbara 1994, 2005). Groundwater supplies are primarily replenished through percolation from flow in local streams, such as Mission Creek, as well as inflow from adjacent bedrock. However, the City also actively manages groundwater supplies through conjunctive use, drawing upon groundwater to meet a portion of annual water demand, while increasing naturally-occurring groundwater recharge in wet years by releasing available

The City's groundwater supplies serve as a critical drought buffer and may become more important by 2030 if surface water supplies decline; however, groundwater may be limited by decreased recharge and potential for seawater intrusion.

excess Santa Ynez River water from Mission Tunnel into Mission Creek. Although the City draws upon groundwater as needed to meet ongoing demand, a primary goal of current groundwater management is to maintain the basin as full as possible to act as a reserve for periods of drought (City of Santa Barbara 2005).

Potential declines in surface water supplies may shift reliance to groundwater resources in California (Hayhoe et al. 2004). On the Central Coast, a growing demand for water and limited surface water supply is already leading to more dependence on groundwater (DWR 2005). Projections suggest that efforts to offset declines in surface water through increasing withdrawal on groundwater will be hampered by decreases in groundwater recharge in water-stressed regions, such as the southwestern U.S. (Gray et al. 2008). In coastal regions, sea level rise may also affect groundwater aquifers by causing an increase in the intrusion of salt water into coastal aquifers, depending on the groundwater gradients and pumping rates (Wilkinson 2002; DWR 2005). As was predicted by models, the salt water interface in the City's Downtown groundwater basin moved significantly closer to City production wells during high levels of pumping during the drought of 1986-1991 (Ferguson 2008). The basin has largely recovered in the last 15 years and the City has drilled new wells farther inland to minimize potential for future seawater intrusion. However, potential decreases in stream flow, increased frequency and duration of droughts, and possible increased reliance on groundwater has the potential to increase stress on City groundwater supplies, with possible associated salt water intrusion related to groundwater drawdown and/or sea level rise.

Water Quality

The surface water in City creeks, as well as coastal beach water, have at times harbored levels of pathogens (e.g., bacteria, viruses) not meeting adopted water quality protection standards. The City has undertaken a wide range of measures to improve water quality in the area, which have resulted in dramatically improved conditions and reduction in instances of inadequate water quality.

Global climate change is projected to adversely affect surface water quality due to changing temperatures, decreased stream flow, runoff rates and timing, increased flooding, and the ability of watersheds to assimilate wastes and pollutants (Wilkinson 2002; DWR 2005). Higher temperatures and nutrient loads could reduce the oxygen content of water, negatively affecting aquatic organisms. More intense rain events could result in greater amounts of sediment, nutrients, pathogens, and toxic inputs into water bodies from non-point sources (i.e., urban runoff). (Gray et al. 2008). These factors could adversely affect water quality in City creeks such as Arroyo Burro and Mission creeks, and downstream beaches such as East Beach and Arroyo Burro (Hendry's) Beach (refer to Section 11.0, *Hydrology and Water Quality*). Sea level rise could also increase the risk of saltwater contamination at the SWP supply intake in the Sacramento-San Joaquin Delta, and intrusion into coastal aquifers such as the City groundwater basin (Wilkinson 2002). Refer to Section 11.0, *Hydrology and Water Quality* for more information on existing water quality and the potential influences of global climate change.

Overall, the implications of global climate change for the City's water supply and the quality of water in area rivers and creeks are likely to be adverse; however, existing policies and programs aimed at maintaining safe yields, identifying new sources, and encouraging conservation would help offset potential reductions in traditional City supplies or reductions in water quality.

18.1.2 Flooding of Creeks and Watersheds

Flood hazards in the City are largely related to the floodplains associated with Mission Creek in portions of Downtown, from the Laguna Channel and Sycamore Creek on the City's Eastside, and from Arroyo Burro Creek in the Upper State Street and Hitchcock Avenue areas and along Modoc Road.

Global climate change has the potential to increase both the frequency and severity of flooding from the City's creeks in several ways. First, increasingly erratic weather patterns are projected to result in an increase in high magnitude rainfall events, with possible increased flood flows, and the associated potential for an increase in the depth and velocity of floodwaters, resulting in a larger area subject to flooding.

Second, increased fire frequency and severity could increase the vulnerability of areas downstream from burned watersheds in the Santa Ynez Mountains due to more rapid runoff from denuded watersheds and obstruction of creek channels by debris flows. Further, these two factors could interact to exacerbate flooding where a high rainfall event occurs over a denuded watershed.

Third, as described below, rising sea levels could exacerbate existing backwater effects along lower Mission and Sycamore creeks and particularly the Laguna Channel, causing periodic increases in the back-up of flood waters into developed areas of the City. Backwater flooding is an existing issue in lower-lying areas of the City and has been identified as a global climate change-related issue of concern in low-lying coastal areas (Florsheim 2004). In addition, if it becomes necessary to alter Lake Cachuma's operations to emphasize water supply retention in wet years as opposed to flood control, such changes in operating rules may occur at the expense of some potential for increased flooding outside the City along the lower Santa Ynez River. Refer to Section 11.0, *Hydrology and Water Quality* for a discussion of existing flood zones.

18.1.3 Sea Level Rise

Based on tide gauge data, global sea level rise during the 20th century lies in the range of 3.1 to 13.0 inches, with an average rise of 7.1 inches (IPCC 2007). Data for the City over the full period does not exist, but the sea level rise for the coastline of the City from 1973 to 1999 totaled 3.4 inches (Zervas 2001). Average global sea level is predicted to rise between 7 and 23 inches by the end of the 21st century.

However, sea level rise could be much greater depending on the extent of polar ice sheet melting. Ice-sheet disintegration is a complex phenomenon and still involves many uncertainties which are reflected in the lack of published literature regarding the issue. Because of this lack of consensus, sea level estimates do not include the full effects of changes in ice sheet flow. For example, complete melting of the Greenland ice sheet could contribute approximately 23 additional feet to average global sea level rise (IPCC 2007).



Rising sea level and increased storm intensity could result in backwater flooding to low-lying coastal areas.

Current understanding of the effects of the receding ice sheets is too limited to provide a best estimate or an upper boundary for sea level rise at this time (IPCC 2007). The State has made specific projections of sea level rise of approximately 4.6 feet by 2100 (CCCC 2009). Sea level rise has the potential to adversely affect public and private facilities in the City in several ways, such as seawater intrusion into groundwater basins (refer to Section 18.1.1, *Water Supply* above), inundation of low-lying areas (refer to Section 18.1.2, *Flooding of Creeks and Watersheds* above), and coastal erosion and bluff retreat as described below.

Coastal Erosion

Erosion of beaches and coastal cliffs in Santa Barbara has the potential to substantially alter the City coastline over time. Studies suggest that erosion could accelerate as sea levels rise and the coast is exposed to higher waves (refer to Section 8.0, *Geological Conditions*). Higher water levels result in greater wave energy reaching higher on the shoreline and directly onto the face of cliffs. According to the best available models, the State projects the coastline of Santa Barbara County will recede by an average of 178 feet by 2100 (CCCC 2009) (Figure 18.1).

In Santa Barbara, this could include erosion along more than 2.5 miles of beaches that front low-lying coastal land, including East Beach, West Beach, and Leadbetter Beach. Such erosion could expose public facilities such as the coastal bike trail, public parking lots, the Cabrillo Bath House, and Stern's Wharf to periodic inundation and/or increased damage from wave action. Many of these City facilities already experience periodic moderate levels of damage from high tides and winter storms. The Leadbetter Beach parking lot, City beaches, coastal bike path, and area parking lots sustained damage during the El Nino storms of 1983. Increased erosion of these beaches could also impair recreation, with possible economic implications, as well as damage to sensitive habitats at the estuaries of Mission and Sycamore creeks.

Increased coastal erosion could also affect the almost 4 miles of coastal bluffs that front the Mesa and eastern Hope Ranch. Along this reach of coast, dozens of residences, Shoreline Park, and the Douglas Family Preserve could be exposed to increased bluff erosion associated with rising sea levels. The often ephemeral sandy beach and underlying rocky intertidal areas that front this section of coastline could be particularly susceptible to increased beach erosion, and related impacts to recreational use could occur. Bluff failures along this reach have resulted in periodic damage to Shoreline Park, as well as the loss of two homes and threats to several others. Many homes along this reach have limited remaining bluff setbacks and are thus more vulnerable to increased rates of bluff retreat and erosion.

Over the long-term, increasing beach and bluff erosion may increase requests for construction of seawalls, groins, or beach nourishment projects to protect public facilities and private structures. Coastal protection structures are documented to often have adverse effects on beaches and sand supply, whereas beach nourishment projects, while more environmentally benign, can be expensive and require repeat applications of sand (Titus 1991).

Coastal Inundation

Increased flooding associated with sea level rise is an identified concern for low-lying communities across Santa Barbara County (CCCC 2009). Much of the City waterfront, lower reaches of Downtown, and the lower Eastside are less than 10 feet above historic mean sea level. Even the lower projected sea level increases could adversely affect drainage and increase risk for seawater inundation in these areas (Figure 18.2).

The State projects that 1,300 people living in low, coastal areas of Santa Barbara County will be at risk from flooding in by 2100; the estimated cost in 2009 dollars to replace threatened structures is \$1.1 billion. (CCCC 2009).

LEGEND

- Year 2025 Coastal Bluff Erosion Hazard Zone
- Year 2050 Coastal Bluff Erosion Hazard Zone
- Year 2010 Coastal Bluff Erosion Hazard Zone

Note: State estimates for coastal erosion are not accurate enough to be used for planning purposes and those projected to the years 2050 and 2100 are beyond the planning horizon of *Plan Santa Barbara*.

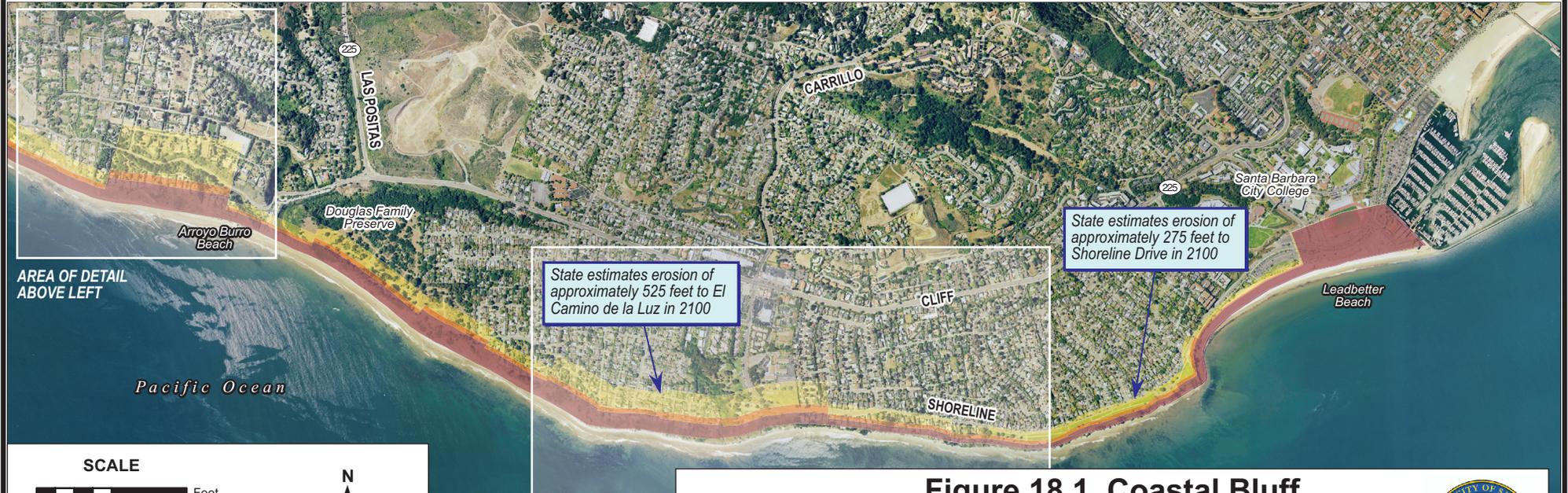
Source: Pacific Institute GIS 2009.



Inset map scale 1:12,000



Inset map scale 1:12,000



AREA OF DETAIL ABOVE LEFT

State estimates erosion of approximately 525 feet to El Camino de la Luz in 2100

State estimates erosion of approximately 275 feet to Shoreline Drive in 2100

AREA OF DETAIL ABOVE RIGHT

SCALE



1:24,000
1 inch equals 2,000 feet



NAD 1983 State Plane California V FIPS 0405 (Feet)

Figure 18.1 Coastal Bluff Erosion Hazard Zone

Plan Santa Barbara Environmental Impact Report
City of Santa Barbara and Its Sphere of Influence

Basemap prepared by **amec**



LEGEND

- Sphere of Influence
- City Limits
- Central Business District
- Areas Inundated by a 100-Year Coastal Flood Under Baseline (Year 2000) Conditions
- Future Areas Predicted for Inundation by a 100-Year Coastal Flood Under a Scenario of 1.4 Meter (55-inch) Sea Rise

Note: The Pacific Institute data did not include the beach area between East Beach and the Harbor as an inundation area; this area has been included in this figure as an area that would be inundated under baseline and future conditions.

Sources: City of Santa Barbara 2008, GIS database; Pacific Institute GIS 2009.

SCALE

0 450 900 1,800 Feet

0 0.125 0.25 0.5 Mile

1:21,600
1 inch equals 1,800 feet

NAD 1983 State Plane California V FIPS 0405 (Feet)

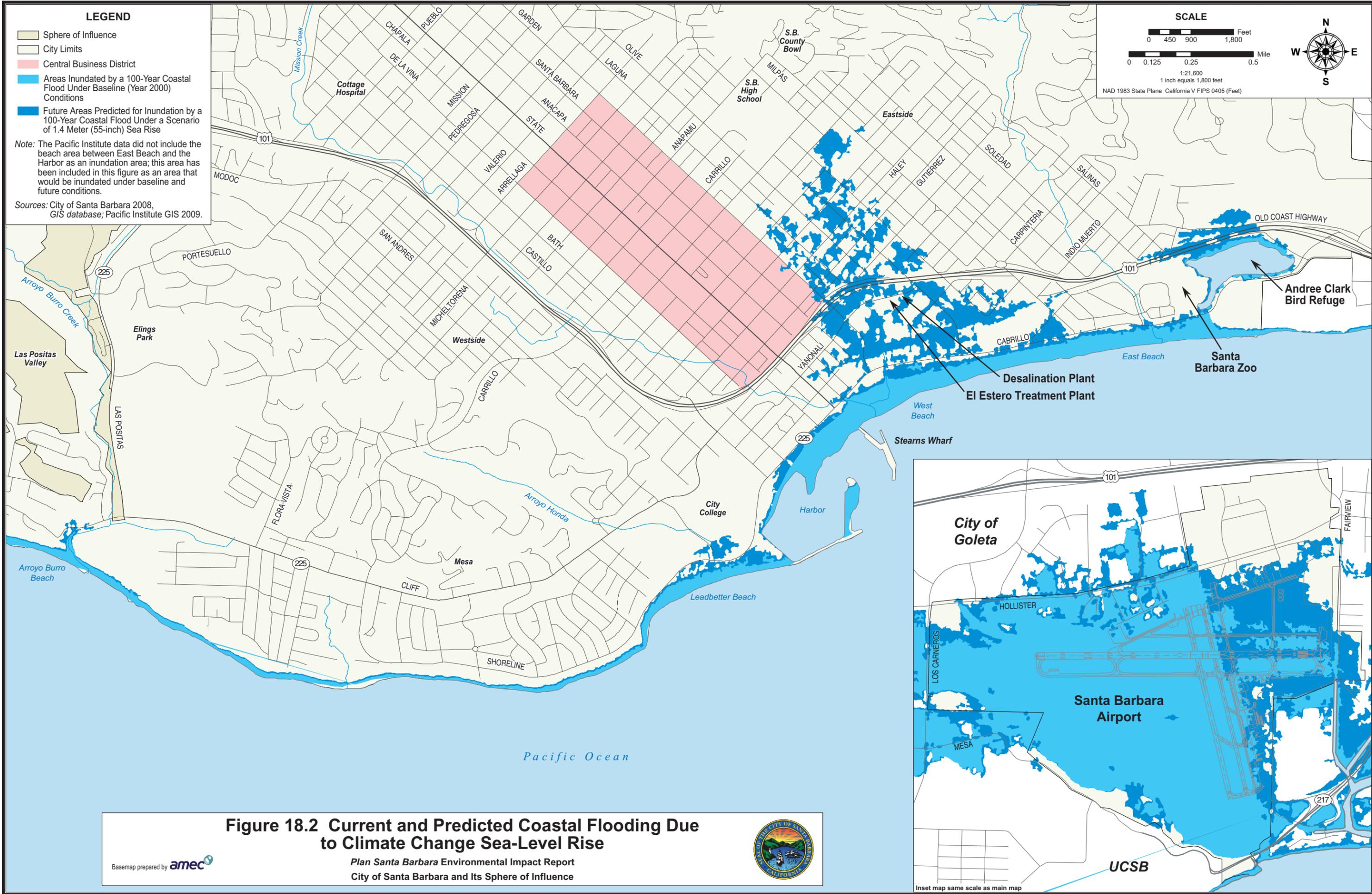


Figure 18.2 Current and Predicted Coastal Flooding Due to Climate Change Sea-Level Rise

Basemap prepared by **amec**

Plan Santa Barbara Environmental Impact Report
City of Santa Barbara and Its Sphere of Influence



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Flooding could result from the increased height of storm surges, flood flows, higher tides, and backwater flooding. In addition, erosion of some sand spits and dunes could expose previously protected areas to flooding. Currently, during high tides or major storm events, floodwaters from Mission Creek, the Laguna Channel, and Sycamore Creek can experience backwater conditions where elevated ocean levels prevent floodwaters from draining rapidly, causing increased upstream flooding. In addition, the City has multiple smaller drains which empty onto area beaches and could also experience backwater conditions associated with higher sea levels. Such backwater conditions are identified as a substantial global climate change-induced effect for coastal drainages (Florsheim et al. 2004).

Wastewater Treatment

Rising sea levels could potentially interfere with treated wastewater discharge and/or potentially increase flood hazards to treatment plants in low-lying areas (CCCC 2009). The City's El Estero Wastewater Treatment Plant is located within 0.25 miles of East Beach at an elevation of approximately 12 to 14 feet above historic mean sea level. This treatment plant currently discharges treated wastewater approximately 1.5 miles offshore in 70 feet of water. While it does not appear likely that the plant could be subject to flooding with modest rises in sea level, projections show that the El Estero facility would be increasingly vulnerable over time to a 100-year flood event with a 4.6-foot sea-level rise. Thus, the potential exists that rising sea levels may eventually require modifications in plant facilities or operations in the coming decades.

Overall, implications for the City related to global climate change-induced sea level rise are potentially substantial, especially with regard to coastal erosion and endangerment of existing coastal structures, as well as inundation and flooding of low-lying City areas. Mitigation measures listed in Section 8.0, *Geological Conditions* (i.e., MM GEO-1, Adaptive Management Planning) would be required to offset these potential effects.

18.1.4 Wildfires

Significant wildfires have occurred in recent history across the Santa Barbara front-country, resulting in loss of life and injury, and the cumulative loss of over 1,000 homes, apartments, and other structures. Most recently, substantial fires occurred in 2008 and 2009, resulting in injuries, major evacuations, and nearly 300 homes lost. The Tea Fire (2008) and the Jesusita Fire (2009) cumulatively burned over 10,000 acres of the Santa Barbara front-country.

Increased wildfire activity over recent decades may reflect sub-regional responses to changes in climate, including unusually warm spring seasons, longer summer dry seasons, reduced winter precipitation, and earlier spring snowmelt, particularly in mid-elevation forests. Oscillations between periods of increased precipitation and periods of drought first increases vegetation due to rain (i.e., fire fuel or biomass), and then exposes vegetation to extreme fire conditions. Increased frequency and length of drought periods, warmer temperatures, and the consequent low moisture content in soils and vegetation have led to the observed increased wildfire activity (Westerling et al. 2006; Wilkinson 2002).



More frequent periods of drought predicted to occur as a result of climate change could increase wildfire frequency and intensity.

Global climate change projections of future decreased precipitation, increased temperature, longer, more frequent periods of drought, periodic high rainfall events with increased vegetation growth, and altered wind patterns have the potential to gradually increase wildfire risks in Santa Barbara in the coming decades. More frequent occurrences of “sun downer” wind conditions⁴, combined with warmer, drier summers, could escalate public safety risks and environmental and economic losses to wildfires (Wilkinson 2002). The portions of the 8-mile “front country” interface with the foothills of the Santa Ynez Mountains and Los Padres National Forests that have not recently burned may be particularly vulnerable (refer to Section 9.0, *Hazards* for wildland fire issues and Section 14.0, *Public Services* for fire service issues).

18.1.5 Public Health

Global climate change could potentially have substantial future effects on key biological, hydrological, and ecological systems that are integral to human well being.

Recent studies of the Los Angeles area project a six- to eight-fold increase in the number of heat wave days⁵ by the end of the 21st century from the existing value of approximately 38 days (Tamrazian et al 2009). Under the worst-case scenario, the length of the heat wave season is forecast to increase by 9 to 13 weeks (Hayhoe et al. 2004)⁶.

The elderly, children, and the economically disadvantaged are at the highest risk for health-related impacts of climate change such as heat stroke, pathogens, and respiratory and cardiovascular diseases.

As a result, future heat-related mortality is projected to increase by five to seven times, and conditions such as heat cramps, fainting, heat exhaustion, and heat stroke are forecast to increase dramatically. Groups especially susceptible to these conditions are the elderly, children, the economically disadvantaged, and those with ailments and medical conditions (Hayhoe et al. 2004; Wilkinson 2002).

Global climate change is considered likely to increase the future risk and geographic spread of infectious diseases and related vectors, including mosquitoes and ticks that carry West Nile virus, Eastern and Western equine encephalitis, Bluetongue virus, and Lyme disease. Climate may also influence pathogens that result in gastrointestinal diseases through food- and water-borne exposures and may result in increased incidence of some diseases. However, interactions between temperature and viruses are not well established (Gray et al. 2008).

Global climate change is also projected to affect both natural and man-made air pollution and potentially alter the distribution and types of airborne allergens (refer to Section 6.0, *Air Quality* for existing air quality conditions). Increased temperatures may enhance the formation of ground-level ozone (i.e., smog), particularly in urban areas. Exposure to ground-level ozone, particulate matter, and certain GHGs (i.e., carbon monoxide, sulfur dioxide, and nitrous oxide) can exacerbate respiratory and cardiovascular diseases, weaken the body’s immune system, damage lung tissue, and potentially cause cancers and premature deaths. Additionally, warmer temperatures may enhance pollen production or alter the geographic distribution of plant species, leading to changes in the timing and/or duration of seasonal allergies and impacting the frequency and severity of asthma (Wilkinson 2002).

⁴ Sundowners are downslope winds that often begin in the late afternoon or early evening. Their onset is typically associated with a rapid rise in temperature and decrease in relative humidity. In the most extreme sundowner wind events, wind speeds can be of gale force or higher, and temperatures over the coastal plain, and even coastal temperatures, can rise above 100°F.

⁵ The definition of heat wave recommended by the World Meteorological Organization is when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 9°F, the normal period being 1961–1990. Other researchers (Tamrazian et al 2009) consider a heat wave to be defined by three consecutive days over 90°F. This document uses the latter definition.

⁶ Los Angeles is the most comparable area to Santa Barbara for which studies have been completed. It is unclear to what extent Santa Barbara’s coastal climate would moderate heat -related changes.

The potential human health effects of global climate change on the City would be reduced through existing State, County, and City public health programs, and the gradual onset of global climate change would allow for sufficient time to respond to most public health issues. Proposed State and local measures to decrease emissions would offset potential effects on air quality. As a result, global climate change implications for public health within the City are expected to be less than considerable.

18.1.6 Energy Demand

There is substantial uncertainty about the potential effects of global climate change on energy demand, production, and distribution. Predicted climate change-induced impacts on energy include increased energy use for cooling, increased peak demand for electricity, increased energy used to pump water for municipal uses, changes in the fuel types and delivery form of energy, and changes in energy consumption in key climate-sensitive sectors of the economy (e.g., construction, agriculture, transportation) (Gray et al. 2008). Refer to Section 17.0, *Energy* for existing energy conditions.

Climate change is expected to result in increased peak demand for electricity, increases in energy used to pump water for municipal uses, increased energy used for cooling, and a potential reduction in California's hydroelectric power supplies.

The State Water Project is the largest user of electricity in the State due to requirements for pumping over mountain ranges. Local water supplies are less energy-intensive due to limited transport distances (Wilkinson 2002).

Global climate change-induced water shortages may reduce the amount of water available to generate hydroelectric power, reducing the 16 percent of the County's current supplies of electricity derived from this source, with both fiscal and energy production consequences (CEC 2008). For example, California's costs for electricity increased by \$3 billion during the 1987-1992 drought due to reduced hydroelectric power production (Wilkinson 2002). Global climate change is predicted to reduce the reliability of California's hydroelectric power supplies due to changes in rainfall patterns, increased droughts and declining Sierra snow pack (DWR 2005).

More frequent and longer heat waves during summer months in the future could also increase demand for electricity for greater use of air conditioning (Gray et al. 2008).

In summary, global climate change-induced increases in energy demand could be considerable, but would likely be accommodated through existing energy infrastructure. In addition, existing and proposed State and City policies encouraging and requiring energy conservation measures could offset much of climate change-induced energy demand.

18.1.7 Economy

Fisheries

The California marine region and marine ecosystems of the Santa Barbara Channel are susceptible to climate-induced changes. Changes already thought to be underway include greatly reduced zooplankton biomass and seabird populations in the waters of the Southern California Bight⁷, as well as distributional changes in many fish populations (Wilkinson 2002).

Changes in ocean temperatures have been shown to impact the distribution and abundance of many biologically and commercially important marine species.

⁷ The Southern California Bight includes the California coastal waters from Point Conception to the U.S. border with Baja California, including the Channel Islands and large expanses of open water.

Such changes have the potential to adversely affect the City's marine fisheries which provide approximately 0.8 percent of Santa Barbara jobs and contributed \$64 million of annual revenue in 2000 (NOAA 2009). For example, warmer seawater during El Niño events causes squid fisheries to decline dramatically. Market squid landings declined to less than 1,000 metric tons during the 1997-1998 El Niño from 110,000 tons (Wilkinson 2002 referencing Boesch et al. 2000).

Benthic rockfish and most invertebrates (e.g., abalone) respond more slowly to thermal changes, often by a gradual northward extension of the range and a loss of the southern portions of the population. Higher storm frequency and/or longer intervals of elevated thermal conditions may result in periods of low reproduction, long enough to endanger the sustainability of these species and their stocks (Wilkinson 2002).

Increased storm intensity and frequency could uproot kelp forests and impact regeneration of mature kelp habitats, which are important to many commercial fish and benthic invertebrate species. In addition, critical marine upwelling, which is responsible for bringing nutrients to the surface, may be altered or become biologically ineffective due to changes in water temperatures (Wilkinson 2002).

Tourism

The tourism industry is a very important revenue-generating sector in California and in the City. The City attracts as many as 5.7 million visitors per year, with annual hotel taxes to the City exceeding \$15 million (Santa Barbara Convention and Visitor's Bureau 2009).

A key tourist draw in the City is the beach, however; many of California's beaches may eventually shrink due to sea level rise and increased erosion caused by winter storms. As sea levels rise, increasing volumes of replacement sand could be needed to maintain current beach width and quality, which already costs millions of dollars each year. As a result, some beach nourishment programs may no longer be viable (UCS 2007).

Future increases in wildfires and extreme heat events could reduce the number of tourists as more people may want to stay inside in controlled temperatures. However, extreme heat events could also cause more visitors to travel toward the coast from inland and larger urban areas such as Los Angeles.

Future increases in the frequency and intensity of winter storms, coastal flooding, or beach water quality issues could result in fewer off-season tourists. Changes in the marine ecosystem offshore could also likely result in distributional changes in many marine animal populations which could affect the whale watching, scuba/snorkeling, and recreational fishing tourism industry.

Recreation

Outdoor recreational activities such as camping, hiking, and beach-going could be affected by future changes to resources, such as shrinking beaches, shifting vegetation, declining stream flows, declining forest productivity, and increased wildfire frequency. Increased coastal erosion and water quality-related beach closures could affect swimmers, sunbathers, volleyball players, surfers, snorkelers/SCUBA divers, and other recreational users.



Projected future beach erosion and decreases in ocean water quality could adversely affect the City's important tourism industry.

Overall, potential global climate change-related implications for the economy are very uncertain; it is likely that some fisheries would be adversely affected while others may remain stable, while implications for tourism and recreation are even less clear. Most likely, changes due to global climate change would not be substantial enough to discourage a significant number of tourists from visiting the City.

18.1.8 Biological Resources

On the South Coast, one likely consequence of climate disturbance could be a shift of many species ranges to the north. Consequently, the Gaviota Coast could likely become more important for sustaining the region's ecological integrity. The native plants unique to California are vulnerable to global climate change, and it is projected that two-thirds of these "endemics" could suffer more than an 80 percent reduction in geographic range by the end of the century, according to a recent study (Loarie et al. 2008).

Researchers who are studying the impacts of global climate change on biodiversity note that we cannot reliably predict the fate of specific species. However, a general trend appears clear: in response to rising temperatures and altered rainfall, many plants could move northward and toward the coast, following the shifts in their preferred climate, while others, primarily in the southern part of the State and in Baja California, may move up into cooler mountain areas.

If plants are able to disperse in time to find more suitable habitat, research indicates that individual plants' ranges could shift by an average of 95 miles under higher global climate change scenarios, often with no overlap between the old and new ranges. Paradoxically, this could separate species that now live together: Substantial numbers of floral communities may be split up as some species move south and uphill while others move north and towards the coast. The shifting and shrinking ranges of endemic species would likely affect animal diversity as well.

The low elevation of coastal wetlands makes these coastal ecosystems vulnerable to the impacts of sea-level rise. Increased near-shore wave intensity and large storm events are predicted to increase shoreline erosion, breaking natural barriers and increasing the likelihood for more frequent and potentially permanent inundation. Areas permanently below the rising tide level could be converted to open water and lose value as wetland habitat.

An additional pressure from global climate change is the potential for increasing ocean acidification. Oceanic CO₂ uptake can result in chemical changes in seawater, and directly affect the calcification cycle and the ocean's array of calcifying organisms. This complex chemical phenomenon can result in both reduction of certain calcifying organisms' ability to make shells for survival (e.g., coralline red algae and urchins), and the dissolution of already existing shells (Orr et al. 2005). Other biological effects of decreasing ocean water pH levels have been noted, including hypercapnia, a condition caused by excessive CO₂ in the blood, in fish and cephalopods (e.g., squids), adverse impacts to reproduction, metabolism and growth in some invertebrates, and beneficial and adverse impacts to various photosynthetic organisms (Polefka and Forgie 2008).

Overall, implications of global climate change for biological resources would be adverse and potentially considerable, especially for certain sensitive species that are not able to easily shift their range. Particular strategies for aiding species to adapt to global climate change may vary; however, preserving larger contiguous habitats and linkages between habitats may aid in species adaptation and migration. For aquatic species in area streams such as the southern steelhead, minimizing water withdrawals to maintain stream flow, and preserving or restoring riparian woodland to provide shade and cover may assist such species in adapting to changes in stream flows. However, there are no guaranteed methods to fully offset global climate change

impacts on individual species; only substantial reductions in existing and future GHG emissions would arrest or reverse future global climate change impacts on biological resources.

18.1.9 Recommended Measures for Adaptation to Climate Change Effects

Regardless of how successful actions prove in limiting GHG emissions, some impacts of global climate change have already begun to occur and will continue to occur as a result of past or current GHG emissions. Even if all GHG emissions were stopped today, temperatures are projected to continue to rise through the rest of the century, inevitably resulting in some degree of global climate change. Consequently, a proactive global climate change plan must include the development of parallel efforts to ease adaptation to the environmental changes that may occur.

Examples of these types of efforts, as suggested by the State in the 2009 Climate Adaptation Strategy (California Natural Resources Agency 2009) are listed below. For coastal areas, improved shoreline management and managed retreat for exposed structures and facilities are under consideration. For sensitive species, retaining contiguous habitat areas and links between urban area habitats and larger open space areas may aid in migration of species, and restoring degraded habitats may provide flexibility and added range for limited species.

2009 State of California Climate Adaptation Strategy

Local Government Guidance:

- **Setbacks:** Mandatory construction setbacks can be imposed to prohibit construction and significant redevelopment in areas that will likely be impacted by sea-level rise within the life of the structure.
- **Additional Buffer Areas:** Additional buffer areas can be established in some places to protect important cultural and natural resource assets.
- **Clustered Coastal Development:** Coastal development can be concentrated in areas of low vulnerability; this may also help in reducing carbon emissions from transportation.
- **Rebuilding Restrictions:** Rebuilding can be restricted when structures are damaged by sea-level rise and coastal storms.
- **New Development Techniques:** Building codes can be amended to require that coastal development incorporate features that are resilient to sea-level rise.
- **Relocation Incentives:** Federal, State, and local funding or tax incentives to relocate out of hazard areas.
- **Rolling Easements:** Policies and funding to facilitate easements to (a) relocate developments further inland, (b) remove development as hazards encroach into developed areas, or (c) facilitate landward movement of coastal ecosystems subject to dislocation by sea-level rise and other global climate change impacts.
- **Engineering Solutions:** New engineering approaches will need to be applied to ports, marinas, and other infrastructure that must be located on the shoreline, to maintain their function as the sea level rises.
- **Amend Local Coastal Plans and General Plans to Address Climate Change Adaptation:** By 2011, or within one year after development of the tools or guidance necessary to support such amendments, and if funding is secured, all coastal jurisdictions, in coordination with the California Coastal Commission, should begin to develop amended Local Coastal Plans that include global climate change impacts.

Source: California Natural Resources Agency 2009.

Plan Santa Barbara proposed policies for adaptation to climate change effects include ER1-Climate Change, which directs that development and public facilities incorporate measures to adapt to climate changes; ER2-Emergency Response Strategies and Climate Change, which directs incorporation of climate change effects such as extreme weather events and sea level rise into emergency response planning; ER3-Comprehensive

Climate Change Action Plan, which directs preparation of a plan as specified in AB 32, to include planning for adaptation to climate change; and ER4-Urban Heat Island Effect, which directs measures to minimize impermeable surfaces, increase vegetation, and provide incentives for green roofs. (Plan policy numbers in subsequent Plan drafts may have changed from those referenced in the EIR.)

This EIR has also identified mitigation measures and recommended measures that would further address adaptation to climate change, including for

- biological resources (*MM BIO-1.a Important Upland Habitat and Corridor Areas Program, RM-4 Urban Forest and Individual Specimen Trees Protection*)
- coastal bluff retreat and sand supply (*MM GEO-1.a Adaptive Management Planning, Updated Bluff Retreat Guidelines, and Shoreline Management Plan; RM GEO-1.a Siting of Development and Public Facilities*)
- wildfire hazards (*RM HAZ-3 Water Systems and Supplies*)
- sea level rise (*MM HYDRO-1 Adaptive Management Planning; Flooding and Groundwater*)
- water supply (*RM PU-1 Long-Term Water Supply Plan Update*)

18.2 Existing Citywide Greenhouse Gas Emissions

Estimated existing and historical carbon dioxide and other GHG emissions generated citywide in Santa Barbara were calculated using the software package Clean Air and Climate Protection (CACP) 2009 (ICLEI 2009). This inventory of City GHG emissions is used as a baseline for projecting future City GHG generation, and for identifying City GHG reduction targets consistent with State legislative directives (discussed further in Section 18.3.2, *California Policies*).

18.2.1 Sources of Greenhouse Gas Emissions

This inventory of existing community GHG emissions focuses on activities that directly produce GHG emissions, and on the consumption of energy which indirectly produces GHGs at the source of energy production. It is these types of local activities that can be addressed by community-level emission reduction strategies. Specifically, this inventory addresses:

- Transportation GHG emissions
 - Automobile and truck petroleum combustion within the City and by commuters
 - Aircraft fuel (Jet A and aviation gasoline) combustion by aircraft flying in and out of Santa Barbara Airport
- Residential, Commercial, and Industrial energy consumption
 - Electricity consumption (indirect GHG emissions)
 - Natural gas consumption (direct GHG emissions)
 - Construction vehicle petroleum combustion
- Water, waste, and wastewater GHG emissions
 - Wastewater treatment (direct GHG emissions [primarily methane])
 - Solid waste decomposition (direct GHG emissions [primarily methane])
 - Energy consumption for SWP water pumping (indirect GHG emissions from electricity consumption)

The methodology used for this inventory does not include energy used in producing consumer goods imported from outside the community (e.g., automobiles, most consumer products, most of the City's food, etc.), nor does it include the potential for capture and storage of carbon by living plants (called biomass sequestration) nor the effects of wildfires⁸. Wood burning, while a substantial contributor to particulate emissions, is considered to be essentially carbon neutral and is not considered here.⁹

18.2.2 Emissions Inventory Calculation Assumptions

Emissions were calculated for 2007. Emissions for all sources except transportation and construction equipment were also calculated for 1990, allowing the City to evaluate status with respect to emission reduction targets of AB 32 (refer to Section 18.3.2, *California Policies*) and the Kyoto Protocol, to which the City is a signatory.

For some emission sources such as transportation, comparable data on vehicle miles traveled (VMT) was not available; as a result, the 1990 values for these emission sources were estimated to be 15 percent below current values, which is a method approved by the California Air Resources Board (CARB).

The year 2007 was selected as the existing environmental setting as this is the most recent year for which comprehensive data were available, and provides a snapshot of the current emissions setting. Emissions from 2004 were calculated and compared to 2007 to check that baseline data was not anomalous; the comparison revealed no anomaly in 2007 data and the 2004 analysis was not carried forward. In order to facilitate analysis, all GHGs were converted by the software into tons of "carbon dioxide equivalents" (tons CO₂e), which consider the greenhouse potential of the various different GHGs in terms of the most common GHG, CO₂.

Calculated GHG emissions are presented in Table 18.1 below. Complete assumptions and technical details for the GHG analysis are presented in Appendix K. (Refer also to Section 17.0, *Energy* for a further discussion of energy consumption within the City, electric power generation, natural gas and transportation energy sources, etc.; and Section 16.0, *Transportation*).

18.2.3 Existing Greenhouse Gas Emissions in Santa Barbara

Transportation

The greatest overall source of GHG within the City is gasoline consumption for transportation, which in 2007 represented double the GHG emissions of all non-transportation sources combined.

Values for City residents' use of Santa Barbara Airport (SBA) fuel consumption were estimated to be 50 percent of countywide aircraft fuel consumption, proportionate to SBA's percentage of countywide air traffic and City residents' use of the Airport (Santa Barbara County Association of Governments [SBCAG] 2007). This fuel consumption includes fuel burned outside Santa Barbara airspace.

⁸ Worldwide, wildfires release an amount of CO₂ into the atmosphere equal to 50 percent of that from combustion of fossil fuels (Bowman et al. 2009).

⁹ As is the case for the rest of southern California, wood burned for heating fuel in Santa Barbara is typically sourced from industrial softwood reforestation projects and orchards in northern California and Oregon. The CO₂ coefficient for burning such "fuelwood" is generally considered to be zero. Carbon released from burning wood cycles in and out of the atmosphere very quickly when compared with the geologic time-scale of the carbon contained in fossil fuel. It is generally thought that the equivalent amount of carbon released by burning is re-sequestered in growing plant material, assuming that the ability of vegetation to perform this task remains stable (City of Eugene 2007). Though there is ongoing debate about the sequestration ability given the changing nature of forest and vegetation, for this inventory we have accepted the assumption in the CACP software model of a net zero GHG impact of wood burning.

Table 18.1: Historic and Existing Greenhouse Gas Production From the City By Source (metric tons of CO₂e¹)

		1990		2007	
		Total	Per Capita	Total	Per Capita
<i>Electricity Consumption²</i>					
	Residential	70,082	0.82	54,553	0.61
	Commercial	99,471	1.16	77,464	0.86
	Industrial	56,517	0.66	29,620	0.33
<i>Natural Gas Consumption</i>					
	Residential	85,681	1.00	80,707	0.90
	Commercial	42,841	0.50	46,578	0.52
	Industrial	1,145	0.01	640	0.01
<i>Construction Equipment (primarily diesel)³</i>		355	0.004	418	0.005
<i>Landfill Decomposition⁴</i>		139,408	1.63	55,125	0.62
<i>Water Pumping (SWP)⁵</i>		N/A	N/A	611	0.006
<i>Wastewater Treatment⁶</i>		5,277	0.06	N/A	N/A
Non-Transportation Subtotal		500,777	5.85	345,716	3.84
<i>Transportation Fuel Consumption</i>					
Internal City Trips	Gasoline ⁷	145,607 ⁸	4.50	171,303	5.02
	Diesel ⁷	73,788 ⁸	0.86	32,854	0.96
Commute Trips	Gasoline ⁷	150,089	1.74	176,575	1.96
	Diesel ⁷	28,785	0.33	33,865	0.38
Other Non-Internal Trips	Gasoline ⁷	348,783	4.05	410,333	4.56
	Diesel ⁷	66,893	0.78	78,698	0.87
Aircraft Gasoline ⁸		2,658 ⁹	0.03	3,127	0.03
Jet Fuel ⁸		40,506 ⁹	0.47	47,654	0.53
Transportation Subtotal		857,110	10.04	954,409	10.6
Total GHG Emissions		1,357,887	15.86	1,300,125	14.46

¹ CO₂e combines all GHGs into a single value based on the greenhouse potential of CO₂.
² Although the emissions from electricity generation do not occur within the City, the City's electricity consumption results in GHG emissions at the generation site which would not have otherwise occurred.
³ Construction emissions calculated using URBEMIS 2007 Version 9.2.4 based on the annual rate of development from 1990 to 2007.
⁴ Represents waste generated in the City and primarily sent to Tajiguas Landfill. A small amount of waste is sent to other landfills within and outside the County; this is also included in this value. The calculated emissions are only for the waste generated that year; decomposition emissions from waste that was disposed of in prior years (including those from the former Las Positas landfill) are not included. Does not account for methane that is captured for the recently installed fuel cell.
⁵ Energy consumed for water pumping within City boundaries is included in electricity consumption. The City did not use SWP water until after 1990. 2007 values assume usage of 631 AFY from SWP (refer to Section 15.0, Public Utilities).
⁶ In 2005 the City installed a fuel cell that uses methane from wastewater treatment to generate electricity rather than flaring the methane. Electricity consumption from wastewater treatment is included in electricity consumption.
⁷ VMT data is from Plan Santa Barbara traffic modeling; represents 2008 values.
⁸ Based on countywide aviation fuel consumption, assumes that 50 percent of countywide figures are from City residents using Santa Barbara Airport. Because it is based off fuel consumption, this figure includes take-off, landing and in-flight consumption.
⁹ Because reliable information for VMT in the City and aircraft operations at Santa Barbara Airport in 1990 is not available, GHG emission values for 1990 represent a 15 percent reduction over 2007 values per CARB guidance.

Because average vehicle fuel efficiency in the U.S. has not markedly improved since 1990 (Schipper 2008), the expected increased citywide VMT since 1990 has led to an increase in transportation-related GHG emissions within the City since 1990¹⁰.

¹⁰ Comparable measurements to those used for Plan Santa Barbara baseline and forecast conditions are not available for 1990; however, what data is available, as well as anecdotal observation indicates a substantial increase in VMT and congestion since 1990.

Electricity and Natural Gas

Indirect emissions of GHGs from City electricity consumption have dropped substantially since 1990 as a result of significantly greater reliance on renewable energy sources, newer and more efficient types of natural gas-fired powerplants, and elimination of all coal-fired generation in Southern California Edison's (SCE's) energy portfolio. Natural gas consumption has remained mostly flat.

Landfill

The greatest percentage reduction in GHG emissions has come from landfill decomposition, where the major increase in diversion of paper, yard waste, and other organic wastes has resulted in a more than 60 percent reduction in landfill gas emissions. This GHG analysis does not include emissions resulting from ongoing decomposition of waste that was disposed of in prior years; thus, no emissions are included from the former Las Positas landfill (now the site of Elings Park), which was closed in 1965. It also does not account for methane emissions that are captured by the methane fuel cell at the Tajiguas landfill.

Water Conveyance

To convey water to Southern California from the Sacramento-San Joaquin Delta, the SWP must pump it 2,000 feet over the Tehachapi Mountains, the highest lift of any water system in the world. Pumping 1 acre-foot of SWP water to Southern California requires approximately 3,000 kilowatt-hours (kWh) (or 3 megawatt-hours). To convey State Water to Santa Barbara from the Sacramento-San Joaquin Delta, it must be pumped over the Coastal Range in San Luis Obispo County and then into Lake Cachuma, requiring approximately 3,000 kWh per acre-foot. The City's utilization of SWP water in 2007 was 631 AFY. The City's recent deliveries of State Water have averaged approximately 540 AFY.

City Total and Per Capita Emissions (2007)

Total GHG emissions from the City are approximately 1,303,368 metric tons of CO₂e (refer to Table 18.1). This level represents a modest decline from the estimated total City GHG emissions from 1990 (1,357,887 metric tons of CO₂e). This surprising result is mostly the result of major recycling and waste diversion efforts undertaken by the City since 1990 (see above), as well as substantially reduced GHG emissions from the electricity generation sources used by SCE. These reductions more than offset the relative large increase in emissions from transportation. The city of Santa Barbara per capita emissions (14.46 tons per capita) appear higher than those that have been calculated for other similarly-sized cities with limited industrial capacity such as Eugene, Oregon (8.6 tons per capita in 2005 [City of Eugene 2007])¹¹. However, this Santa Barba-

Apparent Trends in GHG Emissions from the City, 1990-2007

Overall **GHG emissions** have increased somewhat since 1990 as a result of expected increased VMT.

- **Electricity consumption** now results in fewer indirect GHG emissions as a result of less coal-fired generation, increased use of renewable energy sources, and installation of more efficient combined cycle natural gas-fired power plants.
- Overall GHG emissions from **natural gas consumption** have remained relatively steady.
- Although citywide transportation data is not available for 1990, based on statewide trends, it is expected that GHG emissions from **transportation** would have been lower in 1990 as a result of lower overall VMT.
- GHG emissions from **solid waste decomposition** have dropped dramatically as a result of greater waste diversion and a smaller quantity of paper, wood, and organic materials being placed in Tajiguas landfill.

¹¹ Other inventories include San Diego (12 tons per capita in 2006), or California as a whole (13 tons per capita in 2006 [City of San Diego 2009]). As stated, the *Plan Santa Barbara* emissions inventory includes more sources than these other inventories (e.g., water pumping, commuting, wastewater treatment) so they are not directly comparable.

ra inventory captures more emissions factors than other community analyses to date; as a result the per capita emissions are not directly comparable to these other communities. A weakness of this and other GHG analyses is that they fail to capture the “upstream” GHG emissions of imported goods; if the GHG emissions associated with such items were quantified, it is expected that the City (and other cities with minimal industrial sectors) would have substantially higher GHG emissions inventories and per capita emissions, more comparable to cities with major industrial and manufacturing sectors such as Los Angeles.

18.3 Climate Change Policies

18.3.1 Federal Policies

The U.S. Environmental Protection Agency (USEPA) is the Federal agency responsible for implementing the Federal Clean Air Act. On September 30, 2009 USEPA proposed new criteria for GHG that define when Clean Air Act permits would be required under the New Source Review and Title V operating permits programs. The proposed criteria would tailor these permit programs to limit which facilities would be required to obtain permits, and would cover nearly 70 percent of the nation’s largest stationary source GHG emitters—including power plants, refineries, and cement production facilities, while shielding small businesses and farms from permitting requirements. These criteria are currently under review. No existing Federal regulations address reduction of GHG emissions or global climate change.

18.3.2 California Policies

The California Global Warming Solutions Act of 2006 (AB 32) recognizes that California is a major contributor to U.S. GHG emissions. AB 32 acknowledges that such emissions cause significant adverse impacts to human health and the environment, and therefore must be identified and mitigated where appropriate. AB 32 also establishes a State goal of reducing GHG emissions to 1990 levels by 2020 – a reduction of approximately 30 percent from projected State emission levels and 15 percent from current State levels, with even more substantial reductions required in the future (OPR 2008).

The State’s Climate Change Scoping Plan¹² that implements AB 32 proposes a comprehensive set of actions designed to reduce overall carbon emissions in California, improve the environment, reduce dependence on oil, diversify energy sources, save energy, and improve public health, while creating new jobs and supporting growth in California’s economy (CARB 2008).

The California Air Resources Board (CARB) has also recently adopted a statewide GHG emissions limit for 2020 [427 million metric tons of CO₂ equivalents (CO₂e)], an emissions inventory, and requirements to measure, track, and report GHG emissions by major industries (OPR 2008).

Recently adopted Senate Bill (SB) 97 amends CEQA to establish that GHG emissions and their effects are appropriate subjects for CEQA analysis, and directs the OPR to develop draft CEQA Guidelines for evaluating and mitigating GHG emissions and global climate change effects. The California Resources Agency adopted the Guidelines in January 2009 (OPR 2008).

The recent passage of SB 375 (Steinberg, Chapter 728, Statutes of 2008) created a process whereby local governments and other stakeholders must work together within their region to achieve the reductions speci-

¹² The measures in the Scoping Plan adopted by CARB in December 2008 will be developed over the next three years and be in place by the year 2012 (CARB 2008).

fied in AB 32 through integrated development patterns, improved transportation planning, and other transportation measures and policies. The Santa Barbara Association of Governments (SBCAG) is the lead agency for preparation of a regional plan for our area, a process that is underway in coordination with local jurisdictions.

California is also working closely with six other states and four Canadian provinces in the Western Climate Initiative (WCI) to design a regional GHG emissions reduction program that includes a cap-and-trade approach¹³.

18.3.3 Regional Plans and Policies

Relevant Plans and Regulations

- **Assembly Bill (AB) 32:** establishes a state goal of reducing GHG emissions to 1990 levels by 2020 and provides a comprehensive set of actions to reduce carbon emissions.
- **AB 32 Scoping Plan:** includes a range of GHG reduction actions which include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.
- **State Bill (SB) 97:** amends CEQA to establish that GHG emissions and their effects are appropriate subjects for CEQA analysis (effective July 1, 2009).
- **SB 375-** provides that regional councils set emissions-reducing goals for which regions can plan, integrates disjointed planning activities, and provides incentives for local governments and developers to follow new conscientiously-planned growth patterns.
- **OPR Draft CEQA Guidelines:** Establishes guidelines for the mitigation of GHG emissions or the effects of GHG emissions.
- **SB 107:** Requires investor-owned utilities to increase their total procurement of renewable energy by at least 1 percent of retail sales per year to meet the required 20 percent by 2010.

The County of Santa Barbara is currently developing a GHG inventory for unincorporated portions of the County, and will subsequently prepare a Climate Change Strategy document, in anticipation of the development of a full Climate Action Plan in the future. These documents and plans will be used by the County to identify the ways in which lands under County jurisdiction can reduce their GHG emissions to conform to AB 32 goals.

SBCAG is currently developing their own GHG inventory that would include all emissions within the County. Following this inventory will be the development of a Climate Action Plan for the County as a whole, which will allow for coordinated GHG reduction programs between multiple jurisdictions to achieve the maximum results. This Climate Action Plan will identify County- and City-specific targets for GHG reduction, in a manner consistent with AB 32.

Finally, the Santa Barbara County Air Pollution Control District (SBCAPCD) is developing a limited County-wide GHG emissions inventory (only including CO₂ emissions) for inclusion in the 2010 Clean Air Plan. This inventory is intended to be used for informational purposes only at this stage and is not expected to guide regional planning efforts.

¹³ The WCI partners released the recommended design for a regional cap-and-trade program in September 2008.

18.4 Greenhouse Gas Evaluation Approach

18.4.1 Project Components

The analysis in Section 18.5, *Future Citywide Greenhouse Gas Emissions* below estimates potential future GHG emissions in the City, assuming future development to the year 2030 under the proposed *Plan Santa Barbara* General Plan policies and growth scenario. This calculation of future GHG emissions is used to characterize the future contribution of the City to global climate change.

Plan Santa Barbara policies and programs that would address energy conservation and reduction in VMT and therefore GHG emissions reduction include the following: LG2-Limit Non-Residential Growth, LG9-Mobility Oriented Development Area (MODA), ER1-Climate Change, ER2-Emergency Response Strategies and Climate Change, ER4-Urban Heat Island Effect, ER3-Comprehensive Climate Change Action Plan, ER5-Energy Efficient Buildings, ER6-Local Renewable Energy Resources, ER7-Obstacles for Small Wind Generators, ER8-Facilitate Renewable Energy Technologies, ER9-Solar Energy, C1-Reduce Transportation Energy Use and Increase Alternative Transportation Infrastructure and Utilities, and C6-Regional Commuter Transit (refer to Appendix A). (Plan policy numbers in subsequent Plan drafts may have changed from those referenced in the EIR.)

Land use planning decisions, such as measures that discourage or encourage automobile use, can have a direct effect on the generation of GHGs (IPCC 2007).

18.4.2 Evaluation of Future Citywide Greenhouse Gas Generation

Evaluation of GHG emissions follows guidance provided in AB 32, OPR's proposed amendments to CEQA guidelines, OPR's 2008 Technical Advisory, California Air Pollution Control Officers Association's (CAPCOA's) CEQA and Climate Change white paper, CAPCOA's Model Policies for Greenhouse Gases in General Plans, and comments from the State Attorney General's office on other General Plan EIRs (e.g., County of San Diego).

Future citywide GHG emissions calculations are derived from the modeling software package CACP 2009 (ICLEI), and compared against the existing citywide emissions generation (identified in Section 18.2, *Existing Citywide Greenhouse Gas Emissions*). Potential sources of GHGs are the same as those described for existing conditions (refer to Section 18.2.1, *Sources of Greenhouse Gas Emissions* above). Populations for the year 2030 were based on projected residential development under *Plan Santa Barbara* and alternatives (refer to Section 4.0, *EIR Growth and Policy Assumptions*) and the existing number of persons per residence (average of 2.4 persons per unit). The additional electricity and natural gas consumption that would occur in the City as a result of development under *Plan Santa Barbara* policies or alternatives were based on the projected development and existing per unit (residential) or per square foot (sf) (commercial or industrial) consumption rates. Different consumption rates were used for single-family units and multi-family units, the data for which came from SCE and which applies to the "Climate Zone" in which the City is located. Because the energy efficiency of future construction is expected to be greater than current construction, use of these rates produces a conservative estimate of future energy consumption. No estimates are available for the energy generation mix in 2030, so 2007 SCE-specific GHG emission coefficients (as included in the CACP 2009 software) were used. This also results in conservative estimates of future indirect GHG emissions from electricity consumption.

GHG emissions from future transportation fuel consumption under *Plan Santa Barbara* or alternatives were calculated based on the *Plan Santa Barbara* traffic model's projected VMT and the Caltrans MVSTAFF report's predicted fleetwide fuel economy and vehicle mix for 2030. This traffic model accounts for the effects of proposed *Plan Santa Barbara* policies to reduce trip generation and VMT, but does not take into account the potential effect on commute trips from potential changes in provision of affordable housing or the overall jobs/housing balance in the City. The model includes trips generated by projected development in the City's sphere of influence, which slightly inflates the GHG emissions. Recent federal fuel efficiency standards (modeled on the State's AB 1463), the Low Carbon Fuel Standard, and other future State and federal actions are expected to result in substantial reductions in the GHG emissions of new vehicles, and are expected to begin to influence the mixture of the vehicle fleet and the carbon content of fuel later in this decade. However, the future implementation of these measures is uncertain, and a substantial portion of the vehicle fleet in 2030 would likely continue to be older, less efficient cars. It is important to note that the current standard for vehicle fuel efficiency is 27.5 miles per gallon; yet the fleetwide fuel economy is approximately 18.3 miles per gallon. It is reasonable to expect that the future fleetwide fuel economy under these regulations will remain far below the new standard of 35 miles per gallon. Therefore, the potential future effects of these State and federal regulations have not been included in modeling of GHG emissions in an effort to provide a sufficiently conservative estimate of future emissions.

Calculation of GHG emissions from landfill decomposition assumes that waste diversion in 2030 would remain the same as currently exists (approximately 70 percent diversion), and that per capita solid waste generation rates would also remain the same as at present. Future solid waste disposal quantities are based off projected population growth and the existing per capita solid waste generation rate, which accounts for both residential and non-residential growth. Calculations of decomposition emissions utilize the factors in the CACP 2009 software package.

Emissions of GHG related to pumping of SWP water to Lake Cachuma were calculated by determining the amount of electricity required to deliver the water from its source in the Delta, approximately 3,000 kWh per acre-foot. The per capita usage of SWP water is assumed to remain the same as existing, which in 2007 was 0.00699 AFY per person. The electricity mix used is that for SCE, although other electricity providers provide the majority of the electricity for pumping.

Future GHG emissions calculations are considered as to whether they reflect a substantial increase in energy consumption and GHG emissions, and whether they are consistent with State regulations for limiting GHGs. Because the regional process for allocating GHG emissions reduction targets to individual cities and counties has not been completed for Santa Barbara County, this assessment is done qualitatively.

Existing City, State, and Federal policies and regulatory processes that serve to reduce generation of GHGs are identified (Section 18.2, *Existing Citywide Greenhouse Gas Emissions* above), and considered in the analysis below. Proposed *Plan Santa Barbara* policies and programs that would reduce GHG generation are also identified as part of the analysis. Recommended measures are identified that could further reduce GHG emissions as amendments or additions to *Plan Santa Barbara* draft policies, programs, or standards.

Further details regarding the calculation of existing and future GHG emissions are provided in Appendix K, *Global Climate Change*.

As a new analysis requirement, specific criteria for evaluating the significance of GHG emission effects have not been established. This analysis uses the following guideline for determining significance, based on general guidance provided by the pending State CEQA Guidelines amendments scheduled to go into effect March 18, 2010, and the suggested guidance released in 2009 by the California Attorney General's office as

required by Senate Bill 97: Projected citywide greenhouse gas emissions may be considered to have a significant effect if they would be inconsistent with established GHG emissions targets specified in AB 32.

18.5 Future Citywide Greenhouse Gas Emissions

Total citywide GHG emissions under *Plan Santa Barbara* would be increased over existing levels by 21.1 percent (274,026 metric tons CO₂e). The two primary sources of these emissions would be fuel combustion for transportation (i.e., gasoline, diesel) and energy consumption in buildings (i.e., electricity). These two primary sources are discussed separately below.

18.5.1 Citywide Transportation GHG Emissions in 2030 and Effects on Climate Change

Future development projected under the *Plan Santa Barbara* General Plan update would result in a gradual increase in number of vehicle trips and VMT. This increased vehicle travel would result in increased GHG emissions associated with consumption of fossil fuels (i.e., gasoline, diesel). Increased road and transit-related construction and maintenance required to accommodate increased traffic would generate additional indirect GHG emissions. New vehicle trips constitute by far the largest source of new GHG emissions associated with *Plan Santa Barbara*.

In total, citywide vehicular GHG emissions are projected to increase by 238,410 metric tons CO₂e, or 26.4 percent by the year 2030 to a total of 1,142,038 metric tons CO₂e (refer to Table 18.2). Including aircraft, transportation GHG emissions would increase by 242,760 metric tons CO₂e, or 25.4 percent to a total of 1,197,169 metric tons CO₂e.

Emissions Source		GHG Emissions		
		Citywide	Per Capita	Increase over Existing
<i>Vehicle Trips</i>				
Internal City Trips ²	Gasoline	172,517	1.76	1,214 (0.7%)
	Diesel	35,526	0.36	2,672 (8.1%)
Commute Trips ²	Gasoline	198,107	2.02	21,532 (12.2%)
	Diesel	40,796	0.42	6,931 (20.5%)
Other Non-Internal Trips ²	Gasoline	574,234	5.86	163,901 (39.9%)
	Diesel	120,858	1.23	42,160 (53.6%)
Vehicle GHG Emissions Subtotal		1,142,038	11.66	238,410 (26.4%)
<i>Aircraft Use</i>				
Aircraft Gasoline ³		3,367	0.03	240 (7.7%)
Jet Fuel ³		51,219	0.53	3,565 (7.5%)
Aircraft GHG Emissions Subtotal		54,586	0.56	3,805 (7.5%)
Total Transportation GHG Emissions		1,196,624	12.22	242,215 (25.4%)
¹ CO ₂ e combines all GHGs into a single value based on the greenhouse potential of CO ₂ . ² Based on VMT data from <i>Plan Santa Barbara</i> traffic modeling; includes trips from projected growth in the City sphere of influence. ³ Based on countywide aviation fuel consumption; assumes that 50 percent of countywide figures are from City residents using Santa Barbara Airport. Because it is based off fuel consumption, this figure includes take-off, landing and in-flight consumption. Assumes per capita aircraft usage is the same as baseline.				

Potential new trip generation and increased VMT associated with increased population under *Plan Santa Barbara* would be lessened or partially offset by implementation of transportation demand reduction and alternative transportation measures (e.g., changes in parking requirements, travel demand management, transit improvements, etc.), refer to Section 16.0, *Transportation*. Further, automobile trip generation and VMT of mixed-use development within the MODA are expected to be substantially lower than are associated with traditional suburban development.

Somewhat counter-intuitively, the land use and trip reduction measures contained in *Plan Santa Barbara* would be expected to increase average trip length from the existing 7.49 miles per trip to 9.00 because a higher percentage of short trips from in-fill development would be met through walking, transit, or biking. However, although VMT and resultant GHG emissions under *Plan Santa Barbara* are projected to increase, the trip reduction programs would materially slow the growth in VMT due to the associated shift in transportation modes and the elimination of many internal City trips. This is reflected in the reduction in GHG emissions for internal City trips, which nearly offsets the forecast increase in GHG emissions from commuting.

Measures to alleviate traffic congestion such as the U.S. Highway 101 widening project, as well as City projects to improve signal timing and install of roundabouts would tend to increase fuel economy and reduce GHG emissions. Fuel economy for on-road vehicles (which includes heavy trucks) in California is forecasted to increase 1.7 percent between 2008 and 2030, going from 18.255 miles per gallon (mpg) to 18.574 mpg (Caltrans 2009). If this conservative estimate were to be exceeded through technological improvements and changes in driver behavior, substantial reductions in future GHG emissions are possible.

Aviation and jet fuel consumption by aircraft at Santa Barbara Airport would be difficult to reduce through City policy changes because supply and demand for flights is driven more by regional and national economic conditions and airfare costs. One area in which improvements are being made at other airports is in air traffic control and minimizing delay. However, Santa Barbara Airport experiences minimal delays¹⁴ and any improvements in efficiency would be incremental and likely not cost-effective.

This increase in GHG emissions would be roughly equivalent to the amount of CO₂ sequestered by 11,149,896 mature trees, or 95,000 acres of forest.

Plan Santa Barbara does address several of the means identified in the AB 32 Scoping Plan (CARB 2008) by which local jurisdictions might be able to reduce GHG emissions associated with transportation:

- Congestion pricing strategies (akin to those in place in London, England). Regional and local agencies, however, do not have the authority to pursue these strategies on their own, as Federal approval and State authorization must be provided for regional implementation of most pricing measures.
 - Not addressed under *Plan Santa Barbara* or proposed mitigation measures due to the reasons stated by CARB.
- Land use planning for sustainable communities which reduce dependence on the automobile
 - Addressed via *Plan Santa Barbara* Policies which direct the majority of new development to City areas best served by transit and walkable commercial areas (e.g., LG4-Location of Residential Growth, LG9-Mobility Oriented Development Area, LG15-Sustainable Neighborhood Plans).
- Programs to reduce vehicle trips while preserving personal mobility, such as employee transit incentives, telework programs, car sharing, parking policies, public education programs and other strategies that en-

¹⁴ Less than 0.2 percent of flights departing Santa Barbara Airport are delayed by weather, and less than 1 percent are delayed by air traffic issues. The bulk of delays are due to the air carriers themselves or incidents at other airports (<http://delaystats.aircraftdata.net/airport-delays/SBA/Santa-Barbara--CA--Santa-Barbara-Municipal.aspx>).

hance and complement land use and transit strategies can be implemented and coordinated by regional and local agencies and stakeholder groups.

- Addressed by several *Plan Santa Barbara* Policies (ER14-Lower Emissions Vehicles and Equipment, C1-Reduce Transportation Energy Use and Increase Alternative Transportation Infrastructure and Facilities, and C6-Regional Commuter Transit). Also addressed in MM TRANS-2 (Reduce Traffic Demand).

Existing Policies: Existing, ongoing City policies and programs that address reduction of transportation energy consumption and resulting GHG emissions are contained within the adopted Circulation Element and include: the encouragement of multi-modal transportation and related facilities, reduction of drive-alone trips, improved efficiency in Downtown parking, and enhanced land use tools and strategies supportive of multi-modal transportation including incentives for mixed-use development. These measures were taken into account in the *Plan Santa Barbara* traffic model that was used to identify VMT for the proposed project.

Proposed Policies: Proposed *Plan Santa Barbara* policies that would help to reduce trip generation and associated fuel use and GHG production include LG4-Location of Residential Growth, LG9-Mobility Oriented Development Area, LG15-Sustainable Neighborhood Plans, EF4-Jobs/Housing Balance, ER14-Lower Emissions Vehicles and Equipment, C1-Reduce Transportation Energy Use and Increase Alternative Transportation Infrastructure and Facilities, and C6-Regional Commuter Transit. These measures were taken into account in the *Plan Santa Barbara* traffic model that was used to identify VMT for the proposed project. (*Plan policy numbers in subsequent Plan drafts may have changed from those referenced in the EIR.*)

Impact Significance: Even with these existing and proposed policies, the projected substantial increase in city-wide GHG emissions to the year 2030 generated from the additional transportation fuel use of future growth represents a significant contribution to global climate change, and would not be consistent with AB 32 directives to reduce statewide emissions to 1990 levels by 2020. Implementation of MM TRANS-2 (Reduce Traffic Demand) would substantially reduce VMT and trip generation associated with new and existing development. However, even with this mitigation, impacts to GHG emissions from transportation would be significant.

18.5.2 Citywide GHG Emissions from Buildings in 2030 and Effects on Climate Change

Under *Plan Santa Barbara*, up to an estimated 2,795 new units of residential and 2.0 million sf of non-residential development could potentially occur within the City through the year 2030. Future development is projected to result in additional indirect and direct GHG emissions from expanded use of electrical power and natural gas.

Some of these future GHG emissions could be reduced through development of renewable sources of electrical generation (e.g., solar, wind, etc.); which is expected to occur during the *Plan Santa Barbara* planning horizon in order to comply with SB 1078 and SB 107. However, depending on the rate at which the renewable supplies actually come on line, a substantial increase in combustion of GHG-emitting fossil fuels (i.e., crude oil, coal, natural gas) for electricity generation could also be required. In addition, increased power demand may require construction and maintenance of additional power generation and transmission infrastructure, resulting in indirect additional GHG emissions.

Indirect GHG emissions resulting from citywide electric power demand are estimated to increase by about 8.0 percent annually by 2030 to 178,033 metric tons CO₂e (Refer to Section 17.0, *Energy* for details regarding electricity demand). GHG emissions resulting from residential demand could increase by approximately 7.7 percent, and industrial and commercial uses could increase by 8.1 percent and 8.2 percent respectively, with commercial uses remaining the greatest contributor to GHG emissions from electricity consumption.

Direct GHG emissions resulting from citywide consumption of natural gas are estimated to increase by 8.8 percent to a total of 139,200 metric tons CO₂e, (Table 18.3). Approximately 62 percent of this total would result from natural residential natural gas consumption¹⁵.

Existing Policies: Existing State and City energy conservation building code requirements (Title 22.82) would improve energy conservation in future buildings and reduce associated GHG emissions, as would other existing, ongoing City and private sector efforts to promote green building and sustainable development. Because calculations for future GHG emissions from electricity and natural gas consumption were based on historical rates of consumption from 2007, the effects of these existing, ongoing programs are not reflected in the GHG emission projections shown in Table 18.3.

Proposed Policies: Plan Santa Barbara policies that would help to reduce energy consumption in buildings and associated GHG generation include LG2-Limit Non-Residential Growth, LG3-Future Residential Growth, LG9-Mobility Oriented Development Area, ER3-Comprehensive Climate Change Action Plan, ER5-Energy Efficient Buildings, ER5-Energy Efficient Buildings, ER9-Solar Energy, CH8-Commercial and Mixed Use Development Standards and Guidelines, and H10-Density Incentive for Sustainable Resource Use. (Plan policy numbers in subsequent Plan drafts may have changed from those referenced in the EIR.)

Table 18.3: Annual Greenhouse Gas Production From Development in the City under Plan Santa Barbara, By Source (tons of CO₂e¹)

	2030		
	Total	Per Capita	Change
<i>Electricity Consumption²</i>			
Residential	58,754	0.606	4,201 (7.7%)
Commercial	87,222	0.900	9,758 (12.6 %)
Industrial	32,057	0.327	2,437 (8.2%)
<i>Natural Gas Consumption</i>			
Residential	85,999	0.885	5,292 (6.6%)
Commercial	52,468	0.542	5,890 (12.6%)
Industrial	733	0.007	93 (15.2%)
<i>Construction Equipment (primarily diesel)³</i>	241	0.002	-177 (-42.3%)
<i>Landfill Decomposition⁴</i>	59,397	0.612	4,272 (7.8%)
<i>Water Pumping (State Water Project)⁵</i>	656	0.006	45 (7.4%)
Non-Transportation Subtotal	377,527	3.89	28,568 (8.2%)

¹CO₂e combines all GHGs into a single value based on the greenhouse potential of CO₂.
²Although the emissions from electricity generation do not occur within the City, the City's electricity consumption results in GHG emissions at the generation site which would not have otherwise occurred.
³Construction emissions calculated using URBEMIS 2007 Version 9.2.4. Does not account for increased efficiency of the construction fleet.
⁴Represents waste generated in the City and primarily sent to Tajiguas Landfill. A small amount of waste is sent to other landfills within and outside the county; this is also included in this value. The calculated emissions are only for the waste generated that year; decomposition emissions from waste that was disposed of in prior years (including those from the former Las Positas landfill) are not included. Does not account for methane that is captured for the recently installed fuel cell.
⁵ Emissions from SWP pumping are based on the 2007 per capita rate, extrapolated to 2030 population levels. Potential reductions in the City's SWP allotment are not accounted for. Emissions from water pumping within City boundaries are included in electricity consumption.
 Note: In 2005, the City installed a fuel cell that uses methane from wastewater treatment to generate electricity rather than flaring the methane. Therefore it is assumed that no methane is produced from wastewater treatment in 2030. Electricity-related emissions from wastewater treatment are included in electricity consumption.

Additionally, implementation of an Adaptive Management Program (AMP), which would evaluate, provide feedback, and allow for revisions to components of the General Plan for achievement of Plan Santa Barbara goals, would allow for strengthening of energy conservation and GHG reduction measures throughout the 20-year planning period.

¹⁵ Natural gas is also consumed for electricity production, but those GHG emissions are included in the electricity sector.

Because calculations for future GHG emissions from electricity and natural gas consumption were based on historical rates of consumption from 2007, the effects of these proposed policies and programs are not reflected in the GHG emission projections.

Impact Significance: Potential future development in the City to 2030 under *Plan Santa Barbara* policies could result in additional GHG emissions associated with citywide electricity and natural gas consumption. However, proposed *Plan Santa Barbara* policies, coupled with expected increases in energy efficiency of new residential and non-residential development, would be expected to result in substantially lower consumption of electricity and natural gas than historic rates (which were used to estimate future emissions) would predict. Further, increased use of renewable energy sources in electricity generation, as directed by SB 1078 and SB 107, would further reduce indirect GHG emissions from electricity generation. As a result, the increase in GHG emissions from energy consumption in buildings would be greatly reduced from the forecast in this document and the resulting increase would be considered less than significant.

Implementation of RM ENERGY-2 (Residential, Commercial and Industrial Energy Consumption) in Section 17, *Energy* would further increase energy efficiency and resultant GHG emissions of buildings in the City. Additional Recommended Measures that would also reduce or offset GHG emissions include RM CLIMATE-1 (Carbon Sequestration), RM CLIMATE-3 (Energy-Efficient City Facilities), and RM CLIMATE-4 (Renewable City Energy Sources) listed below in Section 18.10.

18.5.3 Summary of Greenhouse Gas Emission Impacts from *Plan Santa Barbara*

Existing and ongoing City and State programs and utility company measures have greatly minimized GHG emissions from sources such as landfill decomposition (84,283 fewer metric tons CO₂e in 2007 as compared to 1990), energy efficiency of buildings (66,175 fewer metric tons CO₂e in 2007 as compared to 1990 from natural gas and electricity consumption), and wastewater treatment (installation of the fuel cell at El Estero Wastewater Treatment Plant). As a result, the City's current GHG emissions are below estimated levels from 1990, despite a slightly increased population and substantially increased VMT. If the City were to maintain these GHG emission levels until 2020 with no further improvements, the City could potentially be considered consistent with AB 32.

In addition, GHG emissions under *Plan Santa Barbara* may be lower than those calculated for this EIR. For example, this analysis uses official State estimates of fleetwide fuel efficiency that reflect very minimal improvement in fuel economy through 2030; if electric vehicles or an alternative fuel type were able to become firmly established during that time it is reasonable to expect fuel efficiency to be substantially better than this estimate. Further, the calculations included here do not account for increasing building energy efficiency, which is very likely to occur during the 20-year life of *Plan Santa Barbara*.

Nevertheless, the GHG emissions forecasts presented here represent a reasonable worst-case scenario for GHG emissions within the City in the year 2030. Under *Plan Santa Barbara*, GHG emissions could increase to a level that would not be consistent with AB 32 and have the potential to conflict with attainment of as-yet-undefined regional GHG emission targets. It is likely that even with the application of extremely vigorous Transportation Control Measures like those in MM TRANS-2 (Reduce Traffic Demand), GHG emissions under *Plan Santa Barbara* could still exceed AB 32 goals of reducing emissions to 1990 levels by 2020. This exemplifies the challenges facing the State and local municipalities in reducing GHG emissions; it is likely that other cities in California with greater growth rates and less developed alternative transportation programs may fare much worse in their efforts to comply with the law.

Additional recommended measures which would partially offset GHG emissions associated with *Plan Santa Barbara* are RM CLIMATE-1 (Carbon Sequestration), RM CLIMATE-3 (Energy-Efficient City Facilities) and RM CLIMATE-4 (Renewable City Energy Sources) listed below in Section 18.10. RM ENERGY-2 (Residential, Commercial and Industrial Energy Consumption) in Section 17.0, *Energy* would further increase energy efficiency and resultant GHG emissions of buildings in the City.

18.6 Regional GHG Implications

Potential future development under the *Plan Santa Barbara* General Plan Update would incrementally contribute to regional increases in GHG emissions associated with energy consumption, including increased consumption of electricity, natural gas and non-renewable petroleum products used for transportation fuel. In addition to growth directly associated with *Plan Santa Barbara*, an additional 403 new homes and 178,202 sf of non-residential growth are also projected to occur in the City's sphere of influence, either through annexation to the City or as unincorporated area development.

Growth and development within the City's sphere of influence in such areas as the Las Positas Valley and the foothills could tend to consist of more single-family homes and thereby to be more energy-intensive than that for the City as a whole, resulting in greater GHG emissions from development in those areas. In addition, development in these outlying areas could tend to rely more heavily on the automobile for transportation, have longer average trip lengths, and be less served by transit (Refer to Appendix I, *Transportation*). As such, new growth in the sphere could also contribute more to increased GHG emissions from transportation. While existing and proposed policies as well as new technologies could help to reduce these new emissions, per capita GHG emissions are not forecast to drop significantly and overall GHG emissions, particularly those associated with use of fossil fuels would be expected to continue to increase with growth.

Growth in the South Coast will also contribute additional waste to Tajiguas landfill, resulting in additional GHG emission from waste decomposition. Expansion of the methane fuel cell at the landfill would potentially offset some of these increased emissions, but the extent of that offset is not yet clear.

Increased demand for energy associated with *Plan Santa Barbara* would combine with increased regional growth within the sphere, cities of Goleta and Carpinteria, County unincorporated areas, and UCSB to substantially increase overall GHG emissions across the South Coast. Similar to growth within the City, regional growth would likely display variations in direct and indirect GHG emissions, with in-fill development at UCSB and along the Hollister Avenue corridor in Goleta consisting of lower energy consuming multiple-family units in areas well served by transit, while growth in outlying areas, particularly unincorporated communities, would consist of larger single-family homes in areas underserved by transit. Any increased development on the South Coast would result in increased energy demand associated with water pumping from groundwater supplies, surface water supplies (e.g., Lake Cachuma), and SWP water.

Overall growth and development on the South Coast would also contribute to ongoing long-distance commuting associated with the jobs-housing imbalance and insufficient amount of local affordable housing. As currently projected, although *Plan Santa Barbara* would achieve a rough balance between jobs and housing growth, affordable housing production would not meet the needs of new workers, potentially contributing to increased long-distance commuting.

Existing and proposed regional and City policies that encourage energy conservation, such as the Traffic Solutions Program, regional bus services coordinated by SBCAG (e.g., Coastal Express), and energy efficiency standards required for new development would reduce but not halt projected substantial increases in

regional GHG emissions. Existing plans and policies, when combined with the mitigation measures outlined below, could reduce the City contribution to regional cumulative impacts to GHG emissions and global climate change, particularly those associated with increased demand for electricity and natural gas. The process now underway by SBCAG to establish countywide and City-specific targets for GHG emissions reductions (in compliance with AB 32) will provide a key planning framework around which major regional efforts can be organized. The SBCAPCD also provides recommended transportation, energy reduction and land use measures intended to be incorporated into projects to reduce air quality impacts, including emission of GHGs.

However, the continued reliance of regional growth on non-renewable fossil fuels for transportation would be expected to result in a significant cumulative effect of additional GHG emissions, contributing to global climate change.

The City contribution to the generation of regional GHG emissions would be expected to be cumulatively considerable (refer to Section 18.10 for recommended measures to lessen GHG emissions).

18.7 GHG Emissions of Alternatives and Effects on Climate Change

The three alternatives to the proposed project are (1) No Project/Existing Policies Alternative (build-out under existing policies), (2) Lower Growth Alternative, and (3) Additional Housing Alternative. The following identifies comparable effects of GHG emissions on global climate change. Table 18.4 presents a comparison of GHG emissions for *Plan Santa Barbara* and the project alternatives.

18.7.1 No Project/Existing Policies Alternative

Potential future development if existing General Plan policies continued is projected at up to an estimated 2,795 new units and approximately 2.3 million sf of non-residential space by 2030, with total non-residential development slightly greater than that projected for *Plan Santa Barbara*. Additional growth within the City's sphere of influence is projected to include 403 new homes and 178,202 sf of non-residential development.

Development would continue under the existing City policy framework, variable density ordinance, and Land Use Map, as well as policies and programs that manage the City's public utilities. Historic in-fill and mixed-use development trends would continue. Development is anticipated to consist of generally larger multiple-family homes in the urban core, and some potential for development of single-family homes in outlying areas to meet housing demand.

The No Project Alternative is projected to result in total GHG emissions that are 23 percent (301,650 metric tons CO₂e) greater than existing levels, and 2.0 percent (30,867 metric tons CO₂e) greater than those forecast under *Plan Santa Barbara*.

Direct and indirect GHG emissions from electricity and natural gas consumption would be increased by 10.4 percent (30,243 metric tons CO₂e) compared to existing conditions, and would be 0.8 percent (2,572 metric tons CO₂e) greater than under *Plan Santa Barbara* (refer to Table 18.4). These GHG emissions could be incrementally greater than those projected to occur under *Plan Santa Barbara*, due to potentially larger average unit sizes and more non-residential development. Emissions from sphere of influence growth would add additional incremental increases in emissions to this total but are not included in these calculations as it is unclear under which agency such development would occur.

Table 18.4: Citywide GHG Emissions Under the Project and Alternatives, 2030, metric tons of CO₂ equivalents

Emission Source	<i>Plan Santa Barbara</i> (2,795 units, 2.0 mil sf non-residential)		No Project (2,795 units, 2.3 mil sf non-residential)		Lower Growth (~2,000 units, 1.0 mil sf non-residential)		Additional Housing (~4,360 units, 1.0 mil sf non-residential)		
	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	
Electricity Consumption ¹ (Indirect)									
Residential	58,754	0.606	58,754	0.606	57,539	0.605	60,959	0.604	
Commercial	87,222	0.900	88,803	0.915	82,343	0.866	82,343	0.816	
Industrial	32,057	0.327	32,057	0.333	30,024	0.316	30,024	0.298	
<i>Total GHG From Electricity Consumption</i>	<i>178,033</i>	<i>1.835</i>	<i>179,644</i>	<i>1.852</i>	<i>169,906</i>	<i>1.786</i>	<i>173,326</i>	<i>1.718</i>	
Natural Gas (Direct)¹									
Residential	85,999	0.885	85,999	0.885	84,469	0.888	88,777	0.880	
Commercial	52,468	0.542	53,429	0.551	49,526	0.521	49,526	0.491	
Industrial	733	0.007	733	0.007	686	0.007	686	0.007	
<i>Total GHG From Natural Gas Consumption</i>	<i>139,200</i>	<i>1.435</i>	<i>140,161</i>	<i>1.443</i>	<i>134,681</i>	<i>1.416</i>	<i>138,989</i>	<i>1.377</i>	
Construction Vehicles (primarily diesel)	241	0.002	253	0.003	202	0.002	445	0.004	
Petroleum for Transportation									
Internal City Trips	Gasoline	172,517	1.78	175,121	1.81	169,244	1.78	169,233	1.68
	Diesel	35,526	0.37	36,062	0.37	34,852	0.37	34,850	0.35
Commute Trips	Gasoline	198,107	2.04	200,663	2.07	183,714	1.93	153,892	1.52
	Diesel	40,796	0.42	41,322	0.43	37,832	0.40	31,691	0.31
Other Non-Internal Trips	Gasoline	574,234	5.92	594,690	6.13	549,952	5.78	462,095	4.58
	Diesel	120,858	1.24	122,463	1.26	113,250	1.19	95,158	0.94
Aircraft Jet Fuel Consumption		51,219	0.53	51,219	0.53	50,165	0.53	53,278	0.53
Aircraft Aviation Fuel Consumption		3,367	0.03	3,367	0.03	3,301	0.03	3,502	0.03
<i>Total GHG From Transportation</i>		<i>1,196,624</i>	<i>12.33</i>	<i>1,224,907</i>	<i>12.63</i>	<i>1,142,310</i>	<i>11.90</i>	<i>1,003,699</i>	<i>9.95</i>
Public Utilities²									
Solid Waste Decomposition		59,397	0.612	59,397	0.612	58,228	0.612	61,784	0.612
Potable Water Delivery ³		656	0.007	656	0.007	643	0.007	682	0.007
<i>Total GHG from Public Utilities</i>		<i>60,053</i>	<i>0.619</i>	<i>60,053</i>	<i>0.619</i>	<i>58,871</i>	<i>0.619</i>	<i>62,466</i>	<i>0.619</i>
TOTAL ANNUAL GHG EMISSIONS, 2030		1,574,151	16.22	1,605,018	16.54	1,505,970	15.83	1,378,925	13.66
¹ Assumes that future construction will have the same energy consumption rates as the current building stock; while this may not be accurate it provides a conservative estimate. ² Indirect GHGs from electricity consumed for wastewater treatment and internal City potable and recycled water pumping are captured under commercial and or industrial electricity consumption. ³ Includes pumping from SWP deliveries.									

This Alternative could be expected to increase annual transportation GHG emissions by 28.3 percent (270,498 metric tons CO₂e), including emissions from growth in the sphere of influence, roughly 2.4 percent (28,283 metric tons CO₂e) greater than GHG emissions from transportation under *Plan Santa Barbara*. This Alternative would be assumed to continue but not expand existing parking and transportation demand management programs and those that promote alternative transportation. New development would also incrementally increase both new vehicle trips and trip lengths when compared to *Plan Santa Barbara*.

Thus, impacts to GHG emissions associated with the No Project Alternative would be more severe than those anticipated under *Plan Santa Barbara*. Existing plans and policies would reduce this alternative's potential energy demand and associated direct and indirect GHG emissions, particularly those associated with increased demand for electricity and natural gas. Nevertheless, a substantial increase in use of fossil fuels for transportation and associated GHG emissions is projected to result, resulting in significant impacts. Similar to the *Plan Santa Barbara* scenario, this alternative would be expected to also have a considerable contribution to cumulative GHG generation on the South Coast.

18.7.2 Lower Growth Alternative

The Lower Growth Alternative is projected to involve up to approximately 2,000 new units and 1.0 million sf of non-residential space by 2030, a lower amount of growth than permitted under the proposed project. Additional growth within the City's sphere of influence is projected to include 403 new homes and 178,202 sf of non-residential development.

Development would be assumed to continue under many of the existing City policies for land use, as well as existing programs and policies for energy conservation and vehicle trip reduction. The existing Land Use Map would remain in effect, and the variable density ordinance would be amended to reduce unit sizes, but not increase densities in the MODA. Anticipated development could consist of smaller multiple-family homes in the urban core, while more development of single- and multiple-family homes in outlying areas could occur.

The Lower Growth Alternative is projected to result in total GHG emissions that are 15.5 percent (202,602 metric tons CO₂e) greater than existing levels, but 4.3 percent (68,181 metric tons CO₂e) less than those forecast under *Plan Santa Barbara*.

Direct and indirect GHG emissions from electricity and natural gas consumption would be increased by 5.2 percent (15,025 metric tons CO₂e) compared to existing conditions, and would be 4.0 percent (12,646 metric tons CO₂e) less than under *Plan Santa Barbara* (refer to Table 18.4). It can be anticipated that per unit energy consumption and GHG emissions could be somewhat higher than that projected to occur under *Plan Santa Barbara*. However, because the level of residential and non-residential development would be substantially lower than under *Plan Santa Barbara*, overall consumption of electricity and natural gas and resultant GHG emissions would be substantially lower than *Plan Santa Barbara*. Emissions from sphere of influence growth would add additional incremental increases in emissions to this total but are not included in these calculations as it is unclear under which agency such development would occur.

This Alternative could be expected to increase annual transportation GHG emissions by 16.4 percent (187,901 metric tons CO₂e), including emissions from growth in the sphere of influence, roughly 4.5 percent (54,314 metric tons CO₂e) lower than GHG emissions from transportation under *Plan Santa Barbara*. Less residential and commercial development under the Lower Growth Alternative would generate fewer vehicle trips than *Plan Santa Barbara*, lowering overall VMT. This Alternative is assumed to continue but not expand existing parking and transportation demand management programs and those that promote alternative

transportation. Thus, this Alternative could exhibit higher rates of trip generation per unit of development than those projected to occur under *Plan Santa Barbara*. New residential development could also be lower density and more spread out, and have incrementally higher rates of both new vehicle trips and average vehicle trip lengths when compared to *Plan Santa Barbara*.

This Alternative would lower GHG emissions than those forecast for *Plan Santa Barbara* due to the lower amount of development. Existing plans and policies, when combined with the recommended measures outlined below, would reduce this Alternative's energy demand and GHG emissions, particularly those associated with increased demand for electricity and natural gas. However, the increase in citywide transportation fuel use would be expected to result in a substantial increase in GHG emissions and impacts would remain significant, although the emissions would be lower than under *Plan Santa Barbara*. The City GHG emissions under this alternative would be considered a considerable contribution to cumulative emissions on the South Coast.

18.7.3 Additional Housing Alternative

The Additional Housing Alternative is assumed to involve up to an estimated 4,360 new units and 1.0 million sf of non-residential space by 2030, a substantially greater amount of residential growth than under *Plan Santa Barbara* and a lower level of non-residential growth. Additional growth within the City's sphere of influence is projected to include 443 new homes and 178,202 sf of non-residential development.

Development would continue under many existing City policies, and the revised Land Use Map. The variable density ordinance would be amended to restrict unit size and allowable densities within the MODA would be greater than the changes under *Plan Santa Barbara*. Development would be anticipated to consist of smaller multiple-family homes in the MODA, while development of single-family homes in outlying areas could also occur to provide additional housing.

Overall, the Additional Housing Alternative is projected to result in total GHG emissions that are 6.1 percent (78,800 metric tons CO₂e) greater than existing levels, but 12.4 percent (195,226 metric tons CO₂e) less than those forecast under *Plan Santa Barbara*. This total GHG emission level would be only 1.5 percent (21,038 metric tons CO₂e) above estimated 1990 GHG emission levels.

Direct and indirect GHG emissions from electricity and natural gas consumption would be increased by 7.9 percent (22,753 metric tons CO₂e) compared to existing conditions, but would be 1.5 percent (4,918 metric tons CO₂e) less than under *Plan Santa Barbara* despite the major increase in housing (refer to Table 18.4). Per unit demand for electricity and natural gas could be similar to those projected to occur under *Plan Santa Barbara*, with per unit increases in demand on utilities associated with outlying development offset by substantial development of smaller in-fill units using less energy. Due to the increased number of units projected, the Additional Housing Alternative could substantially increase overall residential demand for energy and associated GHG emissions. Energy consumption and GHG emissions from non-residential development could be substantially lower than under *Plan Santa Barbara*. Emissions from sphere of influence growth would add incremental increases in emissions to this total but are not included in these calculations as it is unclear under which agency such development would occur.

This Alternative could be expected to increase annual transportation GHG emissions by 5.2 percent (49,290 metric tons CO₂e), including emissions from sphere of influence growth, roughly 16.1 percent (192,925 metric tons CO₂e) lower than GHG emissions from transportation under *Plan Santa Barbara* despite the substantially greater population increase. This Alternative would be assumed to strongly expand parking and transportation demand management programs and those that promote alternative transportation. Thus, this

Alternative would exhibit substantially lower rates of trip generation per unit of new development than those projected to occur under *Plan Santa Barbara* and would also substantially decrease commuter trips associated with *existing* development, especially within Downtown. Due to greater densities of development within the MODA, new development could also have incrementally lower rates of new vehicle trips on average when compared to *Plan Santa Barbara*. However, average trip length could incrementally increase as more short range trips would be met by walking, biking, and transit. Therefore, although residential development could substantially increase under this alternative, compared to *Plan Santa Barbara*, consumption of nonrenewable fossil fuels for transportation would be expected to drop due to strong trip reduction strategies. Further, improvements to the jobs-housing balance could result in a smaller percentage of commuter trips into the City.

Although almost doubling population growth, this Alternative would substantially lower overall GHG emissions than those forecast for *Plan Santa Barbara* due to inclusion of vigorous trip reduction programs and reduced non-residential growth. Existing plans and policies would reduce this Alternative's energy demand and GHG emissions, particularly those associated with increased demand for electricity and natural gas. While this Alternative would have the lowest GHG emissions of any alternative, in order to bring GHG emissions from this Alternative back to 1990 levels, far reaching measures would be required; for example, a reduction of approximately 35 million annual VMT would be required. Accomplishing this would be equivalent of eliminating approximately 5,900 round trips per day¹⁶. Because this Alternative already includes a very rigorous set of Transportation Control Measures, such a reduction would be difficult to achieve. Therefore, this Alternative would have a substantially lesser but still significant and unmitigable impact on GHG emissions. The City GHG emissions under this Alternative would also be considered a considerable contribution to cumulative emissions on the South Coast.

18.8 Extended Range (2050) GHG Emissions and Effects on Climate Change

Development of the City through 2050 would effectively represent full build-out under proposed land use and zoning plans. The Extended Range Forecast assumes non-residential growth of up to 3.2 million sf and residential growth of up to approximately 8,620 units could occur over this approximately 40-year time frame. Development through 2050 is assumed to proceed under the existing City policy framework as amended by the proposed policies of *Plan Santa Barbara*, including existing and proposed policies and programs to reduce GHG emissions through reduction of trip generation and improvement of building energy efficiency. Development would be assumed to be consistent with the revised Land Use Element and Map, including the amended variable density ordinance that reduces unit sizes and increases allowable densities within the MODA. Anticipated development would be expected to consist of smaller multiple-family homes in the MODA, while development of additional single-family homes in more outlying areas could be expected to occur as less developable land remains within the City and sphere. It can be anticipated that per unit GHG emissions could be similar to those projected to occur under *Plan Santa Barbara*, although under existing regulations and initiatives (e.g., AB 32) it can also be anticipated direct and indirect GHG emissions of new buildings will continue to improve.

However, because the amount of development projected during this period could be approximately double that occurring to 2030 under *Plan Santa Barbara*, associated GHG emissions would be substantially higher

¹⁶ Assuming an average one-way trip length of 9.0 miles.

(Table 18.5). Potential changes in climate could also increase regional demand for heating and cooling, further increasing GHG emissions from building energy consumption.

Overall, GHG emissions from electricity and natural gas consumption by the year 2050 are projected to increase by 20.5 percent (59,311 metric tons CO₂e), more than double the increase forecasted under *Plan Santa Barbara*.

GHG emissions from transportation fuel consumption could increase by 42 percent (401,758 metric tons CO₂e) as compared to existing consumption, roughly 13 percent (159,543 metric tons CO₂e) more than forecast under *Plan Santa Barbara* (refer to Table 18.5). Transportation GHG emissions are heavily influenced by long-term transportation modes and patterns and associated energy demand, which are currently difficult to forecast as new State and Federal initiatives to meet the challenges of potential peak oil production and global climate change have yet to be fully implemented. For example, over this 40-year period, new measures to improve rail service, create hybrid, electric or alternative fuel vehicles, and change patterns of urbanization may all significantly change transportation modes and patterns. These measures, the possible advent of peak oil production, and global climate change all have potential to greatly affect GHG emissions in the decades leading up to 2050.

Table 18.5: Annual Greenhouse Gas Production From Development in the City under *Plan Santa Barbara* in the Year 2050 By Source (tons of CO₂e¹)

	2050			
	Total	Per Capita	Change from Existing	
<i>Electricity Consumption</i> ²				
Residential	67,458	0.608	12,905	
Commercial	93,115	0.839	15,651	
Industrial	34,513	0.311	4,893	
<i>Natural Gas Consumption</i>				
Residential	96,963	0.874	16,256	
Commercial	56,035	0.505	9,457	
Industrial	789	0.007	149	
<i>Construction Equipment (primarily diesel)</i> ³	425	0.004	7	
<i>Landfill Decomposition</i> ⁴	67,927	0.612	12,802	
<i>Water Pumping (State Water Project)</i> ⁵	752	0.006	141	
Non-Transportation Subtotal	417,977	3.77	72,261	
<i>Internal City Trips</i>	Gasoline	195,429	1.76	24,126
	Diesel	40,244	0.36	7,390
<i>Commute Trips</i>	Gasoline	224,418	2.02	47,843
	Diesel	46,214	0.42	12,349
<i>Other Non-Internal Trips</i>	Gasoline	650,500	5.86	240,167
	Diesel	136,909	1.23	58,211
<i>Aircraft Jet Fuel Consumption</i>	58,600	0.53	10,946	
<i>Aircraft Aviation Fuel Consumption</i>	3,853	0.03	726	
Transportation Subtotal	1,356,167	12.22	52,799	
TOTAL ANNUAL GHG EMISSIONS, 2050	1,774,144	15.98	474,019	

However, within the framework of what is under City control during the Extended Range Forecast, programs to manage parking and transportation demand and promote alternative transportation as set forth in *Plan Santa Barbara* could be expanded. Further concentration of development within the City’s core could foster use of alternative modes of transportation. If current trends continue, the use of techniques such as telecommuting and virtual conferencing could materially affect commuting patterns. In addition, actions by the City, State and Federal governments to improve rail service could substantially increase use of this mode to connect the City to outlying communities such as Ventura. Therefore, although overall development

could substantially increase over this period, GHG emissions from consumption of nonrenewable fossil fuels for transportation could peak and begin to decrease.

Existing plans and policies, when combined with those in *Plan Santa Barbara* and the identified mitigation measures and recommended measures for Transportation, Energy, and Climate Change, could lessen long-term GHG emissions, particularly those associated with increased demand for electricity and natural gas. However, if reliance on non-renewable fossil fuels for transportation continues, the increase of GHG emissions would be substantial.

The Extended Range Forecast contribution to regional cumulative GHG emissions generation associated with increased electricity and natural gas consumption and transportation fuel could be reduced to less than significant with application of City and State conservation measures, new energy supply initiatives, and alternative travel technologies and modes. However, continued or increased reliance on fossil fuels for transportation in the longer-term would be expected to result in a substantial City contribution to South Coast GHG generation.

18.9 Mitigation Measures

Mitigation required to offset projected increases in transportation GHG emissions is listed as MM TRANS-2 (Reduce Traffic Demand) in Section 16.0, *Transportation*. Recommended measures RM ENERGY-1 (Transportation Fuel Consumption) and RM AQ-1 (Reduce Sources of Air Pollutants) would also contribute to mitigation of these increases.

18.10 Recommended Measures

The following are recommended additions to the *Plan Santa Barbara* policy update, to provide additional detail, or to incorporate or strengthen existing policies in the General Plan. These would further benefit the environment where potential adverse impacts were identified as not significant or mitigated to less than significant levels, and further mitigation is not required.

RM CLIMATE-1 CARBON SEQUESTRATION

The City should consider adding the following policies to Plan Santa Barbara Environmental Resources Element:

- *Pursue carbon sequestration through the planting of additional trees, with a goal of 1,000 new trees by 2030.*
- *Contribute to regional efforts toward carbon sequestration, such as revegetation of burned areas and brownfield conversions.*
- *Consider other carbon sequestration technologies as they become available.*

RM CLIMATE-2 LANDFILL FUEL CELL

The City should consider adding the following policy to Plan Santa Barbara Public Services and Safety Element:

- *Work with regional partners toward the further development of methane-fuel cell, methane capture, and energy generation at Tajiguas Landfill, and consider a fuel cell installation at the former Las Positas landfill site.*

RM CLIMATE-3 ENERGY-EFFICIENT CITY FACILITIES

The City should consider adding the following policy to Plan Santa Barbara Public Services and Safety Element:

Continue to implement programs through Sustainable Santa Barbara for retrofitting of municipal systems with energy efficient motors, pumps, and other equipment.

RM CLIMATE-4 RENEWABLE CITY ENERGY SOURCES

The City should consider adding the following policies to the Plan Santa Barbara Environmental Resources Element:

- *Consider installation of low-wind speed wind turbines to supply electricity for City operations; interest-free funding could be sourced from Federal Clean Renewable Energy Bonds (CREBs).*
- *Consider installation of solar hot water heaters on City facilities.*
- *Monitor progress of ocean power (e.g., wave energy) pilot projects in the County and elsewhere on the West Coast, and consider pursuing installation of an ocean power project for City use if such projects become commercially feasible during the life of Plan Santa Barbara.*

RM CLIMATE-5 STRONGER SOLAR ENERGY OBJECTIVE

The City should consider adding the following text to ER9-Solar Energy:

- *Establish a citywide goal of 30 MW of new public and private solar energy capacity by 2030.*