



Chapter 5

Greenhouse Gases & Climate Change

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Introduction

This background report creates a foundation for updating the goals, policies, and programs of the Suisun City General Plan.

This report provides a discussion of existing climate conditions, climate change science, and greenhouse gas (GHG) emissions sources in California and the Suisun City area; a summary of applicable regulations; and a description of potential effects of climate change on Suisun City (the City). Key General Plan issues and opportunities are discussed at the end of this report.

Environmental Setting

Certain gases in the earth's atmosphere, classified as greenhouse gasses (GHGs), play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space. A portion of the radiation is absorbed by the earth's surface, and a smaller portion of this radiation is reflected back toward space. The radiation absorbed by the earth is re-radiated, not as high-frequency solar radiation, but lower frequency infrared radiation¹. Most solar radiation passes through GHGs; however, infrared radiation is selectively absorbed by GHGs. As a result, infrared radiation released from the earth that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the "greenhouse effect," is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it.

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and high global warming potential (high-GWP) GHGs. High-GWP GHGs include ozone depleting substances (ODSs), chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and halons, in addition to their replacements, hydrofluorocarbons (HFCs). Other high-GWP GHGs include perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Anthropogenic emissions of these GHGs leading to atmospheric levels in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (IPCC 2007). CO₂ emissions associated with fossil fuel combustion are the primary contributors to human-induced climate change. Following CO₂, CH₄ and N₂O emissions associated with human activities are the next largest contributors to climate change (IPCC 2007).

Greenhouse Gas Emissions

Climate change is a global problem because GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants (TACs) which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately one day), GHGs have long atmospheric lifetimes (one year to several thousand years). GHGs persist in the atmosphere for a long enough

¹ The frequencies at which bodies emit radiation are proportional to temperature. The earth has a much lower temperature than the sun; therefore, the earth emits lower frequency (longer wavelength) radiation.

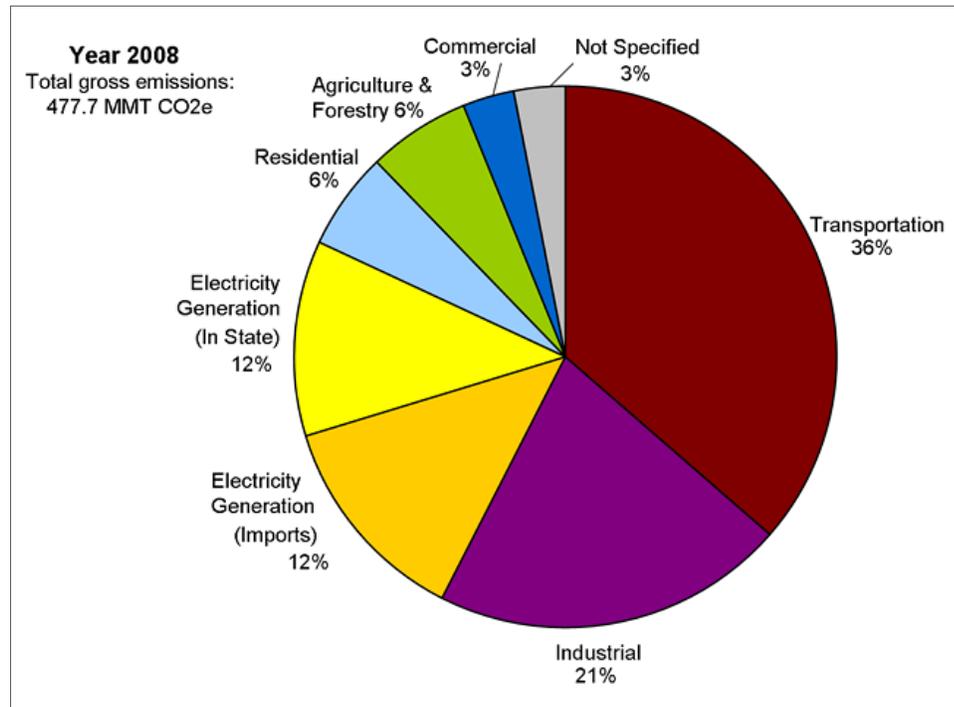
time to be dispersed around the globe. Although the exact lifetime of any particular GHG molecule depends on multiple variables and cannot be pinpointed, more CO₂ is currently emitted into the atmosphere than is sequestered. Carbon (CO₂) sinks, or reservoirs, include vegetation and the ocean which absorb CO₂ through photosynthesis and dissolution, respectively. These are two of the most common processes of CO₂ sequestration.

Of the total annual human-caused CO₂ emissions, approximately 54% is sequestered through ocean uptake, northern hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46% of human-caused CO₂ emissions remain stored in the atmosphere (Seinfeld and Pandis 1998:1091).

Effects of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and TACs. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say that the quantity is enormous, and no single project would be expected to measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or micro-climate.

Sources of Greenhouse Gas Emissions

As the second largest emitter of GHG emissions in the United States and twelfth to sixteenth largest in the world, California contributes a significant quantity of GHGs to the atmosphere (CEC 2006b). Emissions of CO₂ are byproducts of fossil-fuel combustion and are attributable in large part to human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors (ARB 2008). In California, the transportation sector is the largest emitter of GHGs (see Exhibit GHG-1).



Source: ARB 2008

Exhibit GHG-1 Statewide Greenhouse Gas Emissions by Sector (2008)



Land uses are not their own GHG emissions sectors. Plans and regulations that determine permitted land uses (such as general plans) result in land-use and circulation-based activities that lead to GHG emissions from sectors such as transportation, energy, and waste. Therefore, land use decisions and future development projects that occur with implementation of a general plan can affect the generation of GHG emissions from multiple sectors thereby resulting in direct or indirect GHG emissions. For example, residents, employees, shoppers, and visitors drive vehicles that emit GHGs, which are associated with the transportation sector. Electricity consumed in structures would indirectly cause GHGs to be emitted at a utility provider (e.g., coal-fired electrical power plant).

Regional Inventory of Greenhouse Gas Emissions

In 2006, BAAQMD developed its first GHG emissions inventory for the base year 2002. As part of an evolving process to account for more accurate quantification methodologies and emissions activity data, BAAQMD updated its GHG emissions inventory using the base year 2007. The updated inventory included new features that provide a more complete and accurate representation of GHG emissions associated with activities occurring within BAAQMD's jurisdiction. Some examples of GHG emissions sources added for the 2007 inventory are electricity generated from sources outside of BAAQMD's jurisdiction, gases with high global warming potential (GWP) such as HFCs, chlorofluorocarbons (CFCs), biogenic sources, and emissions from ships occurring within 100 miles of the coastline. The inventory also updated certain emissions sources with more complete or accurate activity data such as industrial processes (e.g., oil refinery processes), motor vehicle travel, and economic and population growth. Finally, the updated inventory was able to provide further detail for some emissions sources, such as separating GHG emissions associated with construction and industrial off-road equipment.

As with California as a whole, transportation is the largest sector of GHG emissions in the Bay Area (Table GHG-1).

**Table GHG-1
Greenhouse Gas Emissions Inventory for
the Bay Area Air Quality Management District (2007)**

Emissions Source/Subsource	GHG Emissions (MMT of CO ₂ e)
Transportation	42
Industrial/Commercial	35
Electricity/Cogeneration	15
Residential Fuel Usage	7
Off-Road Equipment	3
Agriculture and Farming	1
Total Bay Area 2007 GHG Emissions	103

Notes: GHG = greenhouse gas; CO₂e = carbon dioxide equivalent; MMT = million metric tons. Values shown do not include biogenic sources. Biogenic sources account for approximately 2 MMT of CO₂e per year.

Source: BAAQMD 2008

Effects of Climate Change

Despite the level of action taken on the part of the world's governments to reduce GHG emissions, the earth is already committed to a certain level of climate change caused by GHG emissions that occurred over the last 150 years. Some quantity of climate change impacts can be considered foreseeable. Climate change could affect environmental conditions in California through a variety of mechanisms. The City should consider adaptive planning to prepare for the foreseeable impacts of climate change.

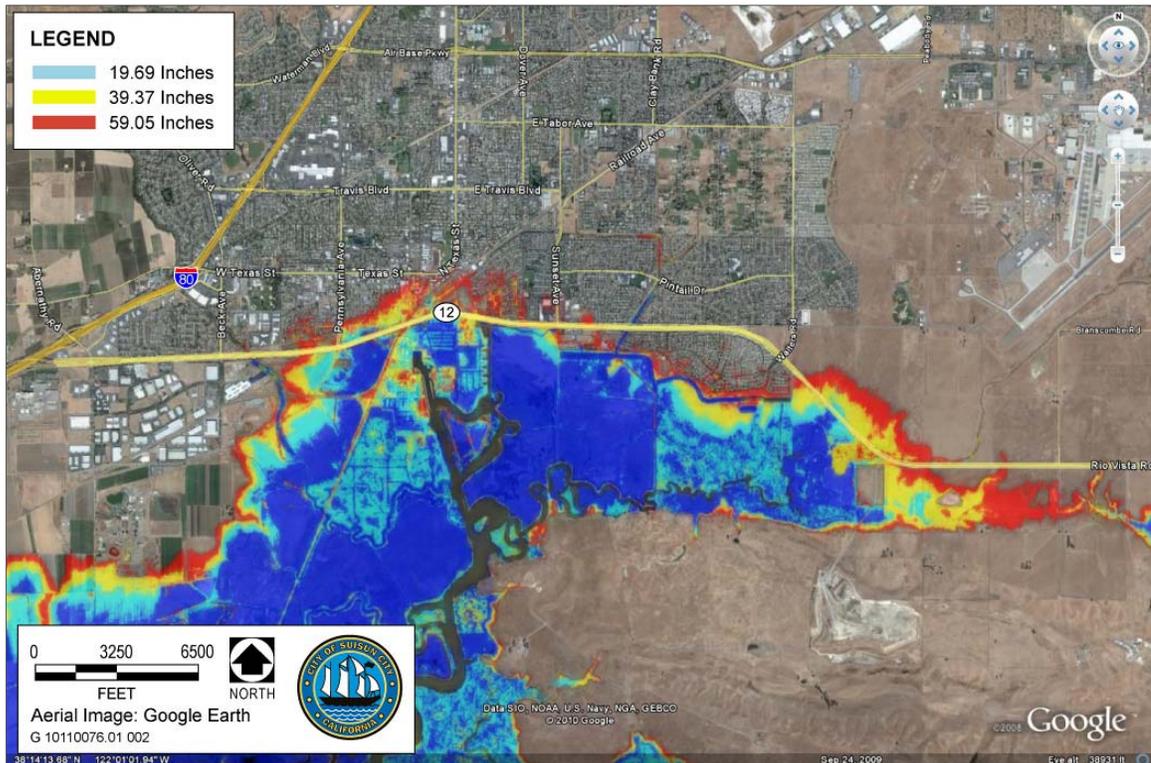
According to the IPCC, which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, global average temperature is expected to increase between 3–7°F by the end of the century, depending on future GHG emission scenarios (IPCC 2007). Resource areas other than air quality and global average temperature could be indirectly affected by the accumulation of GHG emissions.

One effect of climate change is sea level rise. Effects of sea level rise could include increased coastal flooding, saltwater intrusion (especially a concern in the low-lying Sacramento–San Joaquin Delta, where pumps delivering potable water to southern California could be threatened), and disruption of wetlands (CEC 2006). Sea levels along the California coast rose approximately 7 inches during the last century (CEC 2006), and are predicted to rise an additional 7–22 inches by 2100, depending on the future levels of GHG emissions (IPCC 2007). The Governor-appointed Delta Vision Blue Ribbon Task Force recommended that the state plan for a scenario of 16 inches of sea level rise by 2050 and 55 inches by 2100 (California Natural Resources Agency 2008). Sea level rise would affect portions of Suisun City, particularly those areas south of State Route 12. Many important community institutions, infrastructure, housing, and businesses are located in areas affected by sea level rise (see Exhibit GHG-2).

An increase in the global average temperature is expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada. Snowpack in the Sierra Nevada provides both water supply (runoff from melting) and storage (within the snowpack before melting), which is a major source of supply for the state, including Suisun City. According to CEC, the snowpack portion of the water supply could potentially decline between 30–90% by the end of the 21st century (CEC 2006). Although current forecasts are uncertain, it is evident that this phenomenon could lead to significant challenges in securing an adequate water supply for a growing population.

As the climate throughout California changes, the ranges of various plant and wildlife species could shift or be reduced, depending on the favored temperature and moisture regimes of each species. In the worst cases, some species would become extinct or be extirpated from the state if suitable conditions are no longer available.

Additional concerns associated with climate change include increased risk of wildfire caused by changes in rainfall patterns and plant communities, disease and vector problems, and global social and economic problems (CEC 2006).



Source: USGS 2010

Exhibit GHG-2

Sea Level Rise

Regulatory Setting

This section provides a summary of climate change-related legislation that applicable to California and Suisun City. This framework identifies portions of GHG emissions sectors that will be regulated by legislation and portions that will be under the purview of local government entities, such as the City. This section also provides the basis for statewide GHG reduction targets identified in AB 32.

Federal Plans, Policies, Regulations & Laws

Supreme Court Ruling

EPA is the federal agency responsible for implementing the federal Clean Air Act (CAA). The Supreme Court of the United States ruled on April 2, 2007, that CO₂ is an air pollutant as defined under the CAA and that EPA has the authority to regulate emissions of GHGs.

EPA Actions

In response to the mounting issue of climate change, EPA took two actions to regulate, monitor, and potentially reduce GHG emissions. These actions are described in further detail below.

Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide EPA with accurate and timely GHG emissions data from facilities that emit 25,000 MT or more of CO₂ per year. This publically available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost-effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial GHG emitters, along with vehicle and engine manufacturers, will report at the corporate level. An estimated 85% of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.

Endangerment and Cause or Contribute Findings

On December 7, 2009, EPA adopted its Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the CCA (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA which states that the EPA Administrator should regulate and develop standards for "emission[s] of air pollution from any class of classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." The rule addresses Section 202(a) in two distinct findings. The first addresses whether or not the concentrations of the six key GHGs (i.e., CO₂, CH₄, N₂O, HFCs, perfluorocarbons, SF₆) in the atmosphere threaten the health and welfare of current and future generations. The second addresses whether or not the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs and thus to the threat of climate change.

The Administrator found that atmospheric concentrations of GHGs endanger public health and welfare within the meaning of Section 202(a) of the CAA. The Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare.

State Plans, Policies, Regulations, and Laws

Because every nation emits GHGs and thus makes an incremental cumulative contribution to global climate change, cooperation on a global scale will be required to reduce the rate of GHG emissions to a level that can help to slow or stop the human-caused increase in average global temperatures and associated changes in climatic conditions. Several statewide initiatives relevant to land use planning are discussed below; however, this does not represent a complete list of climate change-related legislation in California. Other relevant legislation not specifically described in this section addresses renewable energy generation, energy efficiency, emissions from motor vehicles, carbon intensity of fuels, among other issues.



Executive Order S-3-05

Executive Order S-3-05, which was signed by Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total greenhouse gas emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80% below the 1990 level by 2050.

Assembly Bill 32, the California Global Warming Solutions Act of 2006

In September 2006, Governor Arnold Schwarzenegger signed AB 32. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources.

Climate Change Scoping Plan

In December 2008, ARB adopted its *Climate Change Scoping Plan*, which contains the main strategies the state will implement to achieve reduction of approximately 169 million metric tons (MMT) of CO₂e, or approximately 30% from the state's projected 2020 emission level of 596 MMT of CO₂e under a business-as-usual scenario (representing a reduction of 42 MMT CO₂e, or almost 10%, from 2002–2004 average emissions). The Scoping Plan also includes ARB-recommended GHG reductions for each emissions sector of the state's GHG inventory. The plan calls for the largest reductions in GHG emissions to be achieved by implementing the following measures and standards:

- improved emissions standards for light-duty vehicles (estimated reductions of 31.7 MMT CO₂e),
- energy efficiency measures in buildings and appliances and the widespread development of combined heat and power systems (26.3 MMT CO₂e),
- a renewable portfolio standard for electricity production (21.3 MMT CO₂e), and
- the Low-Carbon Fuel Standard (15.0 MMT CO₂e).

ARB has not yet determined what amount of GHG reductions it recommends from local government operations; however, the Scoping Plan does state that land use planning and urban growth decisions will play an important role in the state's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions. ARB is also developing an additional protocol for communitywide emissions. ARB further acknowledges that decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emission sectors. The Scoping Plan states that the ultimate GHG reduction assignment to local government

operations is to be determined (ARB 2008:17). With regard to land use planning, the plan expects that a reduction of approximately 5.0 MMT CO₂e will be achieved in association with the implementation of SB 375, which is discussed below.

Senate Bill 97

SB 97, signed in August 2007, acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. This bill directed the Governor's Office of Planning and Research to prepare, develop, and transmit guidelines to the California Natural Resources Agency for the feasible mitigation of GHG emissions, or the effects of GHG emissions, as required by CEQA, by July 1, 2009. The California Natural Resources Agency adopted the text of those guidelines on December 30, 2009, and they became effective March 18, 2010.

Senate Bill 375

SB 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocations. SB 375 requires metropolitan planning organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's regional transportation plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for funding programmed after January 1, 2012.

This bill also extends the minimum time period for the Regional Housing Needs Allocation cycle from 5 years to 8 years for local governments located within an MPO that meets certain requirements. City or County land use policies, including general plans, are not required to be consistent with the RTP (and associated SCS or APS). However, new provisions of CEQA would incentivize qualified projects that are consistent with an approved SCS or APS, categorized as "transit priority projects."

On September 23, 2010, ARB adopted regional GHG emission reduction targets under SB 375 (ARB 2010b). ARB adopted the following target for the Metropolitan Transportation Commission (MTC): 7% by 2020 and 15% by 2035. These targets are for reductions in per-capita GHG emissions from passenger vehicles relative to 2005. These targets are not significance thresholds under CEQA. Rather, these targets will be used in developing sustainable communities strategies under SB 375. MTC's jurisdiction encompasses the Bay Area, including the Specific Plan Area.

Regional and Local Plans, Policies, Regulations, and Ordinances

In June 2005, the Bay Area Air Quality Management District (BAAQMD) established the Climate Protection Program to address the evolving issues on climate change and GHG emissions, and their link to existing air pollution prevention programs. The section below describes actions taken as a result of the Climate Protection Program.



Climate Protection Committee

The BAAQMD Climate Protection Committee was formed as part of the Climate Protection Program to provide guidance to the District's Board of Directors regarding policies and positions taken by BAAQMD toward climate protection actions. The actions required to reduce GHG emissions are closely related to existing programs to reduce criteria air pollutants and precursors. To maximize the benefit of existing air quality programs and to avoid any future inefficiencies of climate protection programs, one of the committee's main goals is to integrate climate protection into existing air quality programs (e.g., grant programs, CEQA commenting, regulations). The Climate Protection Committee is also responsible for keeping up to date with actions taken by international, Federal, State, regional and local agencies and organizations that relate to climate protection, which can provide collaboration opportunities for BAAQMD. Lastly, the committee aims to provide public outreach and education to cities and counties within the San Francisco Bay Area.

Greenhouse Gas Fee for Stationary Sources

In May 2008, the BAAQMD Board of Directors approved a new GHG emissions fee that will apply to all BAAQMD-permitted sources. The fee was added to Regulation 3 (Fees) and became effective in June 2008. Permitted sources such as oil refineries, power plants, and industrial and commercial facilities will be required to pay 4.4 cents per metric ton of CO₂e emitted. BAAQMD anticipates the fee to generate approximately \$1.3 million per year, which will be used to pay for the costs of the Climate Protection Program. Among the activities that will be supported by the fee are the development and maintenance of regional GHG inventories, region-wide studies to evaluate potential GHG emissions-control options for stationary sources, development of regulatory measures for stationary sources, review of GHG-related documents, and coordination with CARB for activities associated with implementation of AB 32.

BAAQMD Air Quality Guidelines

In June 2010, BAAQMD released its 2010 *CEQA Air Quality Guidelines*, which include recommended guidance for the analysis of GHG emissions as well as quantitative thresholds of significance for GHG emissions. The 2010 *CEQA Air Quality Guidelines* has the quantitative thresholds that represent the first numeric significance thresholds for GHG emissions in the SFBAB.

For General Plans (such as this General Plan Update), GHG emissions would be cumulatively considerable, according to the BAAQMD guidance, if the General Plan's GHG emissions were greater than 6.6 MTCO₂e/yr per service population. Local agencies can also address CEQA impacts related to GHG emissions attributable to general plan updates through development of a qualified greenhouse gas reductions strategy.²

² According to BAAQMD, a "qualified climate action plan or program" should including the following: a GHG inventory for base year and GHG emissions projections; an adopted GHG reduction goal for 2020 that aligns with the goals of AB 32; identification of GHG reduction measures that would achieve the target; application of relevant reduction measures included in the AB 32 Scoping Plan; quantification of the GHG reductions of each measure and disclosure of calculation assumptions and methods; identification of implementation steps, responsible parties, and financing mechanisms; monitoring and updating procedures; and be accompanied by a certified CEQA document or adopted in an equivalent public review process.

The City would also consider BAAQMD CEQA guidance for assessing the impact of projects and plans that could be developed under the General Plan. According to BAAQMD guidance, lead agencies can use one of three significance thresholds for assessing the impacts of long-term operational emissions of GHGs for individual land use development projects (e.g., residential, commercial):

- operation-related GHG emissions would exceed 1,100 metric tons of carbon dioxide equivalent per year (MTCO₂e/yr); or
- the GHG efficiency of the project would be greater than 4.6 MTCO₂e/yr per service population (SP)³; or
- compliance with a qualified greenhouse gas reduction strategy.

General Plan Issues & Opportunities

Some of the key issues and opportunities related to climate change are presented below.

- **Adapting to Climate Change.** Although the effects of climate change may not be felt in the Suisun City until beyond the time horizon of this General Plan, given the City's location, it is important to begin considering the potential sea level rise impacts. Most of the areas in the City and Sphere of Influence south of State Route 12 would be affected by sea level rise that is anticipated to occur under the best estimates currently available. To what extent should this General Plan Update deal with this longer-term issue? Should the City establish in this updated General Plan a long-term program to consider the location of long-term investments, such as public infrastructure, facilities, and other elements of the built environment?

Just as with air quality, land use and transportation planning decisions largely dictate the level of GHG emissions at the communitywide level. A variety of land use, transportation, and design approaches are commonly used to reduce vehicular travel demand and, therefore, reduce GHG emissions.

However, even climate change is not a top policy priority, there are extensive co-benefits of land use and transportation measures that reduce transportation demand. Congestion can be improved for those that still need to drive. Land and transportation policies that reduce vehicle miles traveled (VMT) reduce harmful air pollution (other than GHGs), enhance mobility, and reduce time spent commuting. Land-efficient development patterns reduce up-front and ongoing infrastructure costs. Communities that provide for efficient transportation choices can reduce household and business costs.⁴ Pedestrian friendliness has been shown to increase home values (Cortright 2009). Encouraging reinvestment and revitalization of existing developed areas can reduce VMT, but also strengthens the local economy, provides better fiscal balance, and can alleviate blighted conditions. In addition, there are extensive federal, state, and regional funding programs available for local governments and that could be used for planning, infrastructure, and other beneficial uses, and that are tied to the community's

³ Service population is defined as the number of jobs plus the number of residents supported by a proposed project.

⁴ According to the 2008 Bureau of Labor Statistics' Consumer Expenditure Survey, transportation represents the second highest spending category at 16% (behind only housing at 35%) of total expenses for consumers (Bureau of Labor Statistics 2008). The proportion of household spending devoted to transportation has substantially increased during the last century as automobile dependence has increased (Johnson 2001).



GHG reduction strategy. With the direct GHG emissions benefits, as well as the wide range of important co-benefits in mind, should the City consider revisions to policies and standards, such as the following (refer also to the Air Quality Background Report, which poses similar questions)?

- **Accommodate land efficient development patterns.** Land-efficient development patterns can increase the efficiency of infrastructure, enable travel by modes other than by car, and reduce trip lengths.
- **Mixed-Use Development.** Placing a variety of land use activities in proximity to each other (housing, shopping, employment, recreation, schools, etc) provides greater choice of mobility—people can walk, bike, or take transit to meet daily needs. This strategy also makes the trips that must occur in a car shorter.
- **Increasing connectivity.** With the surrounding waterbodies, the railroad, and State Highway 12, connectivity is a challenge for Suisun City. However, a highly-connected transportation network can shorten trip lengths and allow land uses to be placed closer in proximity to one another and along direct routes. A roadway network that is not well-connected requires users to travel long distances to destinations that are relatively close by, increases trip lengths, and creates obstacles for walking, bicycling, and transit access.
- **Facilities.** Safe and convenient bike lanes, pedestrian pathways, transit shelters, and other transportation facilities that are incorporated into a comprehensive transportation network can also encourage more travel by other means, thereby reducing air pollution. There may be additional opportunities to expand and connect existing trails with future trail corridors. The City has a special opportunity to take advantage of its location along the Capital Corridor to take advantage of regional transit facilities.
- **Housing and Employment.** Work-related trips and associated air pollution can be reduced by placing jobs and housing closer to one another. The most effective local strategies seek to attract businesses and industries that are a good match for the current and anticipated labor force and to accommodate a variety of housing types that meet the needs of that labor force.

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