APPENDIX H

Global Climate Change Analysis

Global Climate Change Analysis for Amendments to the City of Chula Vista General Plan (GPA-09-01) and Otay Ranch General Development Plan (PCM-09-11)

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TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

FIGURES

TABLES

ATTACHMENTS

Executive Summary

The proposed Otay Ranch General Development Plan (Proposed Project) is located south of Olympic Parkway, west and east of State Route 125 (SR-125) in the Otay Ranch community in the city of Chula Vista (City). The Proposed Project comprises a General Plan Amendment (GPA) and General Development Plan Amendment (GDPA) to allow the ultimate buildout of 6,050 residential units, 1.8 million square feet of commercial uses, 51.4 acres of schools, 50.0 acres of university use, 10.8 acres of community purpose facilities, 55.4 acres of park, and 2.2 million square feet of industrial uses. The purpose of this report is to evaluate the significance of the Proposed Project's GHG emissions that would occur from the construction and ongoing operation of the maximum allowable land uses under the proposed plan. The operational GHG emissions evaluated include emissions from vehicle use, electricity consumption, natural gas combustion, water use, and solid waste disposal. Significance was determined based on the City's threshold requiring a 20 percent reduction in the Proposed Project's overall GHG emissions compared to a business-as-usual (BAU) scenario.

This report concludes that the Proposed Project's contribution to cumulative greenhouse gas (GHG) emissions would be less than significant. A total of 222,284.04 metric tons of carbon dioxide equivalent ($MTCO_2E$) of GHG emissions would be emitted by the Proposed Project each year above existing conditions. This estimate represents a nearly 28 percent reduction in total GHG emissions compared to the BAU condition, which would emit 307,078.01 $MTCO_2E$ of GHG emissions per year above existing conditions. This reduction is due to the Proposed Project's incorporation of key vehicle emission reduction measures as well as increased energy- and water-saving design. Accounting for statewide regulations being imposed on the auto and fuel industries to reduce vehicle GHG emissions statewide, and project-specific design that reduces average vehicle trip lengths, transportation-related BAU emissions would be reduced nearly 40 percent by the Proposed Project. The Proposed Project's average local daily trip length would be 4.62 miles for Village 8 West and 5.08 miles for Village 9. This trip length is less than the regional average trip length of 5.8 miles, and yields a substantially lesser VMT and total vehicle fuel consumption compared to BAU.

Accounting for the Proposed Project's increased energy- and water-saving design requirements, the non-transportation-related BAU emissions (i.e., emissions from energy and water use, solid waste disposal and construction activities) would be reduced 20 percent by the Proposed Project. This reduction results from substantially reduced BAU energy and water use as required in the proposed new General Plan (GP) Policy E 7.8 and in existing City ordinances.

Given its vehicle, energy and water use GHG reduction features, the Proposed Project would generate total GHG emissions 28 percent lower than the total emissions projected

for BAU. The Proposed Project is therefore consistent with the City's threshold and with the Scoping Plan and AB 32 year 2020 goals upon which it is based. The Proposed Project's Climate Change impacts would be less than significant.

1.0 Introduction

This report evaluates the significance of the Proposed Project's contribution of GHG emissions to statewide GHG emissions and GHG emissions reduction targets. To evaluate the incremental effect of Proposed Project development on statewide and global climate change, it is important to have a basic understanding of the nature of the global climate change problem.

1.1 Understanding Global Climate Change

Global climate change is a change in the average weather of the earth, which can be measured by wind patterns, storms, precipitation, and temperature. The earth's climate is in a state of constant flux with periodic warming and cooling cycles. Extreme periods of cooling are termed "ice ages," which may then be followed by extended periods of warmth. For most of the earth's geologic history, these periods of warming and cooling have been the result of many complicated, interacting natural factors that include volcanic eruptions which spew gases and particles (dust) into the atmosphere, the amount of water, vegetation, and ice covering the earth's surface, subtle changes in the earth's orbit, and the amount of energy released by the sun (sun cycles). However, since the beginning of the Industrial Revolution around 1750, the average temperature of the earth has been increasing at a rate that is faster than can be explained by natural climate cycles alone.

With the Industrial Revolution came an increase in the combustion of carbon-based fuels such as wood, coal, oil, natural gas, and biomass. Industrial processes have also created emissions of substances that are not found in nature. This in turn has led to a marked increase in the emissions of gases that have been shown to influence the world's climate. These gases, termed "greenhouse" gases, influence the amount of heat that is trapped in the earth's atmosphere. Because recently observed increased concentrations of GHGs in the atmosphere are related to increased emissions resulting from human activity, the current cycle of "global warming" is generally believed to be largely due to human activity. Of late, the issue of global warming or global climate change has arguably become the most important and widely debated environmental issue in the United States and the world. Because climate change is caused by the collective of human actions taking place throughout the world, it is quintessentially a cumulative issue.

1.2 Greenhouse Gases of Primary Concern

There are numerous GHGs, both naturally occurring and manmade. Table 1 summarizes some of the most common. Each GHG has variable atmospheric lifetime and global warming potential.

The atmospheric lifetime of the GHG is the average time the molecule stays stable in the atmosphere. Most GHGs have long atmospheric lifetimes, staying in the atmosphere hundreds or thousands of years. The potential of a gas to trap heat and warm the atmosphere is measured by its global warming potential or GWP. Specifically, GWP is defined as the cumulative radiative forcing effects of a gas, both direct and indirect, integrated over a specified period of time resulting from the emission of a unit mass of gas relative to some reference gas (U.S. EPA 2002). The reference gas for GWP is carbon dioxide which, as shown in Table 1, thus has a GWP of 1. The GHGs with higher GWPs have a greater global warming effect than carbon dioxide on a molecule by molecule basis.

TABLE 1
GLOBAL WARMING POTENTIALS (GWPs) AND ATMOSPHERIC LIFETIMES (YEARS)

Gas	Atmospheric Lifetime	100-year GWP	20-year GWP	500-year GWP
Carbon Dioxide (CO_2)	50-200	1	1	1
Methane (CH_4)[a]	12±3	21	56	6.5
Nitrous oxide (N_20)	120	310	280	170
HFC-23	264	11,700	9,100	9,800
HFC-125	32.6	2,800	4,600	920
HFC-134a	14.6	1,300	3,400	420
HFC-143a	48.3	3,800	5,000	1,400
HFC-152a	1.5	140	460	42
HFC-227ea	36.5	2,900	4,300	950
HFC-236fa	209	6,300	5,100	4,700
HFC-4310mee	17.1	1,300	3,000	400
CF_4	50,000	6,500	4,400	10,000
C_2F_6	10,000	9,200	6,200	14,000
C_4F_{10}	2,600	7,000	4,800	10,100
C_6F_{14}	3,200	7,400	5,000	10,700
SF_6	3,200	23,900	16,300	34,900

SOURCE: U.S. EPA 2002.
[a] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Of the gases listed in Table 1, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide(N_20) are produced by both biogenic (natural) and anthropogenic (human) sources. The remaining gases occur solely as the result of human processes. Hydrofluorocarbons (HFCs) are synthetic, made-made chemicals used as substitutes for ozone-depleting chloroflourocarbons in automobile air conditioners and refrigerants. Perfluorocarbons (PFCs) such as CF_4 are used primarily in aluminum production and

semiconductor manufacture. Sulfur hexafluoride (SF_6) is used for insulation in electric power transmission and distribution equipment. These remaining gases are not of primary concern to the Proposed Project.

CO_2, CH_4 and N_20 are the GHGs of primary concern in this analysis. Carbon dioxide would be emitted by uses allowed under the Proposed Project during the combustion of fossil fuels in vehicles, from electricity generation and natural gas consumption, and from solid waste disposal. Smaller amounts of methane and nitrous oxide would be emitted from the same Project operations.

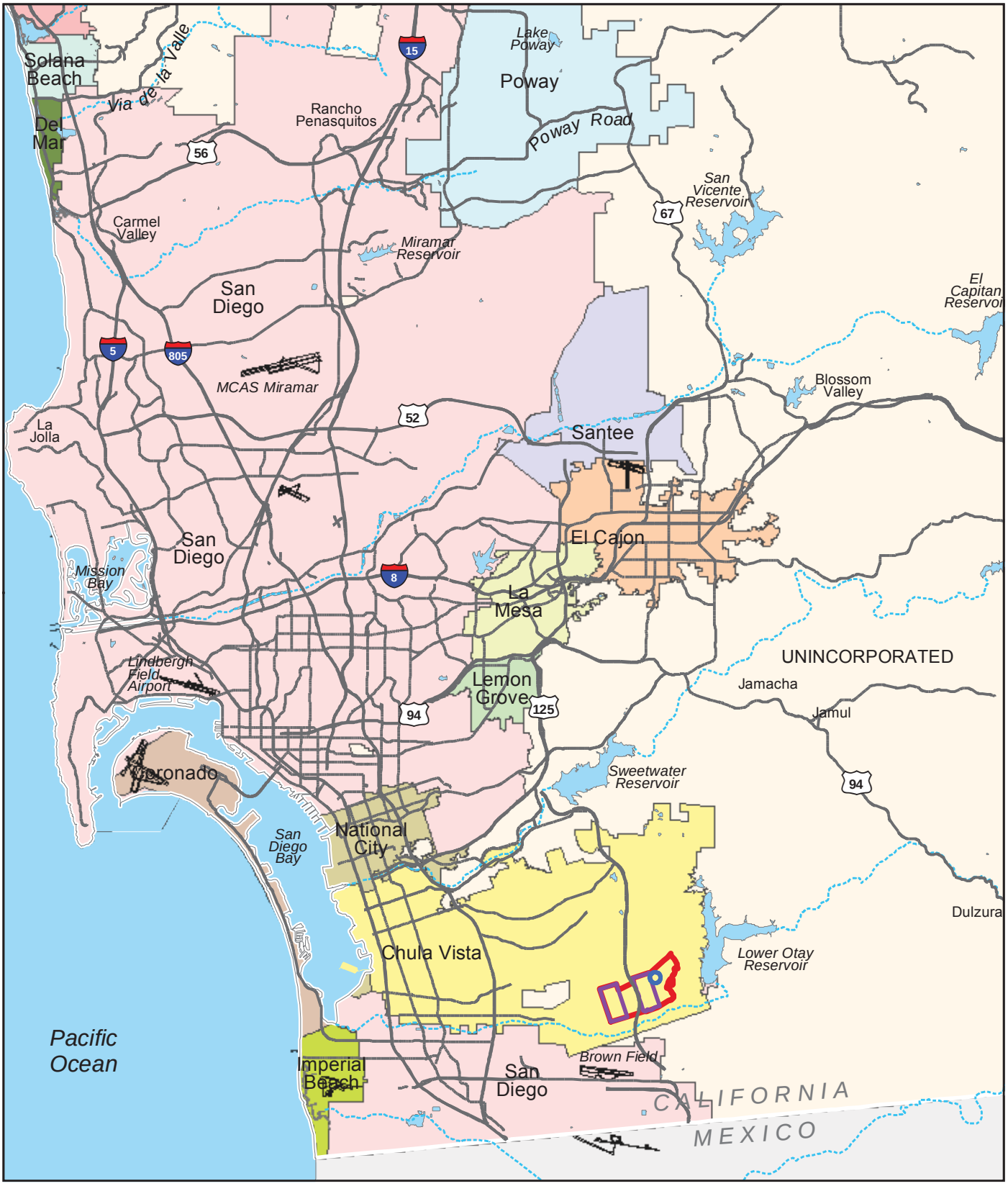
More information on the background of global warming and GHGs can be found in Attachment 1, Understanding Global Climate Change.

2.0 Project Description

2.1 Development Summary

The Otay Ranch GPA and GDPA (collectively known as the Proposed Project) is composed of two parcels of land (Village 8 West and Village 9) located within the Otay Ranch villages planning area. The intent of the Proposed Project is to redefine village boundaries to create Village 8 West and Village 9 as cohesive and integrated village areas which correspond to the City's General Plan. The Proposed Project also includes an 85-acre Regional Technology Park (RTP) within the Planning Area 10/University Site. The discretionary actions required to implement the Proposed Project include a GPA and Otay Ranch GDPA.

The Proposed Project is located south of Olympic Parkway, west and east of State Route 125 (SR-125) in the Otay Ranch community in the eastern part of the City (Figure 1). The proposed GPA and GDPA would revise text and graphics relevant to the subject village areas in these plans to allow the ultimate buildout of 6,050 residential units, 1.8 million square feet of commercial and 2.2 million square feet of industrial uses, 10.8 acres of community purpose use, 51.4 acres of schools, and 55.4 acres of park use on currently vacant land (Figure 2). Figure 3 shows the land use plan of the Proposed Project. The Proposed Project's plan of land uses have been guided by principles that encourage walkability, mixed-use, alternative modes of transportation, and preservation of a large amount of open space.



Project Area

Village 8 West and Village 9

RTP

FIGURE 1

Regional Location

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Image source: Copyright 2010 AerialsExpress, All Rights Reserved (flown Feb 2010)

Project Area
Village 8 West and Village 9
RTP

0 Feet 4,000

FIGURE 2

Aerial Photograph of Project Area

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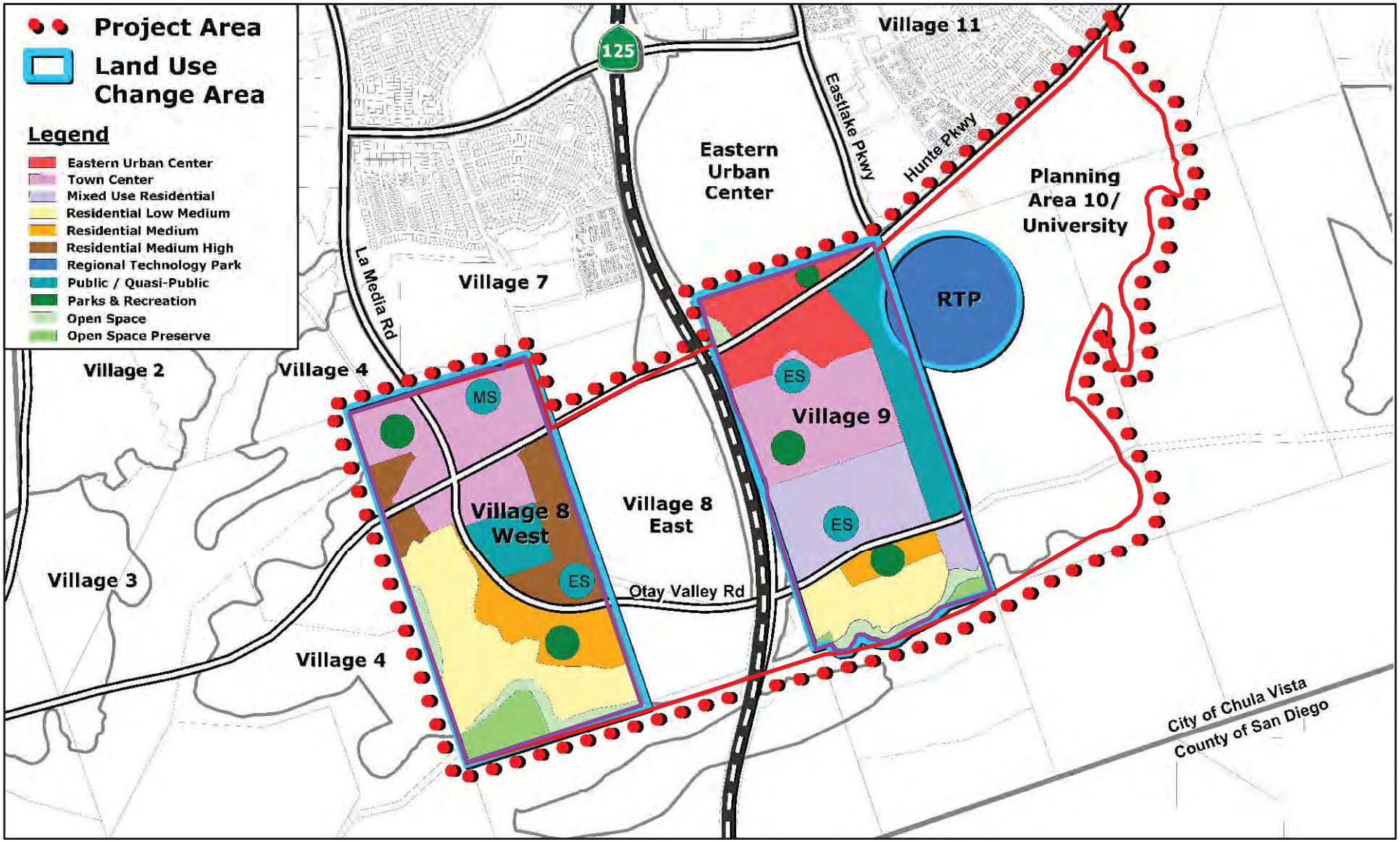

FIGURE 3

Proposed Land Uses

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2.2 Green Building/Energy Efficiency Standards

The proposed GPA includes the addition of a new energy-related Policy E 7.8 into the existing General Plan's Environmental Element to "ensure that residential and non-residential construction complies with all applicable City of Chula Vista energy efficiency measures that are in effect at the time of discretionary permit review and approval or building permit issuance, whichever is applicable." The residential and non-residential construction that would be allowed by the Proposed Project would thus be subject to compliance with all relevant City energy efficiency and green building measures. The City currently has two key Municipal Code ordinances that require advanced water conservation, energy efficiency and other measures that would reduce the emission of GHGs. These ordinances are discussed later in Section 3.2.4.5 and Section 3.2.4.6 and are attached in their entirety as Attachment 2. An overview of the major GHG reducing benefits of these existing ordinances is described below.

2.2.1 Energy Efficiency

In accordance with the City's current energy code and Increased Energy Efficiency Standards (Municipal Code Chapter 15.26, Section 15.26.030), the Proposed Project development shall exceed the current 2008 California Energy Code's residential energy efficiency standards by 15 percent. Projects would accomplish this through improved Heating, Ventilation, & Air Conditioning (HVAC) systems and duct seals; enhanced ceiling, attic and wall insulation; EnergyStar appliances; high-efficiency water heaters; energy-efficient three-coat stucco exteriors; energy-efficient lighting; and high-efficiency window glazing. These energy features would undergo independent third party inspection and diagnostics as part of the City's verification and commissioning process.

2.2.2 Water Conservation

In accordance with the City's current Green Building Standards (Municipal Code Chapter 15.12), residential and commercial buildings would be required to be designed to use at least 20 percent less water per unit than buildings compliant with the existing plumbing code. This would be achieved through advanced plumbing systems such as parallel hot water piping or hot water recirculation systems, and fixtures such as ultra-low flow toilets, water-saving showerheads and kitchen faucets, and buyer-optional high-efficiency clothes washers. As required by the Standards, the 20-percent reduction in potable water use shall be demonstrated by verifying each plumbing fixture and fitting meets the 20 percent reduced flow rate or by calculating a 20-percent reduction in the building water use baseline.

In addition to these indoor water use conservation features, projects would be required to design outdoor landscaping that minimizes turf, maximizes drought-tolerant plants, and incorporates weather-based irrigation controllers, multi-programmable irrigation

clocks, and a high-efficiency drip irrigation system. Also at the time of final inspection, a manual shall be placed in each building that includes, among other things, information about water conservation.

2.2.3 Materials Use and Waste Reduction

In accordance with the Green Building Standards and state and local laws, at least 50 percent of on-site construction waste and ongoing operational waste would be diverted from landfills through reuse and recycling. To further minimize waste, the Standards require projects to incorporate recycled materials for such things as flooring, and to use certified sustainable wood products and other recycled or rapidly renewable building materials where possible. Areas for storage and collection of recyclables and yard waste are also required to be provided for each residence.

2.2.4 Pollutant Control and Heat Island Reduction

To maximize shade and reduce heat island effects, the landscape plans of subsequent projects would be required to include strategic location of deciduous trees and other vegetation, as well as the possible use of cool or green roofs. Impervious surfaces, including paved parking areas, are required to be minimized and pervious pavers and materials used instead where practical. No CFC-based refrigerants are allowed, and interior finishes, adhesives, sealants, paints and coatings, and carpet systems would be required to be low in VOCs (volatile organic compounds), and meet the testing and product requirements of one or more nationally recognized green product labeling programs. Compliance with these requirements shall be verified through documentation.

3.0 Existing Conditions

3.1 Environmental Setting

3.1.1 Regional Climate

The climate of the region which encompasses the City of Chula Vista is identified as Mediterranean, which is characterized by warm, dry summers and mild, wet winters. Clear skies predominate for much of the year due to a semi-permanent high-pressure cell located over the Pacific Ocean. This high-pressure cell also drives the dominant onshore circulation and helps to create subsidence and radiation temperature inversions. Subsidence inversions occur during the warmer months when descending air associated with the high-pressure cell comes in contact with cool marine air.

Radiation inversions typically occur on winter nights when air near the ground cools by radiation and the air aloft remains warm.

An average of 10 inches of rain falls each year from November to early April, while the remainder of the year is typically dry. Typically, measurable rain falls on 20 days per year, with only six of these days experiencing moderate (0.5 inch in 24 hours) rainfall.

3.1.2 State and Regional GHG Inventories

3.1.2.1 California GHG Inventory

The CARB performs statewide inventories. The inventory is divided into nine broad sectors of economic activity: agriculture, commercial, electricity generation, forestry, high GWP emitters, industrial, recycling and waste, residential, and transportation. Emissions are quantified in million $MTCO_2E$. Table 2 shows the estimated statewide GHG emissions for the years 1990, 2000, 2004, and 2008.

TABLE 2
CALIFORNIA GHG EMISSIONS BY SECTOR IN 1990, 2000, 2004, AND 2008

Sector	1990 Emissions in $MMTCO_2E$ (% total)[1]	2000 Emissions in $MMTCO_2E$ (% total)[1]	2004 Emissions in $MMTCO_2E$ (% total)[1]	2008 Emissions in $MMTCO_2E$ (% total)[1]
Sources				
Agriculture	23.4 (5%)	25.44 (6%)	28.82 (6%)	28.06 (6%)
Commercial	14.4 (3%)	12.80 (3%)	13.20 (3%)	14.68 (3%)
Electricity Generation	110.6 (26%)	103.92 (23%)	119.96 (25%)	116.35 (24%)
Forestry (excluding sinks)	0.2 (<1%)	0.19 (<1%)	0.19 (<1%)	0.19 (<1%)
High GWP	--	10.95 (2%)	13.57 (3%)	15.65 (3%)
Industrial	103.0 (24%)	97.27 (21%)	90.87 (19%)	92.66 (19%)
Recycling and Waste	--	6.20 (1%)	6.23 (1%)	6.71 (1%)
Residential	29.7 (7%)	30.13 (7%)	29.34 (6%)	28.45 (6%)
Transportation	150.7 (35%)	171.13 (37%)	181.71 (38%)	174.99 (37%)
Unspecified Remaining[2]	1.3 (<1%)	--	--	--
Subtotal	433.3	458.03	483.89	477.74
Sinks				
Forestry Sinks	-6.7 (--)	-4.72 (--)	-4.32 (--)	-3.98 (--)
TOTAL	**426.6**	**453.31**	**479.57**	**473.76**

SOURCE: CARB 2007, 2010a.
[1]Percents may not total 100 due to rounding.
[2]The remaining are from unspecified fuel combustion and ozone depleting substance (ODS) substitute use which could not be attributed to an individual sector.

As shown in Table 2, statewide GHG emissions totaled 433 $MMTCO_2E$ in 1990, 458 $MMTCO_2E$ in 2000, 484 $MMTCO_2E$ in 2004, and 478 $MMTCO_2E$ in 2008. According to data from the CARB, it appears that statewide GHG emissions peaked in 2004 and are now beginning to decrease (CARB 2010a). Transportation-related emissions consistently contribute the most GHG emissions, followed by electricity generation and industrial emissions.

The forestry sector is unique because it not only includes emissions associated with harvest, fire, and land use conversion, but also includes removals of atmospheric CO_2 by photosynthesis, which is then bound (sequestered) in plant tissues. As seen in Table 2, the forestry sector consistently removes more CO_2 from the atmosphere statewide than it emits. As a result, although decreasing over time, this sector represents a net sink, removing a net 6.7 $MMTCO_2E$ from the atmosphere in 1990, a net 4.7 $MMTCO_2E$ in 2000, a net 4.3 $MMTCO_2E$ in 2004, and a net 4.0 $MMTCO_2E$ in 2008.

3.1.2.2 San Diego County GHG Inventory

A San Diego County regional emissions inventory was prepared by the University of San Diego that took into account the unique characteristics of the region. The 2006 emissions inventory for San Diego County is duplicated below in Table 3. The sectors included in this inventory are somewhat different than those in the statewide inventory.

TABLE 3
SAN DIEGO COUNTY GHG EMISSIONS BY SECTOR IN 2006

Sector	2006 Emissions in $MMTCO_2E$ (% total) [1]
Agriculture/Forestry/Land Use	0.7 (2%)
Waste	0.7 (2%)
Electricity	9 (25%)
Natural Gas Consumption	3 (8%)
Industrial Processes & Products	1.6 (5%)
On-Road Transportation	16 (45%)
Off-Road Equipment & Vehicles	1.3 (4%)
Civil Aviation	1.7 (5%)
Rail	0.3 (<1%)
Water-Borne Navigation	0.127 (<0.5%)
Other Fuels/Other	1.1 (3%)
Total	**35.5**

SOURCE: San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets. Prepared by the University of San Diego School of Law, Energy Policy Initiative Center (EPIC), and available online at http://www.sandiego.edu/epic/ghginventory/.
[1]Percents may not total 100 due to rounding.

Similar to the statewide emissions, transportation-related GHG emissions contributed the most countywide, followed by emissions associated with energy use.

3.1.2.3 City of Chula Vista GHG Inventory

As part of monitoring its progress in attaining the goals of its CO_2 Reduction Plan (see Section 3.2.4.2 below), the City of Chula Vista inventoried citywide GHG emissions in 2005 and 2008. The *2005 GHG Emissions Inventory* was the first formal evaluation of

the City's progress in reaching its emissions goals, and the *2008 GHG Emissions Inventory* was the second formal evaluation (City of Chula Vista 2005, 2008a).

The *2008 GHG Emissions Inventory* separates emissions into two major categories, community and municipal. The community analysis represents the quantity of GHG emissions produced throughout the entire City in both public and private sectors. The municipal analysis represents emissions only from City facilities and operations.

In 2008, community GHG emissions in the City totaled 934,630 $MTCO_2E$. Transportation and mobile sources accounted for approximately 44 percent of this total. This is 29 percent higher than 1990 levels and 17 percent higher than 2005 levels citywide and is attributed to population growth.

In 2008, municipal GHG emissions in the City totaled 16,817 $MTCO_2E$. Transportation and mobiles sources accounted for approximately 46 percent of this total. Emissions from municipal buildings and the municipal vehicle fleet increased from 1990 levels but decreased 17 percent from the 2005 levels.

3.1.2.4 Project Site GHG Emissions

The Proposed Project site is located in the south central portion of the Otay Ranch GDP area. The Otay Ranch GDP area is former agricultural ranch land historically used for ranching, grazing, and dry farming. It is currently vacant of development and is thus not a source of anthropogenic GHGs.

Disturbed and undisturbed natural vegetation comprise the site's dominant land cover. Natural vegetation and soils temporarily store and release carbon as part of the terrestrial carbon cycle. Plants absorb carbon dioxide through photosynthesis as they grow, store it in solid form during the life of the plant, and release it again as a gas when they die and decompose. Soil carbon accumulates from inputs of plants and animal matter, roots, and other living components of the soil ecosystem (e.g. bacteria, worms). Soil carbon is released through biological respiration, or through soil erosion and other forms of soil disturbance. These emissions of carbon dioxide from the Project site are not readily quantifiable, but are likely small from a regional perspective. Negligible emissions of methane and nitrous oxides may also be occurring due to on-site decomposition of wood, or any vegetative matter or waste, or to residue oxidation.

3.1.3 Consequences of Global Climate Change

CARB projects a future statewide GHG emissions increase of over 23 percent (from 2004) by 2020 given current trends (CARB 2008c). The 2008 EPIC study predicts a countywide increase to 43 $MMTCO_2E$ or roughly 20 percent (from 2006) by 2020, given

a BAU trajectory. Global GHG emissions forecasts also predict similar substantial increases, given a BAU trajectory.

The potential consequences of global climate change on the San Diego region are far reaching. The Climate Scenarios report, published in 2006 by the California Climate Change Center, uses a range of emissions scenarios to project a series of potential warming ranges (low, medium or high temperature increases) that may occur in California during the 21st century. Throughout the state and the region, global climate and local microclimate changes could cause an increase in extreme heat days; higher concentrations, frequency and duration of air pollutants; an increase in wildfires; more intense coastal storms; sea level rise; impacts to water supply and water quality through reduced snowpack and saltwater influx; public health impacts; impacts to near-shore marine ecosystems; reduced quantity and quality of agricultural products; pest population increases; and altered natural ecosystems and biodiversity.

3.2 Regulatory Background

In response to rising concern associated with increasing GHG emissions and global climate change impacts, numerous plans, policies and regulations have been adopted at the international, national, state and local levels with the aim of reducing GHG emissions.

3.2.1 International

3.2.1.1 Montreal Protocol on Substances that Deplete the Ozone Layer

Human caused effects on the global atmosphere first became widely known to the public at large in the mid-1970s when it was discovered that a number of substances, particularly chlorofluorocarbons (CFCs) used in refrigeration, when released into the atmosphere could cause the breakdown of significant quantities of the earth's protective ozone (O_3) in the stratosphere (i.e., the "ozone layer"). Somewhat concurrent with this was the discovery of the now well documented "ozone hole" over Antarctica. The ozone layer filters out most of the ultraviolet-B (UV-B) radiation reaching the earth. Therefore, destruction of the ozone layer would allow more UV-B radiation to reach the earth's surface potentially leading to increases in skin cancer and other effects such as crop damage and adverse effects on marine phytoplankton.

In response to these concerns, the Coordinating Committee on the Ozone Layer was established by the United Nations Environment Program (UNEP) in 1977, and UNEP's Governing Council adopted the World Plan of Action on the Ozone Layer. Continuing efforts led to the signing in 1985 of the Vienna Convention on the Protection of the

Ozone Layer. This led to the creation of the Montreal Protocol on Substances That Deplete the Ozone Layer (Montreal Protocol), an international treaty designed to protect the stratospheric ozone layer by phasing out production of ozone depleting substances. The Montreal Protocol was adopted on September 16, 1987 and was enacted on January 1, 1989. The Protocol has been revised five times since 1989, most recently in 1999.

This treaty is considered one of the most successful international treaties on environmental protection in the world, with ratification by 191 countries including the United States. By the end of 2006, the 191 parties to the treaty had phased out over 95 percent of ozone depleting substances (UNEP 2007). Because of this success, scientists are now predicting that the ozone hole will "heal" later this century.

The elimination of these ozone-depleting substances also has benefits relative to global climate change because most of these substances are also potent GHGs with very high GWPs, ranging from 4,680 to 10,720 (UNEP 2007, Australian Government 2007). However, the phasing out of ozone depleting substances has led to an increase in the use of non-ozone depleting substances such as hydrofluorocarbons (HFCs) which, although not detrimental to the ozone layer, are also potent GHGs. As shown in Table 1, these substances have GWPs ranging from 140 to 11,700.

3.2.1.2 Intergovernmental Panel on Climate Change

In response to growing concern about pollutants in the upper atmosphere and the potential problem of climate change, the World Meteorological Organization and the UNEP established the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC was tasked with assessing the scientific, technical, and socioeconomic information relevant to understanding the scientific basis for human-induced climate change, its potential impacts, and options for adaptation and mitigation. The most recent reports of the IPCC have emphasized the scientific consensus that real and measurable changes to the climate are occurring, that they are caused by human activity, and that significant adverse impacts on the environment, the economy, and human health and welfare are unavoidable.

3.2.1.3 United Nations Framework Convention on Climate Change

In 1994, the Unites States joined a number of other nations in signing an international treaty known as the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC recognized that global climate is a shared resource that can be affected by industrial and other emissions of greenhouses gases, and set an overall framework for intergovernmental efforts to tackle the challenges posed by global climate

change. As with the Montreal Protocol, this treaty was ratified by 191 countries including the United States. Under this treaty, governments were to (UNFCCC 2007a):

- Gather and share information on GHG emissions, national policies and best practices;
- Launch national strategies for addressing GHG emissions and adapting to expected impacts; and
- Cooperate with other nations in preparing for adaptation to the impacts of climate change.

The UNFCCC divided countries into three main groups according to differing commitments based on economic strength, vulnerability to adverse climate change impacts, and capacity to respond or adapt to climate change effects. The stronger economic nations, including the United States, were to provide financial and technological support to developing countries to enable them to undertake emissions reduction activities and to help them adapt to adverse effects of climate change.

The UNFCCC was enacted in March 1994; however, it generally lacked powerful, legally binding measures. This led to the development of the Kyoto Protocol.

3.2.1.4 Kyoto Protocol to the UNFCCC

Knowing that the UNFCCC did not contain the legally binding measures that would be required to meaningfully address global climate change, a conference of the UNFCCC signatory nations was held in Berlin in 1995 that launched a new round of discussions to determine more detailed and stronger commitments for industrialized countries (the Berlin Mandate). After two and a half years of negotiations, the Kyoto Protocol was adopted in December 1997 (UNFCCC 2007c). While the 1997 Kyoto Protocol shared the UNFCCC's objectives, it committed signatories to individual, legally binding targets to limit or reduce their GHG emissions. By March 1999, 84 countries, including the United States, had signed the Kyoto Protocol (UNFCCC 2009).

Only Parties to the UNFCCC that have also become Parties to the Kyoto Protocol are bound by the Kyoto Protocol's commitments. Governments become Parties to the Protocol by ratifying, accepting, approving, or acceding to it. Because of the complexity of the negotiations and uncertainty associated with the rules or how they would operate, several of the signing countries, including the United States, were reluctant to actually ratify the Protocol. Therefore a new round of negotiations was undertaken to flesh out the Kyoto Protocol's rulebook. These negotiations concluded with the adoption of the Marrakesh Accords in 2001. With the adoption of the Marrakesh Accords, the Protocol was enacted in February 2005, and by July 2009, 184 governments had become Parties to the Protocol (UNFCCC 2007c, 2009). In December 2009, a Copenhagen Accord was held to address global climate change issues in the future; however, no further

measures were adopted. Another Accord is planned for December 2010 in Cancun, Mexico.

Although a signer to the Kyoto Protocol, to date the U.S. has not ratified the Kyoto Protocol, because it does not mandate emissions reductions from all countries, including several developing countries whose GHG emissions are expected to exceed emissions from developed countries within the next 25 years (U.S. EPA 2007a).

3.2.2 National

3.2.2.1 Clean Air Act, Title VI - Stratospheric Ozone Protection

Similar to the Montreal Protocol discussed above, Title VI of the Clean Air Act was established to protect stratospheric ozone by phasing out the manufacture of ozone-depleting substances, and by restricting their use and distribution (U.S. EPA 2007b). Also similar to the Montreal Protocol, while successful in phasing out ozone depleting substances, Title VI has inadvertently led to an increase in the production and use of non-ozone depleting substitutes such as HFCs that are global warming gases with high GWPs and relatively long atmospheric lifetimes.

3.2.2.2 Climate Change Action Plan

Adopted in 1993, the U.S. Climate Change Action Plan (CCAP) consists of voluntary actions to reduce all significant GHGs from all economic sectors. Backed by federal funding, the CCAP supports cooperative partnerships between the government and the private sector in establishing flexible and cost-effective ways to reduce GHG emissions. The CCAP encourages investments in new technologies, but also relies on previous actions and programs focused on saving energy, reducing transportation emissions, improving forestry management, and reducing waste. With respect to energy and transportation-related GHG emissions reductions, the CCAP includes the following (U.S. Global Change Research Information Office 1993).

- Energy Demand Actions to accelerate the use of existing energy saving technologies and encourage the development of more advanced technologies. Commercial actions focus on installing efficient heating and cooling systems in commercial buildings and upgrading to energy-efficient lighting systems (the *Green Lights* program). The *State Buildings Energy Incentive Fund* provides funding to states for the development of public building energy management programs. Residential actions focus on developing new residential energy standards and building codes and providing money-saving energy efficient options to homeowners.

- Energy Supply Actions to reduce emissions from energy supply. These actions focus on increasing the use of natural gas, which emits less CO_2 than coal or oil, and

investing in renewable energy sources, such as solar and wind power, which result in zero net CO_2 emissions. Energy supply strategies also focus on reducing the amount of energy lost during distribution from power plants to consumers.

- Transportation Actions to reduce transportation related emissions are focused on investing in cleaner fuels and more efficient technologies and reducing vehicle miles traveled (VMT). Also, the U.S. EPA and Department of Transportation (DOT) are to draft guidance documents for reducing VMTs for us in developing local clean air programs.

3.2.2.3 GHG Emissions Intensity Reduction Programs

The GHG Emissions Intensity is the ratio of GHG emissions to economic output. In 2002, the U.S. GHG Emissions Intensity was 183 metric tons per million dollars of Gross Domestic Product (U.S. EPA 2007c). In February 2002, the U.S. set a goal to reduce this GHG Emissions Intensity by 18 percent by 2012 through various reduction programs. A number of ongoing voluntary programs have thus been instituted to reduce nationwide GHG emissions. These include (U.S. EPA 2007c):

- **Climate VISION Partnership:** In 2003, this program established a partnership between 12 major industries and the U.S. Department of Energy (U.S. DOE), the U.S. EPA, the DOT and the U.S. Department of Agriculture. The involved industries include electric utilities; petroleum refiners and natural gas producers; automobile, iron and steel, chemical and magnesium manufacturers; forest and paper producers; railroads; and cement, mining, aluminum, and semiconductor industries. These industries are working with the four agencies to reduce their GHG emissions by developing cost-effective solutions, measuring and reporting emissions, developing strategies for the adoption of advanced technologies, and implementing voluntary mitigation actions.

- **Cleaner Energy-Environment State Partnership:** This program established a partnership between federal and state agencies to support states in implementing strategies and policies to promote renewable energy, energy efficiency, and other cost-effective clean energies. States receive technical assistance from the U.S. EPA.

- **Climate Leaders:** Climate Leaders is a U.S. EPA voluntary program that establishes partnerships with individual companies. Together they establish individual corporate goals for GHG emissions reduction and monitor their emissions to measure progress. More than 100 corporations that represent 8 percent of U.S. GHG emissions are involved in Climate Leaders. More than half have reached their emissions goals so far.

- **Energy Star:** Energy Star was established in 1992 by the U.S. EPA and became a joint program with the U.S. DOE in 1996. Energy Star is a program that labels energy

efficient products with the Energy Star label. Energy Star enables consumers to choose energy efficient and cost saving products. More than 1,400 manufacturers use Energy Star labels on their energy efficient products.

- **Green Power Partnership:** This program establishes partnerships between the U.S. EPA and companies and organizations that have bought or are considering buying green power, which is power generated from renewable energy sources. The U.S. EPA offers recognition and promotion to organizations that replace electricity consumption with green power.

3.2.2.4 Corporate Average Fuel Economy Standards

The federal Corporate Average Fuel Economy (CAFE) standards determine the fuel efficiency of certain vehicle classes in the U.S. While the standards had not changed since 1990, in 2007, as part of the Energy and Security Act of 2007, the CAFE standards were increased for new light-duty vehicles to 35 miles per gallon (mpg) by 2020. In May 2009, President Obama announced further plans to increase CAFE standards to require light duty vehicles to meet an average fuel economy of 35.5 mpg by 2016. With improved gas mileage, fewer gallons of transportation fuel would be combusted to travel the same distance, thereby reducing nationwide GHG emissions associated with vehicle travel.

3.2.2.5 Mandatory Reporting of GHGs Rule

Starting January 1, 2010, large emitters of heat-trapping gases are to begin collecting GHG data and reporting their annual GHG emissions to the U.S. EPA. Under this reporting Rule, approximately 10,000 facilities would be covered, accounting for nearly 85 percent of the nation's GHG emissions. This mandatory reporting applies to fossil fuel and industrial GHG suppliers, motor vehicle and engine manufacturers, and facilities that emit 25,000 $MTCO_2E$ or more per year. Vehicle and engine manufacturers outside of the light-duty sector are required to begin phasing in their GHG reporting starting with engine/vehicle model year 2011.

3.2.3 State

The State of California has adopted a number of plans and regulations aimed at identifying statewide and regional GHG emissions caps, GHG emissions reduction targets, and actions and timelines to achieve the target GHG reductions.

3.2.3.1 EO S-3-05 – Statewide GHG Emission Targets

This executive order (EO) signed by Governor Schwarzenegger on June 1, 2005, established the following GHG emission reduction targets for the state of California:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020 reduce GHG emissions to 1990 levels;
- By 2050 reduce GHG emissions to 80 percent below 1990 levels.

This executive order also directs the secretary of the CalEPA to oversee the efforts made to reach these targets, and to prepare biannual reports on the progress made toward meeting the targets and on the impacts to California related to global warming, including impacts to water supply, public health, agriculture, the coastline, and forestry. With regard to impacts, the report shall also prepare and report on mitigation and adaptation plans to combat the impacts. The first Climate Action Team Assessment Report was produced in March 2006 and has been updated biennially.

3.2.3.2 AB 32 – California Global Warming Solutions Act

In response to Executive Order S-3-05, the California legislature passed Assembly Bill (AB) 32 (Nuñez), the "California Global Warming Solutions Act of 2006", which was signed by the governor on September 27, 2006. It requires the CARB to adopt rules and regulations that would reduce GHG emissions to 1990 levels by 2020. The CARB is also required to publish a list of discrete GHG emission reduction measures.

Specifically, AB 32, the California Global Warming Solutions Act of 2006, requires CARB to (State of California 2006):

- Establish a statewide GHG emissions cap for 2020, based on 1990 emissions by January 1, 2008.
  - ✓ In December 2007, CARB approved a 2020 emission limit of 427 million metric tons of CO_2 equivalent.
- Adopt mandatory reporting rules for significant sources of GHGs by January 1, 2009.
  - ✓ In December 2007, CARB adopted regulations requiring the largest industrial sources to report and verify their GHG emissions. Facilities began tracking emissions in 2008 and reports were due June 1, 2009. Emissions reporting for 2008 was allowed to be based on best available data. Beginning in 2010, emissions reports are to be more rigorous and subject to third-party verification.

    This action builds on the earlier SB 177 (Sher) enacted in 2000 which established a nonprofit California Climate Action Registry for the purpose of administering a voluntary GHG emissions registry.

- Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant GHG sources via regulations, market mechanisms and other actions.

  ✓ A Climate Change Scoping Plan (Scoping Plan) was approved on December 12, 2008. The Scoping Plan contains the main strategies California will implement to achieve a reduction of 174 million $MTCO_2E$ GHG emissions, or approximately 29 percent from the state's projected 2020 emission level of 596 million $MTCO_2E$ under a BAU scenario. The Scoping Plan is discussed in greater detail in Section 3.2.3.3 below.

- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in GHG, including provisions for using both market mechanisms and alternative compliance mechanisms.

- Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.

  ✓ In January 2007, the CARB appointed a ten member Environmental Justice Advisory Committee and appointed members to the Economic and Technology Advancement Advisory Committee.

- Ensure public notice and opportunity for comment for all CARB actions.

  ✓ A number of CARB documents, including the 2020 Emissions Forecast, the Scoping Plan, and the Draft Recommended Approaches for Setting Interim Significance Thresholds, have been circulated for public review and comment.

- Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability; conformance with other environmental laws; and ensure that the rules do not disproportionately impact low-income communities.

3.2.3.3 Climate Change Scoping Plan

As directed by AB 32, the Climate Change Scoping Plan prepared by CARB in December 2008 includes the measures in Table 4 to reduce statewide GHG emissions to 1990 levels by 2020. CARB identified these reductions as necessary to reduce forecasted BAU 2020 emissions by approximately 174 $MMTCO_2E$. CARB will update the Scoping Plan at least once every five years to allow evaluation of progress made and to correct the Plan's course where necessary.

As shown in Table 4, the majority of the reductions are to come from the two sectors that generate the most GHG emissions statewide—transportation and electricity generation. Transportation-related GHG emissions account for approximately 38 percent of the

TABLE 4
CARB SCOPING PLAN RECOMMENDED GHG REDUCTION MEASURES

Recommended Reduction Measures	Reductions Counted Towards 2020 Target In $MMTCO_2E$ (% subtotal)((% total))[2]
ESTIMATED REDUCTIONS RESULTING FROM THE COMBINATION OF CAPPED SECTORS AND COMPLEMENTARY MEASURES	**146.7**
California Light-Duty Vehicle Greenhouse Gas Standards • Implement Pavley Standards • Develop Pavley II light-duty vehicle standards	31.7 (22%)((18%))
Energy Efficiency • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)	26.3 (18%)((15%))
Renewables Portfolio Standard (33% by 2020)	21.3 (14%)((12%))
Low Carbon Fuel Standard	15 (10%)((9%))
Regional Transportation-Related GHG Targets[1]	5 (4%)((3%))
Vehicle Efficiency Measures	4.5 (3%)((3%))
Goods Movement • Ship Electrification at Ports • System-Wide Efficiency Improvements	3.7 (3%)((2%))
Million Solar Roofs	2.1 (2%)((1%))
Medium/Heavy Duty Trucks • Heavy-Duty Vehicle Greenhouse Gas Emissions Reduction (Aerodynamic Efficiency) • Medium- and Heavy-Duty Vehicle Hybridization	1.4 (<1%)((<1%))
High Speed Rail	1.0 (<1%)((<1%))
Industrial Measures (for sources covered under cap&trade program) • Refinery Measures • Energy Efficiency and Co-Benefits Audits	0.3 (<.5%)((<.5%))
Additional Reductions Necessary to Achieve the Cap	34.4 (23%)((20%))
ESTIMATED REDUCTIONS RESULTING FROM UNCAPPED SECTORS	**27.3**
Industrial Measures (for sources not covered under cap&trade program) • Oil and Gas Extraction and Transmission	1.1 ((<1%))
High Global Warming Potential Gas Measures	20.2 ((12%))
Sustainable Forests	5.0 ((3%))
Recycling and Waste (landfill methane capture)	1.0 ((.6%))
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET	**174**[3]

SOURCE: Table 2 of the Climate Change Scoping Plan: A Framework for Change. Prepared by the California Air Resources Board, pursuant to AB 32 the California Global Warming Solution Act of 2006. December 2008.

[1] This number represents an estimate of what may be achieved from local land use changes. It is not the SB 375 regional target. CARB will establish regional targets for each Metropolitan Planning Organization following input of the Regional Targets Advisory Committee and a public stakeholders consultation process per SB 375.

[2] (Percentages) are relative to the capped sector subtotal of 146.7 $MMTCO_2E$, and ((percentages)) are relative to the total target reduction of 174 $MMTCO_2E$, and may not total 100 due to rounding.

[3] The total reduction for the recommended measures slightly exceeds the 169 $MMTCO_2E$ of reductions estimated in the BAU 2020 Emissions Forecast. This is the net effect of adding several measures and adjusting the emissions reduction estimates for some other measures.

forecasted BAU 2020 emissions and over 36 percent of the targeted total reductions. Energy-related emissions (including those from electric power generation, commercial and residential energy use, and industrial oil and natural gas refineries) account for approximately 48 percent of the forecasted BAU 2020 emissions and more than 29 percent of the targeted total reductions.

As indicated in Table 4 and described in greater detail in the following sections, the majority of these reductions in transportation-related and energy-related GHG emissions are to be achieved through statewide regulatory mandates affecting vehicle and fuel manufacture, public transit, and public energy utilities. The remaining reductions are to be achieved through direct regulation and price incentive measures affecting oil and gas extraction industries, forestry practices (including increased tree planting programs), landfill methane capture, and restrictions on high GWP gases (used in select industries). The three measures most applicable to the City's control over land use planning and development are the Regional Transportation-Related GHG Targets, the Energy Efficiency, and the Million Solar Roofs measures. Implementing these three measures accounts for a reduction of 33.4 $MMTCO_2E$ emissions, or approximately 20 percent, of the total statewide GHG emissions reductions.

CARB also lists several other recommended measures which will contribute toward achieving the 2020 statewide reduction goal, but whose reductions are not (for various reasons, including the potential for double counting) additive with the measures listed in Table 4. These include state and local government operations measures, green building, mandatory commercial recycling and other additional waste and recycling measures, water sector measures, and methane capture at large dairies.

The Scoping Plan reduction measures and complementary regulations are described further in the following sections, and are grouped under the two headings of Transportation-Related Emissions Reductions and Non-Transportation-Related Emissions Reductions as representative of the sectors to which they apply.

Transportation-Related Emissions Reductions

Transportation accounts for the largest share of the state's GHG emissions. Accordingly, a large share of the reduction of GHG emissions from the recommended measures comes from this sector. To address emissions from vehicles, CARB is proposing a comprehensive three-prong strategy: reducing GHG emissions from vehicles, reducing the carbon content of the fuel these vehicles burn, and reducing the miles these vehicles travel.

3.2.3.4 AB 1493 – Pavley Greenhouse Gas Vehicle Standards

AB 1493 (Pavley) enacted July 2002, directed CARB to adopt vehicle standards that lowered GHG emissions from passenger vehicles and light duty trucks to the maximum

extent technologically feasible, beginning with the 2009 model year. CARB adopted regulations in 2004 and applied to the U.S. EPA for a waiver under the federal Clean Air Act to implement them.

Under federal law, California is the only state allowed to adopt its own vehicle standards, but it cannot implement them until the U.S. EPA grants an administrative waiver. In December 2004 the Alliance of Automobile Manufacturers sued CARB to block implementation of the new regulations and ultimately, in December 2007, a federal judge decided the case in favor of the CARB (Sacramento Bee 2007). Despite this ruling, the U.S. EPA denied CARB's waiver request in February 2008. In January 2008, the State of California sued the U.S. EPA in an attempt to overturn the U.S. EPA's denial (Marten Law Group 2008).

CARB adopted amendments to its new regulations in September 2009 that would enforce AB 1493 but provide vehicle manufacturers with new compliance flexibility. On June 30, 2009, the U.S. EPA rejected its earlier waiver denial reasoning and granted California the authority to implement these GHG emissions reduction standards for new passenger cars, pickup trucks, and sport utility vehicles. With this action, it is expected that the new regulations will reduce GHG emissions from California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016 (CARB 2010b) for a total reduction of 31.7 $MMTCO_2E$ counted toward the total statewide reduction target (CARB 2008b) (see Table 4). These reductions are to come from improved vehicle technologies such as small engines with superchargers, continuously variable transmissions, and hybrid electric drives.

3.2.3.5 EO S-01-07 – Low Carbon Fuel Standard

This executive order signed by Governor Schwarzenegger in January 2007, directed that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 through a Low Carbon Fuel Standard (LCFS). CARB adopted the LCFS as a discrete early action measure pursuant to AB 32 in April 2009 and includes it as a reduction measure in its Scoping Plan (see Table 4).

The LCFS is a performance standard with flexible compliance mechanisms intended to incentivize the development of a diverse set of clean, low-carbon transportation fuel options. Its aim is to accelerate the availability and diversity of low-carbon fuels such as biofuels, electricity and hydrogen, by taking into consideration the full life-cycle of GHG emissions. A 10 percent reduction in the intensity of transportation fuels is expected to equate to a reduction of 16.5 $MMTCO_2E$ in 2020. However, in order to account for possible overlap of benefits between LCFS and the Pavley GHG standards, CARB has discounted the contribution of LCFS to 15 $MMTCO_2E$ (CARB 2008b).

3.2.3.6 Regional Transportation-Related GHG Targets

The Regional Transportation-Related GHG Targets measure included in the Scoping Plan identifies policies to reduce transportation emissions through changes in future land use patterns and community design, as well as through improvements in public transportation, that reduce VMT. By reducing the miles vehicles travel, vehicle emissions will be reduced. Improved planning and the resulting development are seen as essential for meeting the 2050 emissions target (CARB 2008b p. 20). CARB expects that this measure will reduce transportation-related GHG emissions by about 5 $MMTCO_2E$ or 4 percent of the total statewide reductions attributed to the capped sectors (Table 4). Specific regional reduction targets established through SB-375 will determine more accurately what reductions can be achieved through this measure.

3.2.3.7 SB 375 – Regional Emissions Targets

SB 375 was signed in September 2008 and requires CARB to set regional targets for reducing passenger vehicle GHG emissions in accordance with the Scoping Plan measure described above. Its purpose is to align regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation to reduce GHG emissions by promoting high-density, mixed-use developments around mass transit hubs.

CARB, in consultation with statewide Metropolitan Planning Organizations (MPOs), is to provide each affected region with passenger vehicle GHG emissions reduction targets for 2020 and 2035 by September 30, 2010. The San Diego Association of Governments (SANDAG) is the San Diego region's MPO. On August 9, 2010 CARB released the staff report on the proposed reduction target for San Diego County, which was subsequently approved by CARB on September 23, 2010. The San Diego region will be required to reduce greenhouse gas emissions from cars and light trucks 7 percent per capita by 2020 and 13 percent by 2035 (SANDAG 2010a). The reduction targets are to 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.

Once reduction targets are established, SB 375 requires MPOs in California to prepare and adopt a Sustainable Communities Strategy (SCS) that demonstrates how the region will meet its greenhouse gas reduction targets through integrated land use, housing, and transportation planning. Enhanced public transit service combined with incentives for land use development that provides a better market for public transit will play an important role in the SCS. After the SCS is adopted by the MPO, the SCS will be incorporated into that region's federally enforceable RTP. SANDAG has completed work on the 2050 RTP, the first such plan in the state that will include an SCS (CARB 2010c; SANDAG 2010a). CARB is also required to review each final SCS to determine whether it would, if implemented, achieve the greenhouse gas emission reduction target

for its region. If the combination of measures in the SCS will not meet the region's target, the MPO must prepare a separate Alternative Planning Strategy (APS) to meet the target. The APS is not a part of the RTP.

As an incentive to encourage implementation of the SCS and APS, developers can obtain relief from certain requirements under the California Environmental Quality Act (CEQA) for those projects that are consistent with either the SCS or APS (CARB 2010c).

3.2.3.8 EO S-7-04/SB 1505 – California Hydrogen Highway Network

This executive order signed in 2004 designated California's 21 interstate freeways as the "California Hydrogen Highway Network", and directed the California Environmental Protection Agency (CalEPA) and all other relevant state agencies to plan and build a network of hydrogen fueling stations along these roadways and in the urban centers. This EO also called for the rapid transition to a hydrogen economy in California by January 1, 2005.

In response to this EO, SB 1505 (Lowenthal) was passed a year later requiring the CARB to adopt regulations to ensure that the production and use of hydrogen for transportation purposes contributes to the reduction of GHGs and other air contaminants (Union of Concerned Scientists 2007).

a. Non-Transportation-Related Emissions Reductions

In the energy sector, Scoping Plan measures aim to provide better information and overcome institutional barriers that slow the adoption of cost-effective energy efficiency technologies. They include enhanced energy efficiency programs to provide incentives for customers to purchase and install more efficient products and processes; and building and appliance standards to ensure that manufacturers and builders bring improved products to market. Over the long term, the recommended measures will increase the amount of electricity from renewable energy sources and improve the energy efficiency of industries, homes and buildings. While energy efficiency gains the largest emissions reductions from this sector, other land development applicable measures such as water conservation, materials use and waste reduction, and green building design and development practices, achieve additional emissions reduction.

3.2.3.9 Renewables Portfolio Standard

The Renewables Portfolio Standard (RPS) promotes diversification of the state's electricity supply. Its purpose is to achieve 33 percent renewable energy mix statewide; providing 33 percent of the state's electricity needs met by renewable resources by 2020 (CARB 2008b). The RPS is included in CARB's Scoping Plan list of reduction measures (see Table 4). Increasing the RPS to 33 percent is designed to accelerate the

transformation of the electricity sector, including investment in the transmission infrastructure and systems changes to allow integration of large quantities of intermittent wind and solar generation. Renewable energy includes (but is not limited to) wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. Increased use of renewables would decrease California's reliance on fossil fuels, thus reducing emissions of GHGs from the electricity sector. CARB estimates that full achievement of the RPS would decrease statewide GHG emissions by 21.3 $MMTCO_2E$ (CARB 2008b).

3.2.3.10 Million Solar Roofs Program

The Million Solar Roofs Program was created by SB 1 in 2006 and includes the CPUC's California Solar Initiative and California Energy Commission's (CEC) New Solar Homes Partnership. It requires publicly owned utilities to adopt, implement and finance solar incentive programs to lower the cost of solar systems and help achieve the goal of installing 3,000 MW of new solar capacity by 2020. The Million Solar Roofs Program is one of CARB's GHG reduction measures identified in the 2008 Scoping Plan (see Table 4). Achievement of the program's goal is expected to equate to a reduction of 2.1 $MMTCO_2E$ in 2020 statewide BAU emissions, as counted toward the total statewide reduction of 173 $MMTCO_2E$ (CARB 2008b).

3.2.3.11 SB 1368 – Public Utility Emission Standards

SB 1368 (Parata), passed in 2006, requires the CEC to set GHG emission standards for entities providing electricity in the state. The bill further requires that the California Public Utilities Commission (CPUC) prohibit electricity providers and corporations from entering into long-term contracts if those providers and corporations do not meet the CEC's standards (Union of Concerned Scientists 2007).

3.2.3.12 Title 24, Part 6 - California Energy Code

The California Code of Regulations, Title 24, Part 6 is the California Energy Code. This code, originally enacted in 1978 in response to legislative mandates, establishes energy efficiency standards for residential and non-residential buildings in order to reduce California's energy consumption. The Code is updated periodically to incorporate and consider new energy efficiency technologies and methodologies as they become available. The most recent amendments to the Code, known as Title 24 2008, or the 2008 Energy Code, became effective January 1, 2010. Title 24 2008 requires energy savings of 15–35 percent above the former Title 24 2005 energy code. At a minimum, residential buildings must achieve a 15 percent reduction in their combined space heating, cooling and water heating energy compared to the Title 24 2005 standards. Incentives in the form of rebates and tax breaks are provided on a sliding scale for buildings achieving energy efficiency above the minimum 15 percent reduction over

Title 24 2005. The reference to Title 24 2005 is relevant in that many of the State's long-term energy and GHG reduction goals identify energy saving targets relative to Title 24 2005. By reducing California's energy consumption, emissions of statewide GHGs may also be reduced.

New construction and major renovations must demonstrate their compliance with the current Energy Code through submission and approval of a Title 24 Compliance Report to the local building permit review authority and the CEC. The compliance reports must demonstrate a building's energy performance through use of CEC-approved energy performance software that shows iterative increases in energy efficiency given selection of various HVAC, sealing, glazing, insulation, and other components related to the building envelope. Title 24 governs energy consumed by the built environment and by the major building envelope systems such as space heating, space cooling, water heating, some aspects of the fixed lighting system, and ventilation. Non-building energy use or "plug-in" energy use (such as appliances, equipment, electronics, plug-in lighting) is independent of building design and not subject to Title 24.

3.2.3.13 Title 24, Part 11 – California Green Building Standards

In 2007, Governor Schwarzenegger directed the California Building Standards Commission to work with state agencies on the adoption of green building standards for residential, commercial and public building construction for the 2010 code adoption process. A voluntary version of this California Green Building Standards Code, referred to as CALGreen, was added to Title 24 as Part 11 in 2009. The 2010 version of CALGreen took effect January 2011 and instituted mandatory minimum environmental performance standards for all ground-up new construction of commercial, low-rise residential, and state-owned buildings; as well as schools and hospitals. It also includes voluntary tiers (I and II) with stricter environmental performance standards. Local jurisdictions must enforce the minimum mandatory requirements and may also adopt the Green Building Standards with amendments for stricter requirements.

The mandatory standards require:

- 20 percent mandatory reduction in indoor water use relative to specified baseline levels;
- 50 percent construction/demolition waste must be diverted from landfills;
- Mandatory inspections of energy systems to ensure optimal working efficiency; and
- Low-pollutant emitting exterior and interior finish materials such as paints, carpets, vinyl flooring and particle boards.

The voluntary standards require:

- Tier I – 15 percent improvement in energy requirements, stricter water conservation requirements for specific fixtures, 65 percent reduction in construction waste, 10 percent recycled content, 20 percent permeable paving, 20 percent cement reduction, cool/solar reflective roof.
- Tier II – 30 percent improvement in energy requirements, stricter water conservation requirements for specific fixtures, 75 percent reduction in construction waste, 15 percent recycled content, 30 percent permeable paving, 30 percent cement reduction, cool/solar reflective roof.

Similar to the compliance reporting procedure described above for demonstrating energy code compliance, compliance with the CALGreen water reduction requirements must be demonstrated through completion of water use reporting forms for both commercial and low-rise residential buildings. The water use compliance form must demonstrate a minimum 20 percent reduction in indoor water use by either showing a 20 percent reduction in the overall baseline water use as identified in CALGreen or a reduced per-plumbing-fixture water use rate.

Related to CALGreen are the earlier Sustainable Building Goal (EO D-16-00) and Green Building Initiative (EO S-20-04). The 2000 Sustainable Building Goal instructed that all state buildings be constructed or renovated and maintained as models of energy, water and materials efficiency. The 2004 Green Building Initiative recognized further that significant reductions in GHG emissions can be achieved through the design and construction of new green buildings as well as the sustainable operation, retrofitting, and renovation of existing buildings.

The CARB Scoping Plan includes a Green Building Strategy with the goal of expanding the use of green building practices to reduce the carbon footprint of new and existing buildings. Consistent with CALGreen, the Scoping Plan recognized that GHG reductions would be achieved through buildings that exceed minimum energy efficiency standards, decrease consumption of potable water, reduce solid waste during construction and operation, and incorporate sustainable materials. Green building is thus a vehicle to achieve the Scoping Plan's statewide electricity and natural gas efficiency targets and to lower GHG emissions from waste and water transport sectors.

In the Scoping Plan, CARB projects that an additional 26 $MMTCO_2E$ could be reduced through expanded green building (CARB 2008b, p.17). However, this reduction is not counted toward the BAU 2020 reduction goal to avoid any double counting, as most of these reductions are accounted for in the electricity, waste, and water sectors. Because of this, CARB has assigned all emissions reductions that occur as a result of green building strategies to other sectors for the purpose of meeting AB 32 requirements, but will continue to evaluate and refine the emissions from this sector.

3.2.3.14 SB 97 – CEQA GHG Amendments

SB 97 (Dutton) passed by the legislature and signed by the governor on August 24, 2007 required the office of Planning and Research (OPR) on or before July 1, 2009, to prepare, develop, and transmit to the Resources Agency amendments to the CEQA guidelines to assist public agencies in the mitigation of GHGs or the effects of GHGs as required under CEQA, including the effects associated with transportation and energy consumption, and required the Resources Agency to certify and adopt those guidelines by January 1, 2010. Proposed amendments to the state CEQA Guidelines for GHG emissions were submitted on April 13, 2009, adopted on December 30, 2009, and became effect March 18, 2010.

Section 15064.4 of the amended Guidelines includes the following requirements for determining the significance of impacts from greenhouse gas emissions. While the amendments require calculation of a project's contribution they clearly do not establish a standard by which to judge a significant effect or a means to establish such a standard.

> (a) The determination of the significance of greenhouse gas emissions calls for a careful judgment by the lead agency consistent with the provisions in section 15064. A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of GHG emissions resulting from a project. A lead agency shall have discretion to determine, in the context of a particular project, whether to:
>
> > (1) Use a model or methodology to quantify greenhouse gas emissions resulting from a project, and which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; and/or
> >
> > (2) Rely on a qualitative analysis or performance based standards.

3.2.4 Local

Since the early 1990s, Chula Vista has been engaged in multiple climate change forums including the UNFCCC, the International Cities for Climate Protection campaign and the U.S. Conference of Mayor's Climate Protection Agreement. The key plans and ordinances that the City has adopted and implemented to achieve citywide GHG emissions reductions are summarized below.

3.2.4.1 ICLEI Cities for Climate Protection

In 1992, the City participated in a program aimed at developing municipal action plans for the reduction of GHGs. This program—the Cities for Climate Protection Program—was sponsored by the International Council of Environmental Initiatives (ICLEI) and the UNEP. This program was developed by ICLEI and the UNEP in response to the UNFCCC, and in recognition that all local planning and development have direct consequences on energy consumption and cities exercise key powers over urban infrastructure, including neighborhood design and over transportation infrastructure such as roads, streets, pedestrian areas, bicycle lanes and public transport.

3.2.4.2 Chula Vista CO_2 Reduction Plan

Each participant in the ICLEI program was to create local policy measures to ensure multiple benefits to the city and at the same time identify a carbon reduction goal through the implementation of those measures. The carbon reduction goal was to fit within the realm of international climate treaty reduction goals. In its CO_2 Reduction Plan developed in 1996 and officially adopted in 2000, Chula Vista committed to lowering its CO_2 emissions by diversifying its transportation system and using energy more efficiently in all sectors. To focus efforts in this direction, the City adopted the international CO_2 reduction goal of returning to pre-1990 levels (i.e. 20 percent below) by 2010. In order to achieve this goal, eight actions were identified, which when fully implemented, were anticipated to save 100,000 tons of CO_2 each year.

As a result of the 2005 GHG Emissions Inventory Report, in May 2007 staff reported to City Council that citywide greenhouse gas emissions had increased by 35 percent (mainly due to residential growth) from 1990 to 2005, while emissions on a per capita basis and from municipal operations decreased by 17 percent and 18 percent, respectively. As a result, the City Council directed staff to convene a Climate Change Working Group (CCWG) to develop recommendations to reduce the community's GHGs in order to meet the City's 2010 GHG emissions reduction targets.

3.2.4.3 Climate Change Working Group

The CCWG, which is composed of residents, businesses, and community organization representatives, helps the City in developing climate-related programs and policies. In 2008, the CCWG reviewed over 90 carbon reduction measures and ultimately chose seven measures to recommend to City Council, which the Council subsequently adopted. The measures were designed to reduce or mitigate climate change impacts by reducing GHG emissions within Chula Vista to 20 percent below 1990 levels in keeping with its CO_2 Reduction Plan and UNFCCC goals, but the horizon date was delayed to 2012 instead of 2010. The measures are described below in the following section.

In October 2009, the City Council directed the CCWG to evaluate how the City could "adapt" to potential climate change impacts. The group will be meeting throughout 2010 to develop recommendations based on the City's vulnerabilities and risks to climate change.

3.2.4.4 Chula Vista Climate Protection Measures

On July 10, 2008, the City Council adopted implementation plans for seven climate protection measures to reduce GHG emissions to 20 percent below 1990 levels by 2012. Since the adoption of these measures, the CARB published its BAU 2020 forecast and Scoping Plan described in Section 3.2.3.3, which established statewide reduction measures necessary to achieve the AB 32 goal of reducing GHG emissions to 1990 levels by 2020. This goal is reflected in the City's adopted GHG significance thresholds for project-specific analysis under CEQA (see Section 4.1)

Nonetheless, the implementation plans outline the detailed strategy for initiating, funding, and tracking the following measures (City of Chula Vista 2008b):

1. *Clean Vehicle Replacement Policy for City Fleet:* When City fleet vehicles are retired, they will be replaced through the purchase or lease of alternative fuel or hybrid substitutes. In addition, the City fleet will begin to pursue installing new fuel tanks to allow heavy-duty vehicles to convert to biodiesel fuel immediately.

2. *Clean Vehicle Replacement Policy for City-Contracted Fleets:* As contracts for City-contracted fleet services (such as transit buses, trash haulers and street sweeper trucks) are renewed, the City will encourage contractors to replace their vehicles with alternative fuel or hybrid substitutes through the contract bid process. In addition, the City will pursue implementing two hydrogen vehicle demonstration projects.

3. *Business Energy Assessments:* Although not mandatory, businesses will be encouraged to participate in a no cost energy assessment of their facilities to help identify opportunities for them to reduce monthly energy costs. The business assessment will be integrated into the existing business licensing process and codified through a new municipal ordinance.

4. *Green Building Standard:* Chula Vista will implement a citywide, mandatory green building standard for new construction and major renovations. The new standard will have 3 main components: (1) a minimum energy efficiency (carbon equivalent) requirement of 15 percent above the 2005 Title 24, (2) the early adoption of the new California Green Building Codes for all residential and commercial projects, and (3) a Carbon Offset Fee available for projects not meeting the 15 percent above Title 24 threshold.

5. *Solar and Energy Efficiency Conversion Program:* The City will create a community program to provide residents and businesses a streamlined, cost-effective opportunity to implement energy efficiency improvements and to install solar/renewable energy systems on their properties. The City will develop a funding mechanism to allow program participants to voluntarily choose to place the improvement costs on their property's tax rolls, thereby avoiding large upfront capital costs. In addition, the program will promote vocational training, local manufacturing, and retail sales opportunities for environmental products and services. To help stimulate the private-sector renewable market and lower the cost for installing renewable energy systems on new homes, the City will require all new residential buildings to include pre-wiring and pre-plumbing for solar photovoltaic and solar hot water systems, respectively.

6. *Smart-Growth Around Trolley Stations:* The City will continue to implement the "Smart-Growth" design principles, which promote mixed-use and walkable and transit-friendly development, particularly in and around the E, H, and Palomar trolley stations. These principles were emphasized in the revised Chula Vista General Plan and the Urban Core Specific Plan. In particular, the City will initiate site planning, design studies and Specific Area Plan development to further support "Smart-Growth" development that complements greenhouse gas reductions.

7. *Turf Lawn Conversion Program:* The City will create a community program to provide residents and businesses a streamlined, cost-effective opportunity to replace their turf lawns with water-saving landscaping and irrigation systems. Some municipal turf lawn areas (such as medians, fire stations and non-recreational park areas) will also be converted to act as public demonstration sites and to reduce monthly water costs. The City will establish the model for water-wise landscaping for new development through an update of its Municipal Landscape Ordinance and Water Conservation Plan Guidelines.

An Implementation Progress Report, published in February 2010, reports the implementation status and milestones for each measure. Most measures are meeting milestones outlined in their original implementation plans (City of Chula Vista 2010).

3.2.4.5 Chula Vista Green Building Standards

Consistent with measure 4 above (Section 3.2.4.4), the City Council adopted the Green Building Standards ordinance (GBS ordinance) (Ordinance No. 3140) on October 6, 2009, which became effective November 5, 2009. This represents early adoption of the California Green Building Standards discussed in Section 3.2.3.13, with amendments to include major remodels (not just ground-up new construction) and all residential (not just low-rise single-family residential). Permit applications for all new/remodel residential and

non-residential projects submitted on or after November 5, 2009 are required to comply with the GBS ordinance. Through adherence to the GBS ordinance, new residential and non-residential construction, additions, remodels and improvements will benefit from enhanced energy efficiency, pollutant controls, interior moisture control, improved indoor air quality and exhaust, indoor water conservation, storm water management, and construction waste reduction and recycling. The complete Green Building Standards and Ordinance are included in Attachment 2.

As required by the GBS ordinance, as part of the application for a building permit, construction plans and specifications shall indicate in the general notes or individual detail drawings the Green Building Standards and product specifications and methods of construction that are required. The Building Official may require the applicant to retain the services of a consultant having expertise in Green Building and or energy efficiency techniques to review and evaluate complex systems and/or alternate methods or materials of construction and provide recommendations as to compliance with the requirements of the ordinance. No building permit shall be issued for any project subject to the Standards until the Building Official has determined that the plans and specifications submitted for the building permit are in compliance with the requirements. Compliance verification shall be performed by the Building Official, who shall verify that the green building measures and specifications indicated on the permitted plans and construction documents are being implemented at foundation, framing, electrical, plumbing, mechanical, and any other required inspections, and prior to issuance of a final certificate of occupancy. Additional inspections may be conducted as needed to ensure compliance, and during the course of construction and following completion of the project, the City may require the applicant to provide information and documents showing use of products, equipment and materials specified on the permitted plans and documents.

If at any stage of construction the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a Stop Order may be issued pursuant to CVMC Section 15 06 060 D. At the discretion of the Building Official, the stop work order may apply to the portion of the project impacted by noncompliance or to the entire project. The stop work order shall remain in effect until the Building Official determines that the project will be brought into compliance with the permitted plans and documents.

Prior to final building approval or issuance of a certificate of occupancy the Building Official shall review the information submitted by the applicant and determine whether the applicant has constructed the project in accordance with the permitted plans and documents. If the Building Official determines that the applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and final certificate of occupancy may be withheld until the Building Official determines that the project is in compliance with the GBS ordinance.

3.2.4.6 Chula Vista Increased Energy Efficiency Standards

On January 26, 2010, the City Council adopted the Increased Energy Efficiency Standards ordinance (Ordinance No. 3149). This ordinance became effective February 26, 2010 as section 15.26 of the Municipal Code, and permit applications submitted on or after this date are required to comply with these new energy efficiency standards. The ordinance is included in Attachment 2.

Section 15.26.030 of the Municipal Code requires permit applications to comply with increased energy efficiency standards that achieve 15 to 20 percent greater efficiency than the requirements of the 2008 California Energy Code, Building Energy Efficiency Standards (Title 24, Part 6), depending on climate zone. As shown in Figure 4, the City falls within two climate zones, zone 7 and zone 10.

For climate zone 7, the Code requires:

- All new low-rise residential building or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditional floor area, shall use at least 15 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards allow; and

- All new non-residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non-residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area, shall use at least 15 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards.

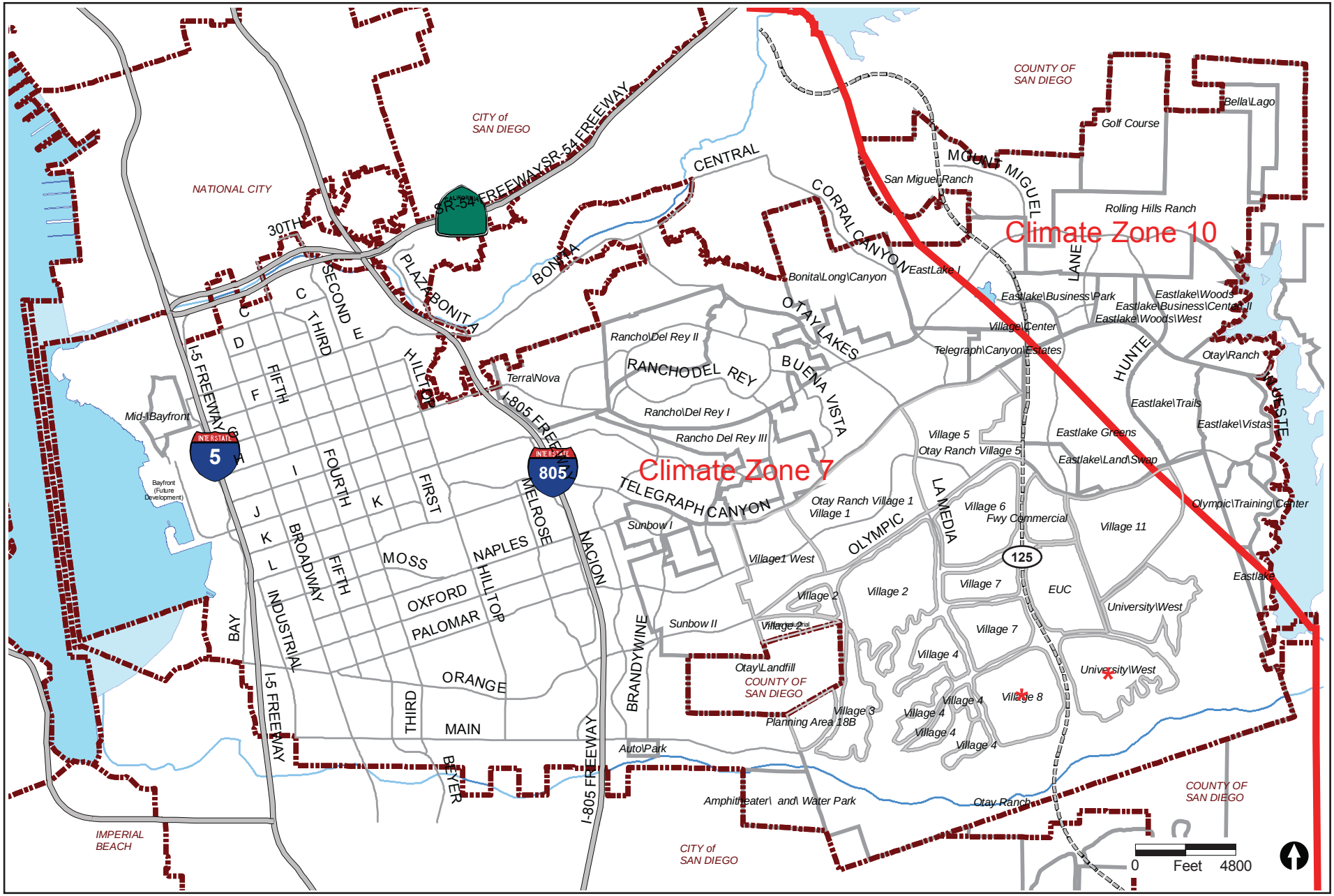
Most of the City lies within climate zone 7 (including the Proposed Project), as shown in Figure 4. For areas further east in climate zone 10, the Municipal Code requires projects to use 20 percent less energy than the 2008 Title 24 Building Energy Efficiency Standards allow. This is to address the higher energy demands typically associated with warmer, inland locations that use more cooling and air conditioning systems.

No City building permit shall be issued unless the permit application demonstrates to the Building Official compliance with the requirements of Section 15.26.030. Compliance is to be demonstrated based on a performance approach, using a CEC-approved energy compliance software program, as specified in the Title 24 2008 Building Energy Efficiency Standards.

3.2.4.7 Regional Climate Action Plan

The SANDAG Regional Climate Action Plan (RCAP) is a long-range policy (year 2030) that focuses on transportation, electricity and natural gas sectors. It complements the Regional Energy Strategy 2030 Update and feeds into the SANDAG Regional

Map Source: City of Chula Vista Geographic Information System, February 2006



Climate Zone Boundary

* Project Location

FIGURE 4

City Climate Zones

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Transportation Plan (RTP) and Regional Comprehensive Plan (RCP). It is currently in process of being prepared and no regional GHG emissions caps or reduction targets have been identified.

4.0 Significance Criteria and Analysis Methodologies

4.1 Determining Significance

To date, there have been no regional, state, or federal regulations establishing a threshold of significance to determine project-specific impacts of GHG emissions. As allowed by the CEQA Guidelines, after considering the thresholds of significance adopted or recommended by other public agencies and experts, including those adopted by the Bay Area and San Joaquin Air Quality Management Districts and the various options reviewed by the CARB, the City has developed its own significance thresholds. The City's thresholds are grounded in statute (AB 32) and executive order (EO S-3-05) and offer a way to achieve the 2020 goal of AB 32. The 2020 goal of AB 32 is to return statewide GHG emissions to 1990 levels by 2020. The City's threshold was established based on this goal of AB 32 and the reduction measures needed to achieve it as identified in the CARB Scoping Plan and as shaped by the assumptions of the business-as-usual (BAU) 2020 statewide forecast.

4.1.1 Business-as-Usual 2020 Emissions

As described above in Section 3.2.3.2, AB 32 directed the CARB to develop a Scoping Plan that identified the reduction measures needed to achieve the targets established in AB 32/EO S-3-05. In order to assess the scope of the needed reductions, CARB first estimated BAU 2020 GHG emissions, as shown below in Table 5.

TABLE 5
CALIFORNIA BAU 2020 GHG EMISSIONS FORECAST

Sector	Projected 2020 Emissions in $MMTCO_2E$ (% total)
Transportation	225.4 (38%)
Electric Power	139.2 (23%)
Commercial and Residential	46.7 (8%)
Industry	100.5 (17%)
Recycling and Waste	7.7 (1%)
High GWP	46.9 (8%)
Agriculture	29.8 (5%)
Forest Net Emissions	0.0
TOTAL	**596.4**

SOURCE: California 2020 GHG Emissions Forecast. Prepared by the CARB. Last updated October 2008; last reviewed May 28, 2010. Available at http://www.arb.ca.gov/cc/inventory/data/forecast.htm. Accessed May 28, 2010.

Table 5 represents the statewide GHG emissions that would be expected to occur in the absence of the GHG reduction measures identified in the Scoping Plan. This forecast also assumed energy efficiency in commercial and residential buildings in accordance with the 2005 Title 24 energy code, water conservation in accordance with the 2006 plumbing code, and waste diversion in accordance with the 1989 Integrated Waste Management Act. In its transportation-related emissions forecast, CARB assumed that total statewide VMT would increase based on growth in statewide population and fixed average trip lengths and vehicle fleet mix. Based on these assumptions, CARB estimated that statewide BAU 2020 GHG emissions will be 596.4 $MMTCO_2E$.

4.1.2 Scoping Plan Reduction Measures

As discussed in Section 3.2.3.3, the Scoping Plan identifies 16 measures that would provide reductions allowing the state to achieve a total GHG emissions reduction of 174 $MMTCO_2E$ by 2020 (see Table 4). Of these measures, three are measures that are, to some extent, within the control of the City. The Scoping Plan reduction measures the City has control over are listed in Table 6 below and include the Energy Efficiency, Regional Transportation-Related GHG Targets, and the Million Solar Roofs measures. Full statewide implementation of these three measures is projected to result in a 33.4 $MMTCO_2E$ reduction in GHG emissions by 2020, for a 19.2 percent reduction in forecasted BAU 2020 emissions.

TABLE 6
CARB SCOPING PLAN RECOMMENDED GHG REDUCTION MEASURES WITHIN CITY'S CONTROL

Recommended Reduction Measures	Reductions Counted Towards 2020 Target in $MMTCO_2E$	Percentage of Total Reductions Counted Towards 2020 Target
REDUCTIONS COUNTED TOWARDS 2020 TARGET WITHIN CITY CONTROL	**33.4**	**19.2%**[1]
Energy Efficiency	26.3	
Regional Transportation-Related GHG Targets	5.0	
Million Solar Roofs	2.1	
REDUCTIONS COUNTED TOWARDS 2020 TARGET NOT WITHIN CITY CONTROL (see Table 4)	**140.6**	80.8%
TOTAL REDUCTIONS COUNTED TOWARDS 2020 TARGET	**174**	100**%**

Based on Table 2 of the Climate Change Scoping Plan: A Framework for Change. Prepared by the California Air Resources Board, pursuant to AB 32 the California Global Warming Solution Act of 2006. December 2008.
[1]19.2% is relative to the targeted total reduction of 174 $MMTCO_2E$. The BAU 2020 forecast initially projected a targeted reduction of 169 $MMTCO_2E$. The proportion of these three Scoping Plan measures would be 19.8 percent relative to that number.

To conform to the Scoping Plan, a proposed project would have to provide the same proportional reduction relative to BAU that the Scoping Plan identifies for these three measures. Rounding this number up to the nearest whole number results in a 20 percent proportion. As allowed in the Scoping Plan, project reductions could come from any one or combination of the three identified measures or complementary measures. For example, energy-related reductions could come from improved building energy efficiency, advanced water conservation measures, or solid waste reduction measures. Transportation-related reductions could come from project features that encourage alternate travel choices, such as through public transportation proximity, subsidized transit passes, preferential parking for carpool vehicles and low-carbon vehicles, bicycle facilities, walking paths; or shorter vehicle trip lengths, such as through the integration of housing proximate to employment, recreation, and community services. In this latter regard, vehicle trip lengths associated with a given project would have to alter the average regional trip length in order to be sufficient enough to change the statewide VMT assumptions in the BAU emissions forecast and associated Scoping Plan vehicle emissions reduction estimates.

4.1.3 Significance Thresholds

Based on the Scoping Plan and its associated BAU 2020 emissions forecast assumptions, the City has established the following City GHG thresholds of significance for land development projects. The City has determined that a project would have significant global climate change effects if it would:

- Conflict with or obstruct the achievement of the Scoping Plan reduction measures by not reducing its GHG emissions by at least 20 percent over that which would have been expected to occur in the BAU condition; or

- Conflict with any other applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs.

These thresholds are grounded in statute (AB 32) and executive order (S-3-05), and supported by substantial evidence in the CARB's BAU 2020 Forecast and Climate Change Scoping Plan. In addition, these thresholds are consistent with the amended CEQA Guidelines which state that cumulative impacts may be measured relative to a cumulative baseline that includes a

> …summary of projections contained in an adopted local, regional, or statewide plan, or related planning document, that describes or evaluates conditions contributing to the cumulative effect. Such plans may include: a general plan, regional transportation plan, or plans for the reduction of GHG emissions.

4.2 Methodology and Assumptions

Emission estimates were calculated for the three GHGs of primary concern (CO_2, CH_4, and N_2O) that would be emitted from the Proposed Project's construction and five sources of operational emissions: on-road vehicular traffic, electricity generation, natural gas consumption, water usage, and solid waste disposal. The method of quantifying GHG emissions in this analysis was based on methodologies recommended and used by several California air quality management districts (AQMD), including the South Coast and Bay Area AQMDs; as well as by the CARB.

To evaluate the Proposed Project relative to the BAU 2020 Forecast, emissions of each source of GHGs were estimated first for a project-equivalent under BAU conditions, assuming building energy efficiency in accordance with the 2005 Title 24 energy code, water conservation in accordance with the current plumbing code, and solid waste disposal quantities in accordance with current statewide legislation. A 20 percent reduction of this amount was then calculated in order to identify the targeted cap in GHG emissions attributable to the Proposed Project. Lastly, emissions of each source of GHGs were estimated for the Proposed Project assuming building energy and water efficiencies required in City ordinances and General Plan policy. This methodology allows for a comparison between the Proposed Project and BAU 2020 relative to the identified significance determination thresholds. These scenario analyses are included in Sections 5.1.1.1 and 5.1.1.2. Emissions calculations for all of these scenarios started with the following identical land use assumptions:

TABLE 7
FUTURE (YEAR 2020) MODELED LAND USES

Land Use	Quantity
Residential	6,050 dwelling units
Commercial	1,800,000 square feet
Industrial	2,200,000 square feet
Park	55.4 acres
School	51.4 acres
Community Purpose Facility	10.8 acres
University	50.0 acres

The land use assumptions in Table 7 reflect the total allowable buildout as envisioned in the Proposed Project for Village 8 West, Village 9 and the 85-acre RTP. By multiplying the GHG emissions calculated for the Proposed Project by a factor of 1.5, an expanded cumulative projects area can be accounted for that includes the Village 8 East and the Planning Area 10 projects. This analysis is provided in Section 5.1.1.3.

Complete emissions calculations are contained in Attachment 3.

4.2.1 Estimating Vehicle Emissions

Vehicle emissions were estimated using emission factors developed by the Bay Area AQMD and EPA in a fuel-based methodology using the following equation:

E = *EF* X *Fuel* X *C* X *GWP*

Where *E* is emission in metric tons per year; *EF* is an emission factor normalized for engine fuel consumption and expressed in units of pounds of GHG per gallon of transportation fuel; *Fuel* is the total quantity of fuel consumed per year; *C* is a constant reflecting the conversion of pounds to metric tons; and *GWP* is the global warming potential of each GHG. This fuel-based method is based on the equation used in CARB's OFFROAD2007 and EMFAC2007 models to estimate off- and on-road vehicle emissions:

E = *EF* X *Pop* X *AvgHp* X *Load* X *Activity*

where *E* is emission in tons per day; *EF* is an emission factor expressed in units of work done by the engine (e.g., g/bhp-hr); *Pop* is the engine population (number of engines in use); *AvgHp* is the average rated power of these engines; *Load* is the load on the engines relative to their average rated power; and *Activity* is the average annual hours of use per engine. However the fuel-based method simplifies the equation by using emission factors normalized for fuel consumption and allows the use of readily available and accurate regional fuel sales data. This method of calculating vehicle emissions also has the advantage of being able to estimate emissions for all three primary GHGs, while

some computer models such as URBEMIS2007 can only directly estimate CO_2 emissions. The fuel-based calculation is thus commonly used to estimate regional emissions from the transportation sector (UCTC 1996, 2000), and is similar to the method CARB used in their BAU 2020 emissions forecast, which used statewide fuel sales data and statewide average VMT.

In this analysis, annual fuel consumption is obtained by multiplying the Proposed Project ADT obtained from the traffic study (LLG 2011) by the local (for the Proposed Project) and regional average (for BAU) trip lengths determined by SANDAG (2009, 20010b). The total VMT derived from this calculation is then multiplied by average vehicle mileage as identified by Caltrans to obtain total fuel consumption. This value is then multiplied by the emission factors in Table 8 to estimate GHG emissions.

4.2.2 Estimating Construction Emissions

Construction activities emit GHGs primarily though combustion of fossil fuels in the engines of off-road construction equipment (mostly diesel) and in the on-road vehicles of the construction workers. Smaller amounts of GHGs are also emitted through the energy use embodied in any water use (for fugitive dust control) and lighting for the construction activity. Construction emissions are not accounted for in the BAU 2020 forecast, and reductions in construction emissions are not specifically identified in the CARB Scoping Plan. However, the Association of Environmental Professionals (AEP) has recently recommended that total construction emissions be amortized over 30 years and added to operational emissions (AEP 2010).

Typically, project-level information is used to calculate construction emissions. In this analysis, given lack of project-specific information, construction emissions were estimated by multiplying the proposed land uses (Table 7, above) by annual construction emission rates of 0.077 $MTCO_2E$ per residential dwelling unit and 0.006 $MTCO_2E$ per square foot of non-residential use. These values were obtained through review of other project-level analyses (City of San Diego 2010a, 2010b).

4.2.3 Estimating Building Use Emissions

For estimates of non-transportation related operational emissions, total projected energy, water, and waste demands were multiplied by emission factors for each emission source and each GHG.

4.2.3.1 Electricity and Natural Gas Estimates

GHG emissions associated with electricity use were calculated by multiplying the total number of dwelling units, commercial and industrial square footage, and park, school, and community purpose facility acreages by the average electricity consumption rates

used in CARB's 2011 California Emissions Estimator Model (CalEEMod) obtained from the CEC end-use surveys for residential and non-residential uses (CEC; 2004 and 2006). These values were then multiplied by the electricity generation GHG emission factors contained in Table 8.

For the BAU calculations, 2006 statewide average electricity consumption rates of 590.88 kilowatt hours (kWh) per single-family residential unit per month, 360.39 kWh per multi-family residential unit per month, 14.10 kWh per commercial square foot per year, 17.60 kWH per industrial square foot per year, 6.35 kWh per school square foot per year, 11.35 kWh per university square foot per year, and 9.38 kWh per square foot per year of park and community purpose uses were used, consistent with the BAU 2020 forecast assumption of building energy efficiency in accordance with the Title 24, Year 2005 energy code.

For the Proposed Project calculations, a 30 percent improvement in residential and non-residential building energy efficiency was assumed based on the requirements of the Increased Energy Efficiency ordinance of the City's Municipal Code. This ordinance is described in Section 3.2.4.6 and would achieve a 15 percent reduction in building energy use compared to the existing 2008 Title 24 energy code and thus a 30 percent reduction in building energy use compared to BAU assumptions.

GHG emissions associated with natural gas were also calculated using rates obtained from CalEEMod/the CEC and the natural gas generation GHG emission factors shown in Table 8. Statewide monthly average natural gas consumption rates of 5,198.70 cubic feet per single-family residential unit, 3,128.97 cubic feet per multi-family residential unit, 2.90 cubic feet of natural gas per square foot of commercial space, 1.29 cubic feet per square foot of school space, 3.48 cubic feet per square foot of university space, 2.77 cubic feet per square foot of community purpose facility, 0.25 cubic feet per square foot of active park use, and 241,611 cubic feet per industrial consumer (assuming a minimum 2-acre lot size) were used to calculate BAU emissions.

For the Proposed Project calculations, a 30 percent improvement in building energy efficiency was assumed based on the requirements of the Municipal Code as described above. These values were then multiplied by the emission factors in Table 8 for natural gas consumption to obtain estimated quantities of GHG emissions.

4.2.3.2 Water Use Emissions Estimates

The GHG emissions associated with water use are calculated by multiplying the embodied energy in a gallon of potable water by the total number of gallons projected to be consumed by the project and then by the electricity generation GHG emission factors. For these estimates, it is assumed that water delivered to the Project site would have an embodied energy of 2,779 kWh/acre foot or 0.0085 kWh/gallon (Torcellini 2003).

To calculate the projected water demand of the Project and BAU, water demand rates by land use type were obtained from the October 2008 Otay Water District Water Resources Master Plan Update (WRMP) and multiplied by the proposed quantities of residential units and non-residential square footage projected for buildout of the Proposed Project.

BAU water use assumptions based on the 2008 WRMP would be as follows: single-family residential units would consume 500 gallons per day (gpd) per unit; multi-family residential would consume 255 gpd[1] per unit; schools and universities would consume 1,785 gpd per acre, parks would consume approximately 2,155 gpd per acre, community purpose facilities would consume approximately 893 gpd per acre, commercial uses would consume 0.14 gpd per square foot; and industrial uses would consume 0.07 gpd per square foot.

Applying conservation measures required in the City's GBS Ordinance, described in Section 3.2.4.5, the Proposed Project's water use would achieve a 20 percent reduction in water consumption (and associated embodied energy) compared to BAU assumptions. Therefore, accounting for the advanced conservation measures of the Proposed Project, BAU/WRMP water consumption rates were adjusted as follows: single-family residential units would consume 400 gpd per unit; multi-family residential units would consume 204 gpd per unit; schools and universities would consume 1,428 gpd per acre; parks would consume approximately 1,724 gpd per acre, community purpose facilities would consume 714.4 gpd per acre, commercial uses would consume 0.11 gpd per square foot; and industrial uses would consume 0.06 gpd per square foot.

4.2.3.3 Solid Waste Emissions Estimates

For both the BAU calculations and the Proposed Project calculations, a countywide average waste disposal rate was used and was obtained from the California Department of Resources Recycling and Recovery (CalRecycle) as included in CalEEMod. While the Proposed Project would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average, these savings cannot be estimated at this time.

CalRecycle maintains a list of different waste generation rates for residential, commercial, and other uses. The multi-family residential waste generation rates range from 3.6 to 8.6 pounds per unit per day, the single-family residential waste generation rates ranged up to 11.4 pounds per unit per day, and the commercial generation rates range from 0.0025 to 0.046 pounds per square foot per day (CalRecycle 2009). To be

[1] Recommended rate of 300 gpd/unit reduced by 0.85 to account for reclaimed water use.

conservative, the higher generation rates of 11.4 pounds daily per single-family dwelling unit, 8.6 pounds per unit per day for multi-family residential, 2.60 pounds per square foot per day for schools and universities, 11.4 pounds per square foot per day for community purpose facilities, 4.76 tons per acre per year for park uses, and 0.046 pounds per square foot per day for commercial and industrial uses were used to determine the total volume of waste by weight. These values were then multiplied by emissions factors used in the EPA Waste Reduction Model (WARM) for the different material classes (glass, metal, plastic, etc.) and two different waste streams (to landfill or to recycling). For the landfill estimates, landfill gas recovery for energy was assumed, and for both the landfill and recycling estimates, a truck haul distance of 20 miles and frequency of once per week. Local recycling and disposal (to landfill) percentages (of total waste generated) were also obtained from CalRecycle and reflect current waste disposal practice in accordance with the statutory 50 percent diversion mandate.

4.2.4 General Assumptions

The emission factors used to calculate vehicle, electricity and natural gas GHG emissions are shown below.

TABLE 8
GHG EMISSION FACTORS

Gas	Vehicle Emission Factors (pounds/gallon gas)[1]	Electricity Generation Emission Factors (pounds/MWh)[2, 3]	Natural Gas Combustion Emission Factors (pound/million ft^3)[4]
Carbon Dioxide	19.564	1,340	120,000
Methane	0.00055	0.0111	2.3
Nitrous Oxide	0.0002	0.0192	2.2

[1]SOURCE: BAAQMD 2006.
[2]SOURCE: U.S. DOE 2002.
[3]Emissions associated with water use are calculated from the embodied energy in a gallon of water multiplied by the same emissions factors for electricity generation. Waste emissions were similarly calculated using the U.S. EPA Waste Reduction model (WARM) emission factors specific to each waste type (e.g., glass, metal, plastic).
[4]SOURCE: U.S. EPA 1998.

Emissions estimated for each of the five emission sources are summed and expressed in terms of total metric tons carbon dioxide equivalent or $MTCO_2E$. CO_2-equivalent emissions are the preferred way to assess combined GHG emissions because they give weight to the GWP of a gas. The GWP, as described above in Section 1.1, is the potential of a gas to warm the global climate in the same amount as an equivalent amount of emissions of CO_2. CO_2 thus has a GWP factor of 1. Methane (CH_4) has a GWP factor of 21 and nitrous oxide (N_20) has a GWP of 310, which means they have a greater global warming effect than CO_2.

5.0 Impact Analysis

5.1 Project Emissions Relative to BAU

5.1.1 Impacts

To evaluate the significance of the Proposed Project's contribution of GHG emissions relative to statewide emissions and BAU reductions, GHG emissions from transportation, electricity, natural gas and water consumption, solid waste disposal, and construction activities, were estimated first for BAU, then for the Proposed Project. The Proposed Project calculations account for GHG emissions reductions from project-specific design features as well as applicable statewide emissions reduction programs.

5.1.1.1 BAU Emissions

a. Transportation-Related Emissions

Transportation-related GHG emissions comprise the largest contributor to existing and forecast GHG emissions, accounting for 38 percent of the total statewide forecasted BAU 2020 emissions (CARB 2008c). On-road vehicles alone account for 35 percent of the total forecasted BAU 2020 emissions. Transportation-related GHG emissions are generated from the combustion of fossil fuels (primarily gasoline and diesel) in vehicle engines. The quantity and type of transportation fuel consumed determines the amount of GHGs emitted from a vehicle. Therefore, not only are vehicle engine and fuel technologies of importance, but so too are the amount of vehicle trips and trip distances that motorists travel.

The traffic study projects that the proposed buildout of Villages 8 West, 9 and the 85-acre RTP would generate 113,073 ADT (LLG 2011). Based on the regional average trip length of 5.8 miles (SANDAG 2009) and an average fuel economy of 18.80 mpg for 2020 (Caltrans 2009), a total of 655,823 vehicle miles would be traveled each day and 34,884 gallons of vehicle fuel would be consumed each day under BAU conditions. Using the vehicle emissions factors contained in Table 8, the combustion of this fuel would result in the emission of 113,416.15 $MTCO_2E$ each year assuming BAU.

b. Electricity Emissions

Electric power generation accounted for the second largest sector contributing to existing and projected statewide GHG emissions, comprising 24 percent of the total statewide BAU 2020 emissions (CARB 2008c). Buildings use electricity for lighting, heating and cooling. Electricity generation entails the combustion of fossil fuels, including natural gas and coal, which are then stored and transported to end users. A

building's electricity use is thus associated with the off-site or indirect emission of GHGs at the source of electricity generation (i.e. the power plant).

Based on 887 single-family residences, 5,163 multi-family residences, 51.4 acres of schools, 50.0 acres of university use, 10.8 acres of community purpose use, 1.8 million square feet of commercial, 2.2 million square feet of industrial space, and 55.4 acres of park space, buildout under BAU assumptions would annually consume 159,018 MWh of electricity. The residential uses would consume approximately 28,618 MWh, the school uses would consume approximately 14,218 MWh, the university uses would consume approximately 24,655 MWh, the community purpose space would consume 4,413 MWh, the commercial uses would consume a maximum of 25,380 MWh, and the industrial uses would consume a maximum of 27,320 MWh each year. The park acreage could consume up to 15,845 MWh annually if developed into active recreational facilities such as a health or racquet club. Passive park space would consume less electricity. These estimates are based on average electricity consumption rates for southern California as identified by the CEC in the URBEMIS 2007 and 2011 CalEEMod air emissions models (CEC; 2004 and 2006). This quantity of electricity consumption equates to the emission of 17,474.49 $MTCO_2E$ each year from residential uses, 15,497.51 $MTCO_2E$ each year from commercial uses, 8,681.51 $MTCO_2E$ each year from schools, 15,054.79 $MTCO_2E$ each year from university uses, 2,694.54 $MTCO_2E$ each year from community purpose uses, 13,822 $MTCO_2E$ each year from active park uses, and 23,874.88 $MTCO_2E$ each year from industrial uses; totaling 97,099.72 $MTCO_2E$ each year.

c. Natural Gas Emissions

Buildings combust natural gas primarily for heating and cooking purposes, resulting in the emission of GHGs. GHG emissions associated with natural gas combustion are estimated by multiplying the total number of dwelling units by average residential natural gas consumption rates and then by their respective GHG emissions factors.

Based on 887 single-family residences, 5,163 multi-family residences, 1.8 million square feet of commercial space, 51.4 acres of schools, 50.0 acres of university use, 10.8 acres of community purpose use, 55.4 acres of park space, and 2.2 million square feet of industrial space, buildout under BAU assumptions would annually consume 583.48 million cubic feet of natural gas. The residential uses would consume approximately 249.19 million cubic feet, the commercial uses would consume approximately 62.64 million cubic feet, the schools would consume approximately 34.70 million cubic feet, the university uses would consume approximately 90.86 million cubic feet, community purpose uses would consume approximately 15.62 million cubic feet, park uses would consume up to approximately 7.24 million cubic feet, and the industrial uses would consume approximately 123.22 million cubic feet each year. This equates to the emission of 13,646.41 $MTCO_2E$ GHG emissions each year from residential uses, 3,430.31 $MTCO_2E$ each year from commercial uses, 1,900.49 $MTCO_2E$ each year from schools, 4,975.86 $MTCO_2E$ each year from university uses, 855.33 $MTCO_2E$ each year

from community purpose facilities, 396.46 $MTCO_2E$ each year from park uses, and 6,747.90 $MTCO_2E$ each year from industrial uses; totaling 31,952.76 $MTCO_2E$ GHG emissions each year.

d. Water Use Emissions

The provision of potable water consumes large amounts of energy associated with source and conveyance, treatment, distribution, end use, and wastewater treatment. This type of energy use is known as embodied energy. Water delivered to the site would have an embodied energy of 2,779 kWh/acre foot or 0.0085 kWh/gallon.

Multiplying the proposed 887 single-family residential units, 5,163 multi-family residential units, 51.4 acres of school use, 50.0 acres of university use, 55.4 acres of parks, 10.8 acres of community purpose, 1.8 million square feet of commercial space, and 2.2 million square feet of industrial space, by the WRMP daily water demand rates of 500 gpd per single-family residential unit, 255 gpd per multi-family unit, 1,785 gpd per school acre, 1,785 gpd per university acre, 2,155 gpd per park acre, 893 gpd per community purpose acre, 0.14 gpd per commercial square foot, and 0.07 gpd per industrial square foot, yields a total daily combined water demand of 2,388,355 gallons under BAU assumptions. Annual BAU water demand would total approximately 904,325,679 gallons. Of this annual total, approximately 642,423,725 gallons would be associated with residential uses, 33,488,385 gallons would be associated with school uses, 32,576,250 gallons would be associated with school uses, 43,576,255 gallons would be associated with park uses, 3,520,206 gallons would be associated with community purpose uses, 91,980,000 gallons with commercial uses, and 56,760,858 gallons would be associated with industrial uses. The embodied energy demand associated with this total water use would equate to 7,686.77 MWh per year. Multiplying this value by the electricity emission factors for the three primary GHGs of concern in Table 8 yields an estimated annual emission associated with BAU water use of 4,693.69 $MTCO_2E$.

e. Solid Waste Emissions

The disposal of solid waste produces GHG emissions from anaerobic decomposition in landfills, incineration, and from the combustion of transportation fuel in the haul trucks that transport waste.

Based on 6,050 residential units, 1.8 million square feet of commercial space, 2.2 million square feet of industrial space, 10.8 acres of community purpose facilities, 51.4 acres of schools, 50.0 acres of university use, and 55.4 acres of park space, buildout under BAU assumptions would annually generate approximately 52,396 tons of solid waste each year. The residential uses would generate approximately 9,948 tons, the commercial uses would generate approximately 15,111 tons, the school uses would generate approximately 2,911 tons, the university use would generate approximately 2,831 tons,

the community purpose facility would generate approximately 2,682 tons, the park would generate approximately 264 tons, and the industrial uses would generate approximately 18,650 tons each year. GHG emissions associated with the disposal or diversion of this waste would equal approximately 8,370.33 $MTCO_2E$ per year.

f. Construction Emissions

Based on estimates of construction-related emissions for typical residential and non-residential projects, approximate annual emission rates of 0.077 $MTCO_2E$ per residential dwelling unit and 0.006 $MTCO_2E$ per non-residential square foot were determined. Multiplying these values by the proposed 6,050 residential units, 4 million square feet of commercial/industrial use, 51.4 acres of schools (converted to 1.79 million square feet based on a conservative coverage ratio of 0.80:1), 50.0 acres of university use (converted to 1.74 million square feet based on a conservative coverage ratio of 0.80:1), 10.8 acres of community purpose facility (converted to 376,358 square feet based on a conservative 0.80:1 coverage ratio) and 55.4 acres of park use (converted to 603,306 square feet of park structure space based on a conservative structure/park acre ratio of 0.25:1) results in annual construction emissions of 51,545.36 $MTCO_2E$.

5.1.1.2 Proposed Project Emissions

a. Transportation-Related Emissions

Proposed Project Average Trip Length Relative to Regional VMT

The BAU 2020 forecasted increase in transportation-related GHG emissions is dominated by an increase in emissions from on-road passenger vehicles; hence the emphasis in the CARB Scoping Plan on measures to reduce GHG emissions from on-road passenger vehicles (refer to Table 4).

CARB's estimated growth in vehicle emissions resulted from projected growth in statewide VMT due primarily to statewide population growth as projected by the Department of Finance. CARB's statewide VMT projections held average vehicle trip length and vehicle fleet mix constant. The BAU trip length for the San Diego region would thus be 5.8 miles, as currently reported by SANDAG (2009).

If a plan or project were to add motorists or to increase local trip lengths to such a degree that the regional average trip length was increased, regional and potentially statewide VMT could be increased. The project would thus be considered to generate vehicle GHG emissions in excess of those accounted for in the BAU 2020 Emissions Forecast. By extension, it would also be considered to generate vehicle emissions beyond those accounted for in the Scoping Plan reduction measures.

Patterns of development can increase, decrease, or have no effect at all on travel choices, depending on their location and design. For example, through provision of

public transit, carpooling, and walking and biking amenities, and by bringing more people closer to more destinations, the City can increase low carbon travel and decrease on-road VMT. These are the types of strategies identified in the Scoping Plan's Regional Transportation-Related GHG Targets measure. CARB expects that this measure will reduce transportation-related GHG emissions by about 5 million $MTCO_2E$, or 3 percent of the total statewide GHG reductions (see Table 4).

The Proposed Project is surrounded by existing or planned residential and mixed-use development to the north and west, with some neighborhood-serving commercial uses in the vicinity. Within the Proposed Project, a mix of residential, commercial, and recreational uses would be provided. These proximities would encourage walking and biking and relatively short local vehicle trips, as reflected in the shorter-than-regional-average trip lengths SANDAG identified for Villages 8 West and 9 (SANDAG 2010b). Compared to the regional average daily vehicle trip length of 5.8 miles, the average daily trip length for Village 8 would be 4.62 miles and the average daily trip length for Village 9 would be 5.08 miles. SANDAG trip length calculations are contained in Attachment 4. The average daily trip length for the RTP in the Planning Area 10/University Site was not determined but industrial park trip lengths are typically shorter than residential trip lengths and the same as commercial trip lengths (Institute of Transportation Engineers 2008). Because the Proposed Project would not increase the regional trip length, its projected vehicle-emissions would be consistent with forecasted vehicle emissions, and its cumulative contribution to statewide vehicle emissions would be less than significant.

According to the traffic analysis, the Proposed Project would generate 113,073 ADT at buildout (LLG 2011). Of this total ADT, 43,564 ADT would be associated with Village 8 West, 56,123 ADT would be associated with Village 9, and the remaining 13,386 ADT would be associated with the RTP in the Planning Area 10/University Site. Average local trip length data provided by SANDAG for the traffic analysis zones (TAZs) for Villages 8 West and 9 identify an average daily trip length of 4.62 miles for TAZ #4391 (i.e., Village 8 West) and 5.08 miles for TAZ #4373 (i.e., Village 9) (SANDAG 2010b). The RTP and Planning Area 10/University Site fall within TAZ #4353. This TAZ was not included in the SANDAG trip length model. Therefore, the SANDAG regional average trip length of 5.8 miles was used to estimate VMT for the RTP. Multiplying these trip length averages by their associated ADTs results in a daily VMT for the Proposed Project of 564,010; with 201,266 daily VMT resulting from Village 8 West, 285,105 daily VMT resulting from Village 9, and 77,639 daily VMT resulting from the RTP.

Overall Transportation Emissions

Using the same fuel economy figure used in the above paragraph to estimate BAU vehicle emissions, the projected daily VMT of 564,010 would result in an annual vehicle emissions generation of 97,538.09 $MTCO_2E$. However, as identified in the Section 3.2 Regulatory Background, there are several plans and regulations aimed at reducing transportation-related GHG emissions nationally and statewide by 2020, by increasing

average vehicle fuel economy, decreasing average engine combustion emissions, and decreasing average VMT and trip length.

The key regulations affecting vehicle emissions include the national CAFE Standards which would increase average vehicle fuel economy to 35 mpg by 2020; the state Pavley GHG Vehicle Emissions Standards which set increasingly stringent emissions limits on vehicles, requiring improvement in vehicle engine technologies; and the state LCFS which reduces the carbon content of vehicle fuels. All of these actions have been approved by either the national or state legislatures and are coming into effect on a staggered timeline, with 2016 being the earliest vehicle model year affected. As shown in Table 4, CARB estimates that an approximate 46.7 $MMTCO_2E$ reduction, or 32 percent of the reduction target for capped sources and 27 percent of the total 174 $MMTCO_2E$ reduction target, would be achieved through full implementation of just the Pavley and LCFS transportation-related regulatory actions. A third action, the Vehicle Efficiency Measure, is estimated by CARB to add another 4.5 $MMTCO_2E$, or 2.5 percent, to the total statewide reductions. The national CAFE Standards, while not quantified in the CARB Scoping Plan, would likely contribute to further reductions in statewide vehicle GHG emissions.

It can be assumed that newer vehicles associated with the Proposed Project would benefit from these regulations, and estimated vehicle emissions would accordingly decrease. By accounting for the Scoping Plan measures already adopted, and the reduced vehicle trip lengths, the estimated vehicle emissions associated with the Proposed Project would decrease by 40 percent (with approximately 10 percent coming from the reduced vehicle trip lengths and nearly 30 percent from the state regulations), resulting in GHG emissions of 68,276.67 $MTCO_2E$ (compared to the 113,416.15 $MTCO_2E$ estimated for BAU).

In order to fully evaluate the significance of the Proposed Project's vehicle emissions reductions relative to the BAU 2020 vehicle emissions forecast and the Scoping Plan's vehicle emissions reductions, it is necessary to look at the Proposed Project in terms of its average trip length and effects on regional VMT.

b. Electricity Emissions

Buildout of the Proposed Project would be subject to the Chula Vista Green Building and Increased Energy Efficiency ordinances of the City's Municipal Code. These two ordinances are described in Section 3.2.4.5 and Section 3.2.4.6 and would achieve a 30 percent reduction in building energy (electricity and natural gas) use compared to BAU assumptions and a 20 percent reduction in potable water consumption (and associated embodied energy) compared to BAU assumptions.

Based on the energy savings required in the City's Increased Energy Efficiency ordinance, the proposed 6,050 residential units, 1.8 million cubic feet of commercial

space, 10.8 acres of community purpose facility use, 51.4 acres of schools, 50.0 acres of university use, 55.4 acres of park space, and 2.2 million square feet of industrial space would annually consume 111,312.92 MWh of electricity. The residential uses would consume approximately 28,617.65 MWh, the commercial uses would consume approximately 17,766 MWh, the school uses would consume approximately 9,952 MWh, the university use would consume approximately 17,258 MWh, the community purpose space would consume 3,089 MWh, active park uses would consume approximately maximum of 15,845 MWh, and the industrial uses would consume approximately 19,124 MWh each year. This equates to the emission of 12,232.14 $MTCO_2E$ each year from residential uses,10,848.26 $MTCO_2E$ each year from commercial uses, 6,077.06 $MTCO_2E$ each year from school uses, 10,538.35 $MTCO_2E$ each year from university use, 9,675.40 $MTCO_2E$ each year from active park uses, 1,886.18 $MTCO_2E$ each year from community purpose facilities, and 16,712.41 $MTCO_2E$ each year from industrial uses; totaling 67,969.80 $MTCO_2E$ each year.

As shown in Table 4, the CARB Scoping Plan includes a Renewables Portfolio Standard which requires public utilities to acquire an increasing proportion of their energy supply from renewable energies. By 2020, 33 percent of all statewide electricity generation is to come from renewable energies. This would result in a statewide emissions reduction of 26.3 $MMTCO_2E$ and is a reduction that is counted toward the total 2020 emissions reduction target. As a result of implementation of the Renewables Portfolio Standard, GHG emissions from electricity generation needed to supply the Project would likely decline as energy supply shifts from fossil-fuel based energies to renewable energy. Renewable energies have zero to little carbon content and their use in electricity generation emits fewer GHGs.

c. Natural Gas Emissions

Buildout of the Proposed Project would be subject to the Increased Energy Efficiency ordinance of the City's Municipal Code. This ordinance is described in Section 3.2.4.6 and would achieve a 15 percent reduction in building energy use compared to the existing energy code (Title 24, Year 2008), which equates to a 30 percent reduction in building energy and natural gas use compared to BAU assumptions.

Based on the energy savings required in the City's Increased Energy Efficiency ordinance, the proposed 6,050 residential units, 1.8 million square feet of commercial space, 10.8 acres of community purpose facility, 51.4 acres of schools, 50.0 acres of university use, 55.4 acres of parks, and 2.2 million square feet of industrial use would annually consume 408.44 million cubic feet of natural gas. The residential uses would consume approximately 174.44 million cubic feet, the commercial uses would consume approximately 43.85 million cubic feet, the community purpose facility would consume approximately 10.93 million cubic feet, the schools would consume approximately 24.29 million cubic feet, the university use would consume approximately 63.60 million cubic feet, the park uses would consume approximately 5.07 million cubic feet, and the

industrial uses would consume 86.25 million cubic feet each year. This equates to the emission of 9,552.49 $MTCO_2E$ of GHGs each year from residential uses, 2,401.22 $MTCO_2E$ each year from commercial uses, 598.73 $MTCO_2E$ each year from community purpose facilities, 1,330.34 $MTCO_2E$ each year from schools, 3,483.10 $MTCO_2E$ each year from university use, 277.52 $MTCO_2E$ each year from park uses, and 4,723.53 $MTCO_2E$ each year from industrial uses; totaling 22,366.93 $MTCO_2E$ of GHG emissions each year.

d. Water Use Emissions

Buildout of the Proposed Project would be subject to the Green Building Standards in the City's Municipal Code. This ordinance is described in Section 3.2.4.5 and would achieve a 20 percent reduction in water use compared to the existing plumbing code (year 2006) and BAU assumptions. An adjustment to the WRMP daily water demand rates identified above for BAU were thus made to account for the City's more stringent water conservation design requirements. Multiplying the proposed 887 single-family residential units, 5,163 multi-family residential units, 51.4 acres of schools, 50.0 acres of university use, 54.4 acres of park use, 10.8 acres of community purpose, 1.8 million square feet of commercial space, and 2.2 million square feet of industrial space, by adjusted WRMP daily water demand rates of 400 gallons per single-family residential unit, 204 gallons per multi-family unit, 1,428 gallons per school acre, 1,428 gallons per university acre, 1,724 gallons per park acre, 714.4 gallons per community purpose acre, 0.11 gallon per commercial square foot, and 0.06 gallon per industrial square foot, yields a total daily combined water demand of 1,982,084 gallons for the Proposed Project. Annual project water demand would total approximately 723,460,543 gallons. Of this annual total, approximately 513,938,980 gallons would be associated with residential uses, 26,790,708 gallons would be associated with school uses, 26,061,000 gallons would be associated with university use, 34,861,004 gallons with park uses, 2,816,165 gallons would be associated with community purpose uses, 73,584,000 gallons with commercial uses, and 45,408,686 gallons would be associated with industrial uses. This water usage amounts to approximately 20 percent less than the average water use for residential and non-residential uses built to the current plumbing code. The embodied energy demand associated with the Proposed Project's total water use would equate to 6,149.41 MWh per year. Multiplying this value by the electricity emission factors for the three primary GHGs of concern in Table 8 yields an estimated annual emission associated with water use of 3,754.95 $MTCO_2E$.

While not shown in Table 4, the CARB Scoping Plan includes other reduction strategies not counted toward the 2020 target reduction of 174 $MMTCO_2E$ statewide. CARB estimates that their recommended water sector measures would reduce an additional 4.8 $MMTCO_2E$ by 2020. These are measures required of water suppliers that would improve energy and other efficiencies associated with water supply. Thus, it is possible that the embodied energy and resulting GHG emissions associated with supplying potable water to the Proposed Project would decrease somewhat by 2020.

e. Solid Waste Emissions

While the Proposed Project would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average BAU, these savings cannot be estimated at this time. Therefore, for purposes of this program-level estimation, the Proposed Project is considered to generate the same amount of waste and associated GHG emissions as that under BAU: 52,397.07 tons of solid waste each year, resulting in 8,370.33 $MTCO_2E$ of GHG emissions each year.

Future development in accordance with the Proposed Project would be required to implement lumber and other materials conservation in conformance with the Green Building Standards in effect at the time of project submittal that would likely exceed average or BAU practice. The importance of this action is revealed in CalRecycle's annual Statewide Waste Characterization Study (2008), which noted that inerts and other materials accounted for nearly one-third (29 percent) of the statewide waste stream, with lumber representing nearly 15 percent. The largest change in the overall waste stream was an increase, from 22 percent to 29 percent, in this materials class, largely due to an increase in lumber.

As shown in Table 4, the CARB Scoping Plan includes Recycling and Waste measures that would reduce statewide emissions by roughly 1.0 $MMTCO_2E$ by 2020. This is to be achieved through improved landfill methane capture. Also, while not shown in Table 4, the CARB Scoping Plan includes other waste sector reduction strategies not counted toward the statewide 2020 emissions reduction target. CARB estimates that these additional waste and recycling sector measures would provide up to an additional 10 $MMTCO_2E$ reduction by 2020. Thus, it is possible that the embodied energy and emissions resulting from disposing of the Proposed Project's solid waste may decrease somewhat by 2020 due to these measures.

f. Construction Emissions

The Proposed Project would generate the same approximate amount of construction emissions as BAU, 51,545.36 $MTCO_2E$ per year.

The Scoping Plan does not identify any measures specific to reducing GHG emissions from construction activities. However, the reduction measure affecting heavy-duty vehicle emissions would potentially encompass off-road construction equipment and reduce emissions through improved engine technology and conversion to non-diesel, low carbon fuels. Thus, as with the majority of the Scoping Plan's transportation-related reduction measures, reductions in construction emissions would have to come from emissions limits on construction equipment, redesign of construction equipment technology, and/or conversion to low carbon fuels. These measures are outside the control of the City or project-specific design.

5.1.1.3 Cumulative Projects GHG Emissions

While the GHG analysis for the Proposed Project is, in consideration of the global nature of climate change, a cumulative analysis, an additional detailed cumulative analysis is provided based on probable future projects (foreseeable) projects within the Project Area. These projects include Village 8 East and Planning Area 10/University Site. This quantitative analysis of the potential cumulative impacts is based on the ratio of ADTs attributed to the foreseeable projects compared to ADTs from the Proposed Project. Specifically, total project generated ADTS (113,073) were divided into total ADT for the cumulative study area (174,700) resulting in a coefficient of 1.5. This coefficient is applied to all GHG emission factors to estimate cumulative emission levels.

a. Transportation-Related Emissions

The Cumulative Projects transportation-related GHG emissions would amount to approximately 102,415.00 $MTCO_2E$ per year, or 1.5 times the 68,276.67 $MTCO_2E$ per year projected for the Proposed Project. This emissions estimate takes into account a less-than-regional-average local trip length and state regulations affecting vehicle engine and fuel manufacture. The reduction in BAU vehicles emissions from these GHG-reducing aspects of the Cumulative Projects would be approximately 40 percent; with approximately 10 percent resulting from smart-growth circulation patterns and 30 percent resulting from statewide regulations.

b. Electricity Emissions

Buildout of Cumulative Projects would be subject to the Chula Vista Increased Energy Efficiency Standards ordinance of the City's Municipal Code. Individual developments would thus be required to achieve at least a 30 percent reduction in building energy (electricity and natural gas) use compared to BAU assumptions. Based on the cumulative coefficient of 1.5, Cumulative Projects would emit approximately 101,954.71 $MTCO_2E$ each year.

c. Natural Gas Emissions

As stated above in buildout of Cumulative Projects would be subject to increased energy efficiency requirements that would save 30 percent building energy and natural gas use compared to BAU assumptions. Based on the cumulative coefficient of 1.5, Cumulative Projects would emit approximately 33,550.40 $MTCO_2E$ of GHG emissions each year associated with natural gas combustion.

d. Water Use Emissions

Buildout of Cumulative Projects would also be subject to the water saving requirements of the City's Green Building Standards ordinance. Individual projects would thus be required to achieve a 20 percent reduction in potable water consumption (and

associated embodied energy) compared to BAU assumptions. This water usage amounts to approximately 20 percent less than the average water use for residential and commercial uses built to the current plumbing code. Based on the cumulative coefficient of 1.5, the estimated annual emissions associated with Cumulative Projects water use would be 5,632.43 $MTCO_2E$.

e. Solid Waste Emissions

While Cumulative Projects would implement lumber and other materials conservation in accordance with the City's Green Building Standards (see Section 3.2.4.5) and likely generate less landfill waste than average BAU, these savings cannot be estimated at this time. Therefore, for purposes of this program-level estimation, buildout of Cumulative Projects is based only on the multiplier of 1.5, without additional credit for conservation measures, amounting to approximately 12,555.50 $MTCO_2E$ of GHG emissions each year.

f. Construction Emissions

Approximately 77,318.04 $MTCO_2E$ per year of construction emissions would be generated by construction of the Cumulative Projects, based on the 1.5 multiplier relative to the Proposed Project.

5.1.2 Significance of Impacts

5.1.2.1 Target Emissions

Based on the calculated BAU project-equivalent emissions and the goal of a 20 percent reduction in BAU 2020 emissions, an emissions cap for the Proposed Project can be determined. As shown in the Table 9 in Section 5.1.2.3 below, the total estimated BAU emissions would be 307,078.01 $MTCO_2E$ each year. A 20 percent reduction in this amount would equal 245,662.41 $MTCO_2E$ each year. Therefore, the Propose Project would be considered to be consistent with the Scoping Plan and AB 32 Year 2020 goals if it were to emit total annual emissions resulting from electricity, natural gas and water use, solid waste disposal and construction activities, equal to or less than 245,662.41 $MTCO_2E$.

5.1.2.2 Proposed Project GHG Reduction Features

As described in Section 2.1, the Proposed Project is a GPA and GDPA to allow the ultimate development of up to 6,050 residential units, 1.8 million square feet of commercial and 2.2 million square feet of industrial uses, 10.8 acres of community purpose use, 51.4 acres of schools, 50.0 acres of university use, and 55.4 acres of park

use. As part of the GPA, proposed text revisions to the GP's Environmental Element, Objective E7 would include the following new Policy E 7.8:

Objective E 7

Promote energy conservation through the efficient use of energy and through the development of local, non-fossil fuel-based renewable sources of energy.

Policy

E 7.8: Ensure that residential and non-residential construction complies with all applicable City of Chula Vista energy efficiency measures that are in effect at the time of discretionary permit review and approval or building permit issuance, whichever is applicable.

This new policy would ensure that all subsequent projects comply with, at a minimum, the existing GBS ordinance and Increased Energy Efficiency Standards ordinance. These two City ordinances are included as Attachment 2 and are hereby incorporated by reference. As described in Sections 3.2.4.5 and 3.2.4.6 respectively, these two ordinances require all new development and redevelopment or remodels over a threshold size to incorporate design that achieves at least 20 percent greater water conservation than the current plumbing code and 15 percent greater energy efficiency than the current 2008 Title 24 energy code (i.e., 30 percent greater energy efficiency than the 2005 Title 24 energy code).

As required in the ordinances, building permits for subsequent development in accordance with the Proposed Project would be thoroughly reviewed by the Building Official for compliance with the ordinances prior to approval. As part of the building permit application, project construction plans and specifications shall indicate the energy and GBS standards, product specifications, and method of construction, in the general notes or individual drawings. No building permit shall be issued for any project until the Building Official has determined that the plans and specifications are in compliance with the requirements of the ordinances. Additional inspections may be conducted as needed to ensure compliance and if at any stage of construction the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a stop order may be issued that will remain in effect until the Building Official allows. Prior to issuance of a certificate of occupancy, the Building Official shall review all relevant information and determine whether the project has been built in accordance with the permit. If the Building Official determines that a project applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and certificate of occupancy may be withheld.

5.1.2.3 Proposed Project GHG Reductions Relative to BAU 2020

The total GHG emissions attributed to vehicle use and building occupancies for BAU and the Proposed Project are summarized below in Table 9. The Proposed Project is estimated to generate a total of 222,284.04 $MTCO_2E$ GHG emissions (68,276.67 from vehicle use and 154,007.38 $MTCO_2E$ from non-transportation-related sources) each year above existing conditions. BAU is estimated to generate a total of 307,078.01 $MTCO_2E$ of GHG emissions each year above existing conditions (113,416.15 $MTCO_2E$ from vehicle use and 193,661.86 $MTCO_2E$ from non-transportation-related sources). This Proposed Project total reduction of 84,793.96 $MTCO_2E$ equates to a 28 percent reduction in BAU emissions, and results from the Proposed Project's incorporation of smart-growth vehicle circulation patterns, lower-emitting vehicles given state regulations, and advanced energy efficiency and water conservation design that would reduce GHG emissions associated with energy and water use. Of the total Proposed Project reduction, a 39,654.48 $MTCO_2E$, or 20 percent, reduction in non-vehicular BAU would result from the advanced energy efficiency and water conservation design alone. Other Proposed Project features that may reduce GHG emissions, such as landscaping, heat island reduction, lumber conservation, and other actions required in the City's Green Building Standards were not readily quantifiable and are not included in the Proposed Project's emissions estimate.

TABLE 9
SUMMARY OF ESTIMATED GHG EMISSIONS AND PROJECT REDUCTIONS RELATIVE TO BAU ($MTCO_2E$)

Emission Source	BAU Project-Equivalent	Target Emissions	Proposed Project	Percent Reduction
Vehicles Use	113,416.15	--	68,276.67	40
Electricity Use	97,099.72	--	67,969.80	30
Natural Gas Use	31,952.76	--	22,366.93	30
Water Consumption	4,693.69	--	3,754.95	20
Solid Waste Disposal	8,370.33	--	8,370.33	0
Construction	51,545.36	--	51,545.36	0
TOTAL	**307,078.01**	**245,662.41**	**222,284.04**	**28**

As shown in Table 9, a 20 percent reduction in BAU GHG emissions would equal 245,662.41 $MTCO_2E$ per year. The Proposed Project would generate an estimated 222,284.04 $MTCO_2E$ per year. Based only on increased energy and water savings afforded by the proposed General Plan Policy 7.8 and existing City ordinances, the Proposed Project would reduce non-transportation-related BAU emissions by 20 percent. Factoring in vehicle emissions reductions, the Proposed Project would reduce overall BAU emissions by 28 percent, thereby exceeding the City's significance threshold of a 20 percent reduction in GHG emissions relative to BAU 2020. Impacts

associated with the Proposed Project's contribution of GHGs to cumulative statewide emissions would therefore be less than significant.

5.1.2.4 Cumulative Projects GHG Emissions

The Cumulative Projects annual GHG emissions would total approximately 333,426.06 $MTCO_2E$ per year. Under BAU, annual GHG emissions would approximate 460,617.01 $MTCO_2E$ per year. These quantities were derived by multiplying the estimates derived through the above BAU and Proposed Project emissions calculations by a factor of 1.5 to reflect the proportionally greater intensity of development allowed through buildout of projects in an expanded cumulative projects area or that includes Village 8 East and Planning Area 10.

These calculations provide a cursory estimate of the magnitude of GHG emissions that would occur under Cumulative Projects buildout. Given that individual projects within the Cumulative Projects area would be subject to the City's existing Green Building Standards and Increased Energy Efficiency Standards ordinances, and the proposed GPA new policy E.7.8, future emissions from these projects would be ensured to be at least 20 percent below BAU GHG emissions; and would more likely, as is the case with the Proposed Project, provide reductions in BAU GHG emissions ranging from 20 to 28 percent.

The Proposed Project's contribution to these Cumulative Projects GHG emissions would not be significant; and climate change impacts associated with the Cumulative Projects buildout is anticipated to be less than significant.

5.2 Project Consistency with Adopted Plans, Policies, and Regulations

5.2.1 Impacts

The regulatory plans and policies discussed extensively in Section 3.0 above aim to reduce national, state, and local GHG emissions by primarily targeting the largest emitters of GHGs: the transportation and energy sectors. Plan goals and regulatory standards are thus largely focused on the automobile industry and public utilities. For the transportation sector, the reduction strategy is generally three pronged: to reduce GHG emissions from vehicles by improving engine design; to reduce the carbon content of transportation fuels through research, funding and incentives to fuel suppliers; and to reduce the miles these vehicles travel through land use change and infrastructure investments.

For the energy sector, the reduction strategies aim to: reduce energy demand; impose emission caps on energy providers; establish minimum building energy and green building standards; transition to renewable non-fossil fuels; incentivize homeowners and builders; fully recover landfill gas for energy; expand research and development; and so forth.

5.2.1.1 Local Plans

As discussed above in Section 5.2.2, the Proposed Project would achieve substantial GHG reductions through green building design that includes increase energy efficiency and improved water conservation, sustainable materials use, waste reduction, lumber conservation, indoor air quality, and heat island reduction. These GHG-reducing design features would be incorporated into subsequent projects as required in the City's Green Building Standards and the Increased Energy Efficiency Standards adopted by ordinance into the Municipal Code. Verification and commissioning of these features would occur through independent third party inspection and diagnostics as part of development permit review and approval.

The Proposed Project would thus be consistent with the City's CPAP and Climate Protection Measures relevant to private land use and development.

5.2.1.2 State Plans

EO S-3-05 established GHG emission reduction targets for the state, and AB 32 launched the Climate Change Scoping Plan that outlined the reduction measures needed to reach these targets. The Scoping Plan and its implementing and complementary regulations are discussed at length in Section 3.2. Also, in Sections 5.1 and 5.2 above, the Project's consistency with the state reduction targets for transportation, energy and other emissions associated with land use and development, is demonstrated. In short, the Proposed Project was shown to provide a 20 percent reduction in non-transportation-related BAU emissions, and a 28 percent reduction in overall BAU emissions, consistent with the percent reduction targeted in the Scoping Plan for land development-related emissions. In addition, the Proposed Project was demonstrated in Section 5.1 to not increase regional VMT, and is therefore consistent with recommendations in the Scoping Plan and assumptions in the BAU 2020 Forecast pertaining to transportation-related emissions. The Proposed Project is also consistent with state goals regarding climate change adaptation and the Scoping Plan's recommendation to expand the use of green building practices in order to reduce the carbon footprint of new buildings and better adapt them to climate change.

The Proposed Project, by providing a 20 percent reduction in non-transportation-related GHG emissions compared to BAU, may be seen to exceed its fair share in achieving the state's reduction target given that the reduction measures and quantities identified in the

Scoping Plan that relate specifically to land development (the Regional Transportation-Related Measure, the Building Energy Efficiency measure, and the Million Solar Roofs measure) add up to approximately 20 percent of the total reduction needed statewide.

5.2.2 Significance of Impacts

The Proposed Project is consistent with the goals and strategies of local and state plans, policies, and regulations aimed at reducing GHG emissions from land use and development. Impacts would be less than significant.

6.0 Conclusions and Recommendations

Assuming full implementation of statutory regulations establishing vehicle and fuel emissions limits and technology improvements and shorter than average trip lengths, ADT associated with buildout of the Proposed Project would result in approximately 68,276.67 $MTCO_2E$ of GHG emissions each year above existing conditions. This estimate represents a nearly 40 percent reduction in vehicular GHG emissions compared to the BAU condition which would result in 113,416.15 $MTCO_2E$ of transportation-related GHG emissions per year above existing conditions. Because the Proposed Project's average local trip length would not be large enough to increase the regional average vehicle trip length or regional VMT, its vehicle emissions are consistent with the state's forecasted 2020 BAU vehicle emissions and sector-wide reductions. The Proposed Project's contribution to cumulative transportation-related GHG emissions is therefore less than significant.

The Proposed Project is estimated to generate 154,007.38 $MTCO_2E$ of non-transportation-related GHG emissions each year above existing conditions, and BAU is estimated to generate 193,661.86 $MTCO_2E$ of non-transportation-related GHG emissions each year above existing conditions. Implementation of the Proposed Project would thus result in a 20 percent reduction in BAU 2020 non-transportation-related emissions, thereby meeting the 20 percent reduction target established by the City consistent with AB 32 and the CARB Scoping Plan. The Proposed Project's non-transportation-related emissions reduction of approximately 39,654.48 $MTCO_2E$ would result from design features required to be incorporated into subsequent development proposals that substantially reduce energy and water use.

The Proposed Project's overall contribution to cumulative GHG emissions would therefore not be significant and would not conflict with or obstruct the goals and strategies of local and state plans, policies, and regulations aimed at reducing GHG emissions from land development.

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ATTACHMENTS

ATTACHMENT 1

Understanding Global Climate Change

RECON

Understanding Global Climate Change

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TABLE OF CONTENTS

FIGURES

TABLES

Understanding Global Climate Change

The earth's climate is in a state of constant flux with periodic warming and cooling cycles. Extreme periods of cooling are termed "ice ages," which may then be followed by extended periods of warmth. For most of Earth's geologic history, these periods of warming and cooling have been the result of many complicated, interacting natural factors that include volcanic eruptions which spew gases and particles (dust) into the atmosphere, the amount of water, vegetation, and ice covering the earth's surface, subtle changes in the Earth's orbit, and the amount of energy released by the sun (sun cycles). However, since the beginning of the Industrial Revolution around 1750, the average temperature of the Earth has been increasing at a rate that is faster than can be explained by natural climate cycles alone.

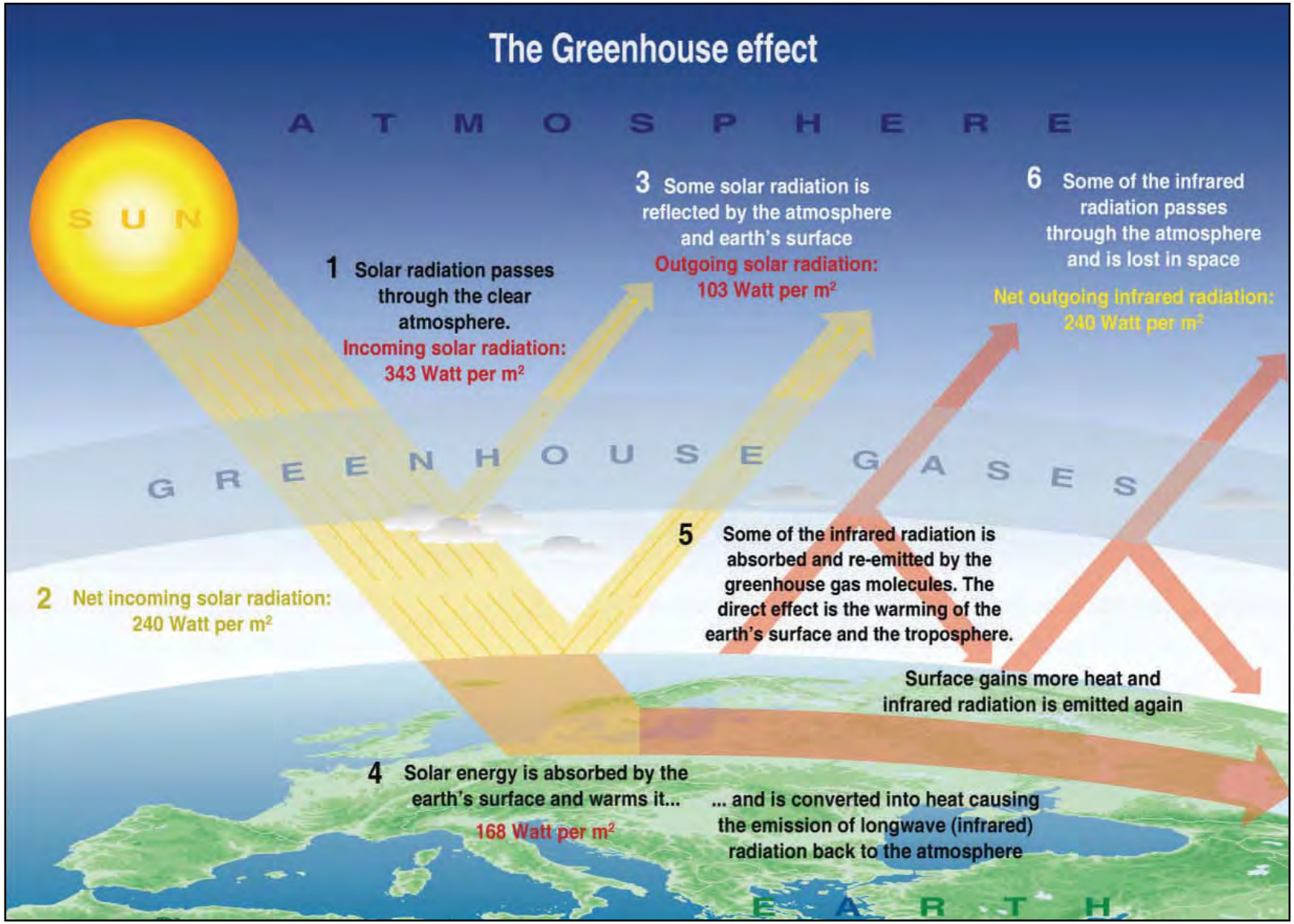
With the Industrial Revolution came an increase in the combustion of carbon-based fuels such as wood, coal, oil, and "biofuels." Industrial processes have also created emissions of substances that are not found in nature. This in turn has led to a marked increase in the emissions of gases that have been shown to influence the world's climate. These gases, termed "greenhouse gases," influence the amount of heat that is trapped in the earth's atmosphere. Because recently observed increased concentrations of GHGs in the atmosphere are related to increased emissions resulting from human activity, the current cycle of "global warming" is generally believed to be largely due to human activity. Of late, "global warming" has arguably become the most important and widely debated environmental issue in the United States and the world.

1.0 The Greenhouse Effect

The presence of natural GHGs in the atmosphere is necessary for life on earth as we know it. The Earth absorbs and reflects incoming solar radiation. The Earth also emits terrestrial (thermal) radiation back out into space. On average, the absorbed solar radiation is balanced by the emitted thermal radiation, thus keeping the Earth at a relatively stable temperature. However, GHGs in the atmosphere absorb a portion of the terrestrial thermal radiation, thus "trapping" heat. The warming of the Earth's surface and atmosphere caused by this trapped heat is known as the "natural greenhouse effect" (United States Environmental Protection Agency [U.S. EPA] 2002). Figure 1 illustrates the "Greenhouse Effect."

Because GHGs "trap" heat in the atmosphere, the Earth's surface is warmer than it would be without the gases. Estimates indicate that without these natural GHGs, the Earth's surface would be about 60 degrees Fahrenheit (°F) colder (U.S. EPA 2007a).

Source: UNEP/GRID–Adrenal 2002a



RECON

FIGURE 1
Greenhouse Effect

2.0 Greenhouse Gases (GHGs)

There are numerous GHGs, both naturally occurring and manmade. Table 1 summarizes some of the most common.

TABLE 1
GLOBAL WARMING POTENTIALS (GWPs) AND ATMOSPHERIC LIFETIMES (YEARS) USED IN THE INVENTORY

Gas	Atmospheric Lifetime	100-year GWP[a]	20-year GWP	500-year GWP
Carbon Dioxide (CO_2)	50-200	1	1	1
Methane (CH_4)[b]	12±3	21	56	6.5
Nitrous oxide (N_20)	120	310	280	170
HFC-23	264	11,700	9,100	9,800
HFC-125	32.6	2,800	4,600	920
HFC-134a	14.6	1,300	3,400	420
HFC-143a	48.3	3,800	5,000	1,400
HFC-152a	1.5	140	460	42
HFC-227ea	36.5	2,900	4,300	950
HFC-236fa	209	6,300	5,100	4,700
HFC-4310mee	17.1	1,300	3,000	400
CF_4	50,000	6,500	4,400	10,000
C_2F_6	10,000	9,200	6,200	14,000
C_4F_{10}	2,600	7,000	4,800	10,100
C_6F_{14}	3,200	7,400	5,000	10,700
SF_6	3,200	23,900	16,300	34,900

Source: U.S. EPA 2002.
[a] GWPs used here are calculated over 100 year time horizon.
[b] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Of the gases listed in Table 1, carbon dioxide, methane, and nitrous oxide are produced by both natural and anthropogenic (human) sources. The remaining gases (hydrofluorocarbons [HFCs; such as HFC-23], perfluorocarbons [PFCs; such as CF_4], and sulfur hexafluoride [SF_6]) are the result of human processes.

The potential of a gas to trap heat and warm the atmosphere is measured by its "global warming potential" or GWP. Specifically, GWP is defined as the cumulative radiative forcing—both direct and indirect effects—integrated over a period of time from the emission of a unit mass of gas relative to some reference gas (U.S. EPA 2002).

GHGs breakdown or are absorbed over time. Thus the potential of a gas to contribute to global warming is limited by the time it is in the atmosphere, its "atmospheric lifetime." To account for these effects, GWPs are calculated over a specific period of time, such as 20, 100, or 500 years. The parties to the United Nations (UN) Framework Convention on Climate Change (UNFCCC) agreed to use consistent GWPs based upon a 100-year time horizon

(U.S. EPA 2002). Because of its relative abundance in the atmosphere and its relatively long atmospheric lifetime, carbon dioxide (CO_2) has been designated the reference gas for comparing GWPs. Thus the 100-year GWP of CO_2 is equal to 1 (see Table 1).

The importance of these gases to climate change is expressed in terms of the amount (concentration) in the atmosphere and the gas' GWP. For comparison, emissions of all GHGs are often expressed in terms of teragrams of carbon dioxide equivalent (Tg CO_2 Eq.). The relationship between gigagrams (Gg) of a gas and Tg CO_2 Eq. is determined by the following (U.S. EPA 2002):

$$Tg\ CO_2\ Eq. = (Gg\ of\ gas)\ x\ (GWP)\ x\left(\frac{Tg}{1{,}000\ Gg}\right)$$

where:

Tg CO_2 Eq.	=	teragrams of carbon dioxide equivalents
Gg	=	gigagrams (equivalent to a thousand metric tons)
GWP	=	global warming potential
Tg	=	teragrams

In addition to those shown in Table 1, there are other GHGs typically not considered when evaluating the effects on global climate change. These are short-lived gases such as carbon monoxide, water vapor, tropospheric ozone, tropospheric aerosols (e.g. sulfur dioxide products and black carbon), and other ambient air pollutants such, as NO_X and non-methane volatile organic compounds (NMVOCs). Because they are short-lived, concentrations of these gases tend to vary spatially and it is difficult to determine their global radiative forcing impacts. Therefore, GWPs are typically not attributed to these short-lived, spatially inhomogeneous atmospheric gases (U.S. EPA 2002).

Descriptions of the main GHGs follow.

2.1 Non-Fluorinated Gases

These GHGs are created and emitted through both natural and human-associated activities.

2.1.1 Carbon Dioxide (CO_2)

Carbon dioxide is the most prevalent GHG. It is both emitted and absorbed through the "carbon cycle" whereby living organisms both utilize and expel CO_2. CO_2 is also emitted through the combustion of carbon based fuels, wildfires, and other processes. Deforestation contributes to increased atmospheric concentrations of CO_2 by removing CO_2 "sinks." In addition, certain specialized industrial production processes and product uses such as

mineral production, metal production and the use of petroleum-based products can also lead to CO_2 emissions (U.S. EPA 2007b).

Processes that absorb CO_2 are known as "sinks," while processes that emit CO_2 are "sources." The primary "non-natural" source of CO_2 emissions is combustion of carbon-based fuels. The primary natural sources of CO_2 emissions are (U.S. EPA 2007b):

- Plant respiration, by which plants convert oxygen and nutrients into CO_2 and energy;
- Ocean–atmosphere exchange, in which the oceans absorb and release CO_2 at the sea surface; and
- Volcanic eruptions, which release carbon from rocks deep in the Earth's crust (this source is very small).

Humans and animals also produce CO_2 that is expelled during respiration (breathing). Natural sinks of CO_2 include:

- carbon dioxide used in plants during photosynthesis; and
- the exchange of CO_2 between the atmosphere and the oceans.

When in balance, natural sources and sinks keep CO_2 concentrations in the atmosphere relatively steady. However, since the Industrial Revolution, human activities have increased CO_2 concentrations in the atmosphere by about 35 percent relative to pre-Industrial Revolution levels, primarily related to carbon-based fuel combustion (U.S. EPA 2007b).

In addition to methods for directly reducing CO_2 emissions to the atmosphere (e.g., burning less fuel), a number of programs are being developed that are designed to remove CO_2 from the atmosphere. These human-influenced or -created carbon sinks include (U.S. EPA 2007b):

- *Geologic sequestration.* Rather than releasing CO_2 emissions to the atmosphere, CO_2 emissions from industrial or energy-related sources are separated and captured, transported to a storage location, and then injected deep underground for long-term isolation (storage) from the atmosphere.
- *Carbon sequestration.* In this process agricultural and forestry practices are used to remove CO_2 from the atmosphere. Plants on agricultural and forestry lands act as sinks that absorb CO_2 through natural photosynthesis. However, agricultural and forestry practices can also release CO_2 and other GHGs to the atmosphere. Sequestration activities can help prevent global climate change by enhancing carbon storage in trees and soils, preserving existing tree and soil carbon, and by reducing emissions of CO_2,

methane (CH_4) and nitrous oxide (N_2O). This sequestration generally only lasts as long as the plants are alive, after which their carbon may be released during decay.

2.1.2 Methane (CH_4)

Human-related sources of methane include fossil fuel production, animal husbandry (enteric [intestinal] fermentation in livestock and manure management) and other agricultural activities, rice cultivation, biomass burning, waste management (landfills), natural gas and petroleum systems, coal mining, stationary and mobile combustion, wastewater treatment, and certain industrial processes. It is estimated that 60 present of global methane emissions to the atmosphere are related to these human-related activities. Natural sources of methane include wetlands (biomass decomposition), gas hydrates, permafrost, termites, oceans, freshwater bodies, non-wetland soils, and other sources such as wildfires (U.S. EPA 2007c).

2.1.3 Nitrous Oxide (N_2O)

The primary human-related sources of N_2O are agricultural soil management (e.g., fertilizers), animal manure management, sewage treatment, mobile and stationary fuel combustion, adipic acid production (primarily used for the production of nylon), and nitric acid production. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests (U.S. EPA 2007d).

2.2 Fluorinated Gases

The remaining gases listed in Table 1 are fluorinated gases that are solely created and emitted through human activities. These gases, also known as "High GWP Gases," are considered the most potent because they have both high GWPs and extremely long atmospheric lifetimes. The result of these long atmospheric lifetimes is the essentially irreversible accumulation of these gases in the atmosphere once they are emitted (U.S. EPA 2007e). However, current concentrations of these gases in the atmosphere are relatively low.

2.2.1 Hydrofluorocarbons (HFCs)

HFCs are man-made chemicals primarily developed as alternatives to ozone-depleting substances for industrial, commercial, and consumer products. As seen in Table 1, the global warming potentials of HFCs range from 140 (HFC-152a) to 11,700 (HFC-23), while the atmospheric lifetime for HFCs varies from just over a year (HFC-152a) to over 260 years (HFC-23). Most of the commercially used HFCs have atmospheric lifetimes less than 15 years. For example, the atmospheric lifetime of HFC-134a, which is used in automobile air conditioning and refrigeration, is 14 years (U.S. EPA 2007e).

The only significant emissions of HFCs before 1990 were of the chemical HFC-23. Between 1978 and 1995, HFC-23 concentrations increased from 3 to 10 parts per trillion (ppt) and continue to rise. Since 1990, when it was almost undetectable, global average concentrations of HFC-134a have risen significantly to almost 10 ppt (parts per trillion). The abundance of certain HFCs is expected to continue to rise in line with their increasing use, particularly as refrigerants around the world (U.S. EPA 2007e).

2.2.2 Perfluorocarbons (PFCs)

The largest known man-made sources of PFCs are primary aluminum production and semiconductor manufacturing. PFCs are also minor substitutes for ozone depleting substances. PFCs are particularly troublesome as GHGs because, in addition to their high GWPs, they also have extremely stable molecular structures and are largely immune to the chemical processes in the lower atmosphere that break down most atmospheric pollutants. It is not until they reach the upper atmosphere (approximately 37 miles above the earth) that they are broken down by high-energy ultraviolet rays from the sun. Thus they have extremely long atmospheric lifetimes (up to tens of thousands of years). Recent relative rates of increase in atmospheric concentrations for two of the most important PFCs are 1.3 percent per year for CF_4 and 3.2 percent per year for C_2F_6 (U.S. EPA 2007e).

2.2.3 Sulfur Hexafluoride (SF_6)

Sulfur hexafluoride is considered the most potent GHG because it has a 100-year GWP of 23,900 coupled with an atmospheric lifetime of 3,200 years. Because of its excellent dielectric properties, SF_6 is used for insulation and current interruption in electric power transmission and distribution equipment. It is also used in the magnesium industry to protect molten magnesium from oxidation and potentially violent burning, in semiconductor manufacturing to create circuitry patterns on silicon wafers, and as a tracer gas for leak detection. Measurements of SF_6 show that its global average concentration has increased by about 7 percent per year during the 1980s and 1990s, from less than 1 ppt in 1980 to almost 4 ppt in the late 1990s (U.S. EPA 2007e).

3.0 Human Induced Climate Change

In 1988, in response to growing concern about the problem of potential global climate change, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC). The IPCC is open to all members of the UN and WMO.

The role of the IPCC is (IPCC 2007a):

> to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. The IPCC does not carry out research nor does it monitor climate related data or other relevant parameters. It bases its assessment mainly on peer reviewed and published scientific/technical literature.

The IPCC recently published its findings that it is highly likely that observed increases in the globally averaged temperature since the mid-20th century are due to human-caused increases in measured GHG concentrations (IPCC 2007b).

As indicated, GHGs are necessary to life as we know it, because they keep the planet's surface warmer than it otherwise would be. For example, Figure 2 shows how the average earth temperature has varied with CO_2 concentrations in the atmosphere over the last 400,000 years. As also evident by the data shown in this figure, there is a strong correlation between CO_2 concentrations in the atmosphere and the average global temperature.

However, concentrations of GHGs are continuing to increase in the atmosphere and it has been observed that the Earth's temperature is climbing above typical past levels. According to National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) data, the following observations have been made (U.S. EPA 2007f; NASA 2007):

- Since 1900, the average surface temperature has warmed by about 1.2–1.4 °F.
- Since the mid 1970s, the average surface temperature has warmed about 1 °F.
- The Earth's surface is currently warming at a rate of about 0.32 °F/decade or 3.2 °F/century.
- The five warmest years over the last century have likely been (in order from hottest to coolest): 2005, 1998, 2002, 2003, 2006. The top 10 warmest years have all occurred since 1990.

In addition to temperature increase, other aspects of the global climate are also changing such as rainfall patterns, snow and ice cover, and average sea levels.

In an attempt to evaluate and predict the relationship between GHG emissions and global temperature changes, atmospheric models have been created to simulate the atmospheric temperature changes that occur from both natural and human created emissions of GHGs. Figure 3 shows the results of some such simulations.

Source: UNEP/GRID–Adrenal 2000

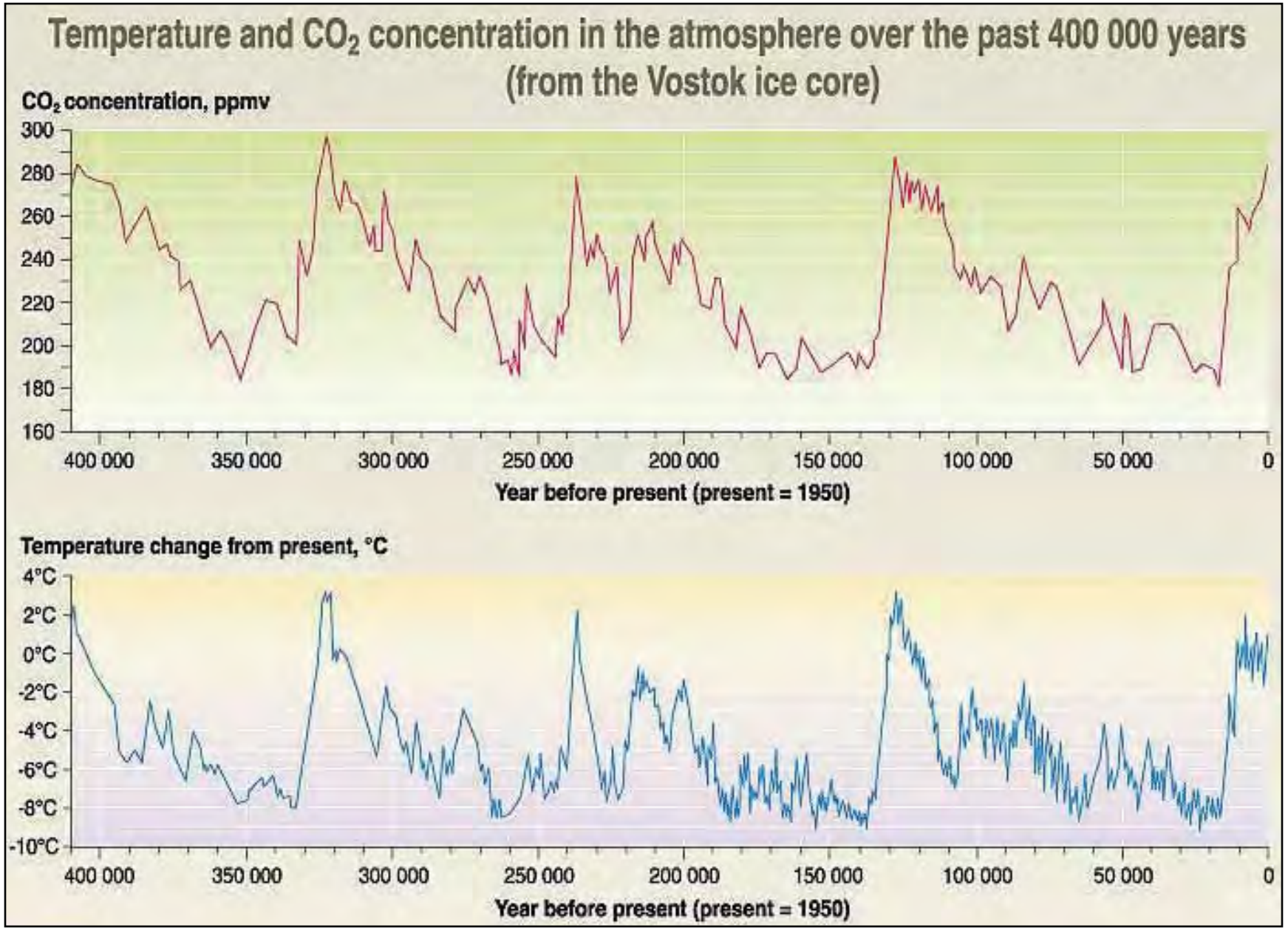


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FIGURE 2
Temperature and CO2 Concentration

Source: UNEP/GRID–Adrenal 2002b

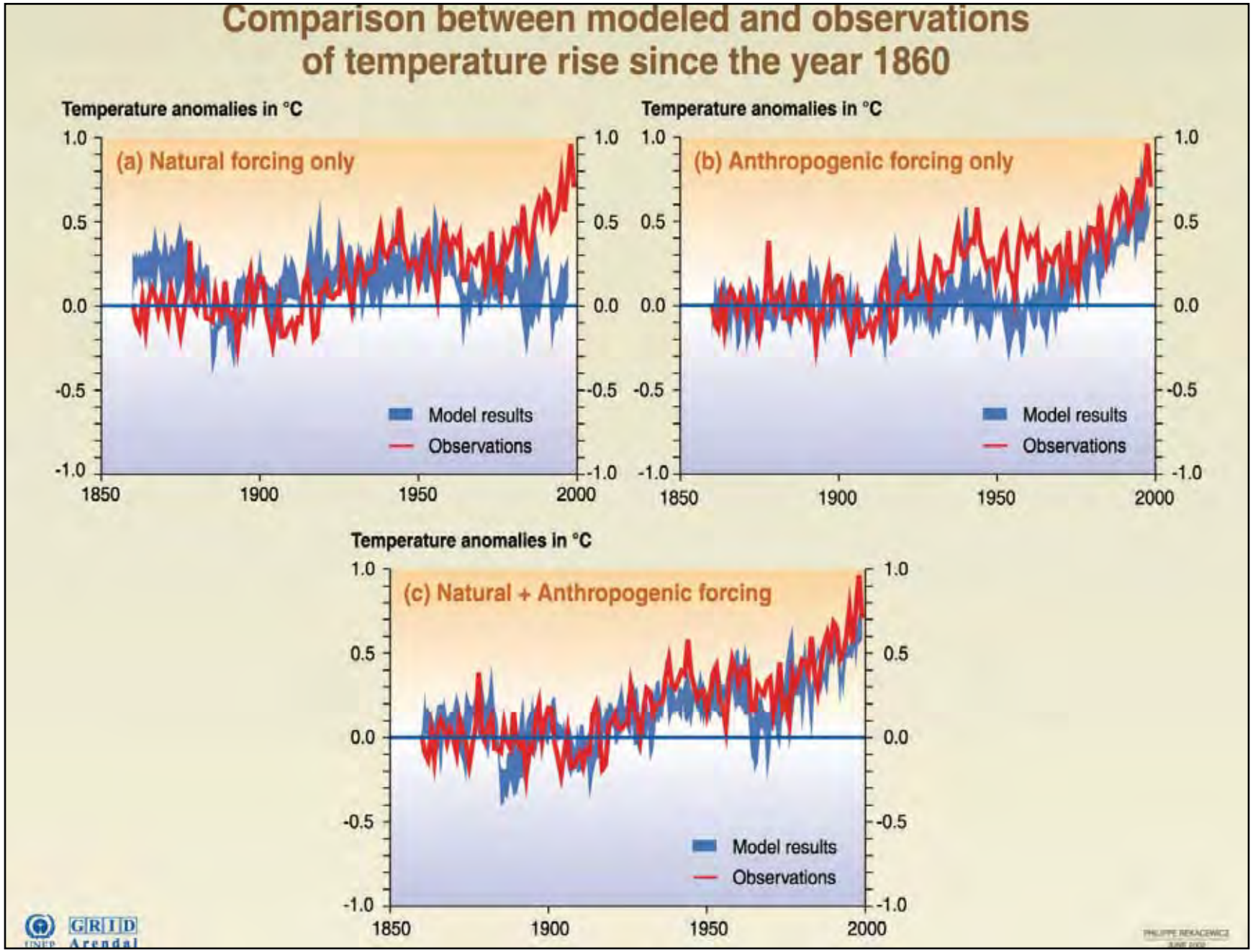

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FIGURE 3
Comparison between Modeled and Observed Temperature

In Figure 3, simulation (a) only includes natural forcings: solar radiation and volcanic activity. As seen, when only natural forcings are included, modeled temperatures do not correlate well with observations, particularly since 1950. Simulation (b) only includes human-caused forcings: GHGs and sulfate aerosols. In this simulation the recent observed rise in temperature matches the modeled temperature fairly well, but modeled temperatures do not match observations around 1950.

Simulation (c) includes both natural and human-caused forcings. As seen, the best match occurs when both natural and human forcings are included.

The relationships between GHG emissions and global climate change are very complex. Therefore, much controversy and debate continues regarding the extent to which human caused GHG emissions are influencing global climate change. Nevertheless, as a result of observations and modeling simulations such as those indicated above, the IPCC has concluded that it is highly likely that most of the warming observed in recent decades is the result of human activities (IPCC 2007b).

4.0 Future Projections of Climate Change

In order to project anticipated future climate changes resulting from human-caused emissions of GHGs, the IPCC developed a series of GHG emission scenarios for use in driving global circulation models for developing climate change scenarios. The emission scenarios were originally released by the IPCC in 1992 and are referred to as the "IS92" scenarios. Subsequent re-evaluation of the scenarios in response to new understanding of possible future GHG emissions and their relationship to climate change led to the development and release of new emission scenarios in 2000. The emission scenarios are based on a number of very complex factors and include not only emission baselines, but also (IPCC 2000):

- Include the latest information on economic restructuring throughout the world;
- Examine different rates and trends in technological change; and
- Expand the range of different economic-development pathways, including narrowing of the income gap between developed and developing countries.

Thus the emissions scenarios cover a wide range of the main driving forces of future emissions, including demographic, technological, and economical factors. As required by IPCC assumptions, none of the scenarios include future policies aimed specifically at climate change. It is intended that the emissions scenarios developed encompass the range of possible emissions of all relevant GHGs, sulfur, and their driving forces (IPCC 2000). The development of the emission scenarios is documented in the IPCC Special Report on Emissions Scenarios (SRES; IPCC 2000). Emissions were developed using four qualitative

"storylines" that yielded four sets of scenarios called "families": A1, A2, B1, and B2. The process resulted in a total of 40 SRES emission scenarios. The 40 emission scenarios were grouped into six scenario groups. All emission scenarios are considered equally valid with no assigned probability of occurrence (IPCC 2000). Figure 4 presents a schematic and narrative of the main characteristics of the SRES emission scenarios.

The emission scenario groups are used to estimate the future CO_2 and other GHG concentrations in the atmosphere. Figure 5 shows the past and projected CO_2 concentrations from the years 1000 to 2100. As seen in this figure, all scenarios project a marked increase in CO_2 concentrations by 2100 relative to past conditions. Figure 6 shows the projected variations in the earth's temperature, relative to the 1990 temperature, that correspond to the emission scenario groups. The results shown in this figure indicate that under best-case emissions, the earth's average temperature is projected to increase by approximately another 2.5 °F by the year 2100. Under worst-case emissions, the earth's average temperature is projected to increase by as much as 10 °F.

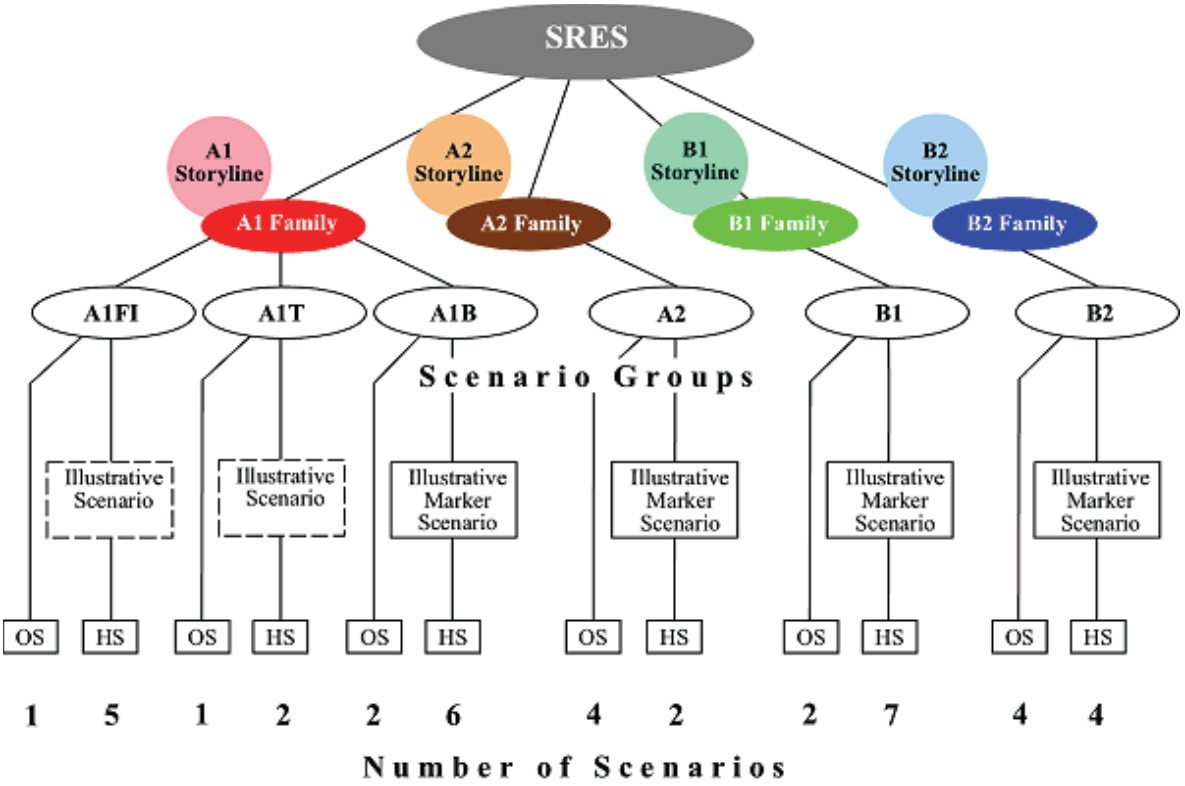
5.0 Implications of Climate Change

The increase in the earth's temperature is expected to have wide ranging effects on the environment. Although global climate change is anticipated to affect all areas of the globe, there are numerous implications of direct importance to California. Statewide average temperatures are anticipated to increase by between 3 and 10.5 °F by 2100. Some climate models indicate that this warming may be greater in the summer than in the winter. This could result in widespread adverse impacts to ecosystem health, agricultural production, water use and supply, and energy demand. A report prepared by the California Climate Change Center focuses on these potential impacts, which are summarized below (State of California 2006a).

- **Precipitation and Water Resources.** Projections indicate that total annual precipitation and rainfall statewide patterns are anticipated to change little over the next century. The predominantly Mediterranean precipitation pattern of most precipitation occurring in the winter months is expected to continue. It is also possible that the intensity and frequency of extreme storm events could increase, thus affecting the balance between water storage and the need for flood control.

  Although most of the precipitation falls during the winter months, water demand is greatest during the summer months. Much of California is reliant on the winter Sierra Nevada snowpack. If temperatures continue to rise as expected, more precipitation will fall as rain instead of snow. Further, that snow which does fall will melt earlier reducing the spring snowpack by as much as 70 to 90 percent. This has potentially major implications for water supply, agriculture, and hydropower generation. This also would adversely impact the economies of communities reliant on winter recreational activities.

Source: IPCC 2000



Schematic illustration of SRES scenarios. Four qualitative storylines yield four sets of scenarios called "families": A1, A2, B1, and B2. Altogether 40 SRES scenarios have been developed by six modeling teams. All are equally valid with no assigned probabilities of occurrence. The set of scenarios consists of six scenario groups drawn from the four families: one group each in A2, B1, B2, and three groups within the A1 family, characterizing alternative developments of energy technologies: A1FI (fossil fuel intensive), A1B (balanced), and A1T (predominantly non-fossil fuel). Within each family and group of scenarios, some share "harmonized" assumptions on global population, gross world product, and final energy. These are marked as "HS" for harmonized scenarios. "OS" denotes scenarios that explore uncertainties in driving forces beyond those of the harmonized scenarios. The number of scenarios developed within each category is shown. For each of the six scenario groups an illustrative scenario (which is always harmonized) is provided. Four illustrative marker scenarios, one for each scenario family, were used in draft form in the 1998 SRES open process and are included in revised form in this report. Two additional illustrative scenarios for the groups A1FI and A1T are also provided and complete a set of six that illustrate all scenario groups. All are equally sound.

By 2100 the world will have changed in ways that are difficult to imagine - as difficult as it would have been at the end of the 19th century to imagine the changes of the 100 years since. Each storyline assumes a distinctly different direction for future developments, such that the four storylines differ in increasingly irreversible ways. Together they describe divergent futures that encompass a significant portion of the underlying uncertainties in the main driving forces. They cover a wide range of key "future" characteristics such as demographic change, economic development, and technological change. For this reason, their plausibility or feasibility should not be considered solely on the basis of an extrapolation of current economic, technological, and social trends.

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B)[3] .

The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

The B1 storyline and scenario family describes a convergent world with the same global population that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with continuously increasing global population at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels.

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FIGURE 4
The Main Characteristics of the Four
SRES Storylines and Scenario Families

Source: UNEP/GRID–Adrenal 2005a

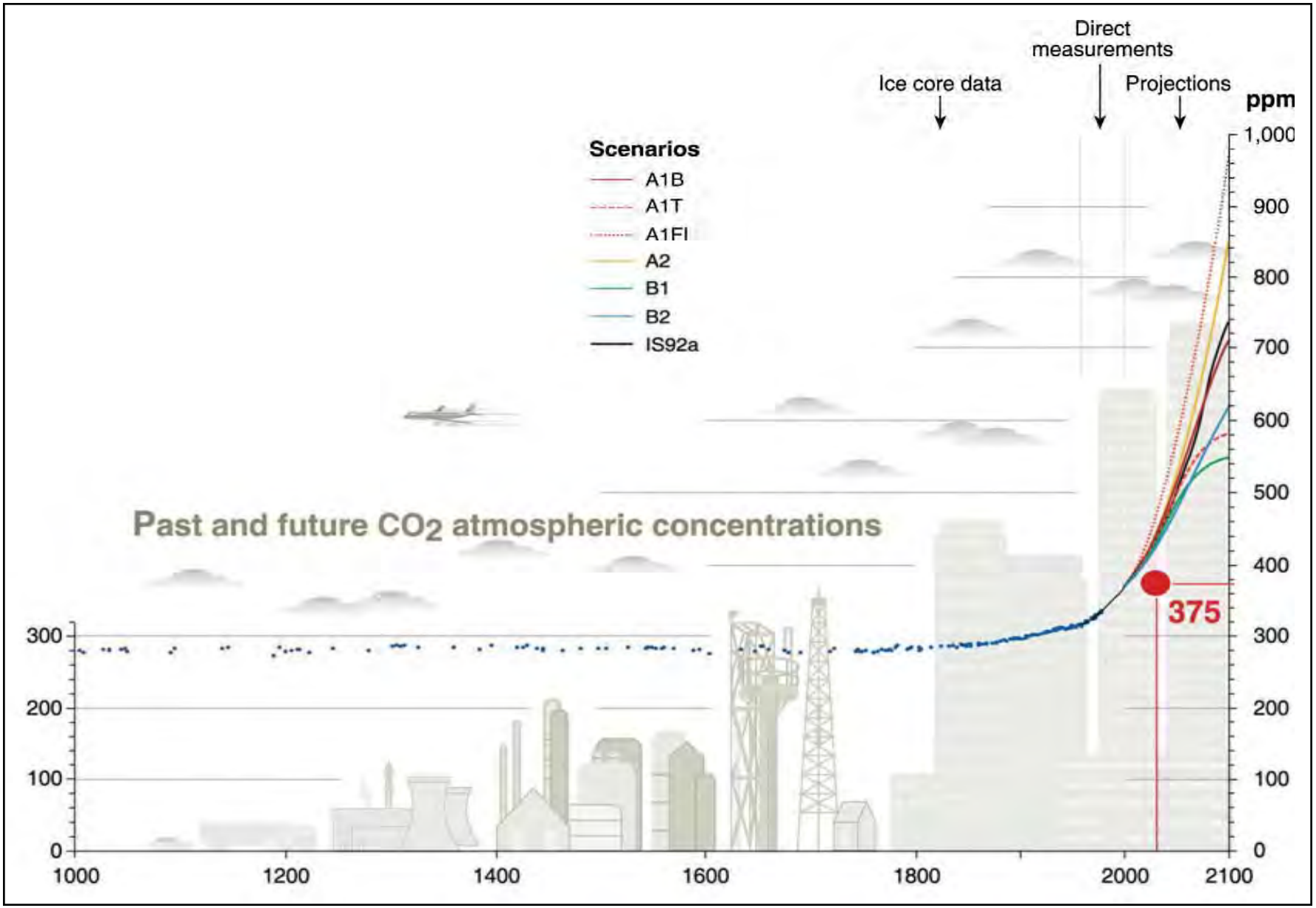

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FIGURE 5
CO_2 Scenarios

Source: UNEP/GRID–Adrenal 2005b

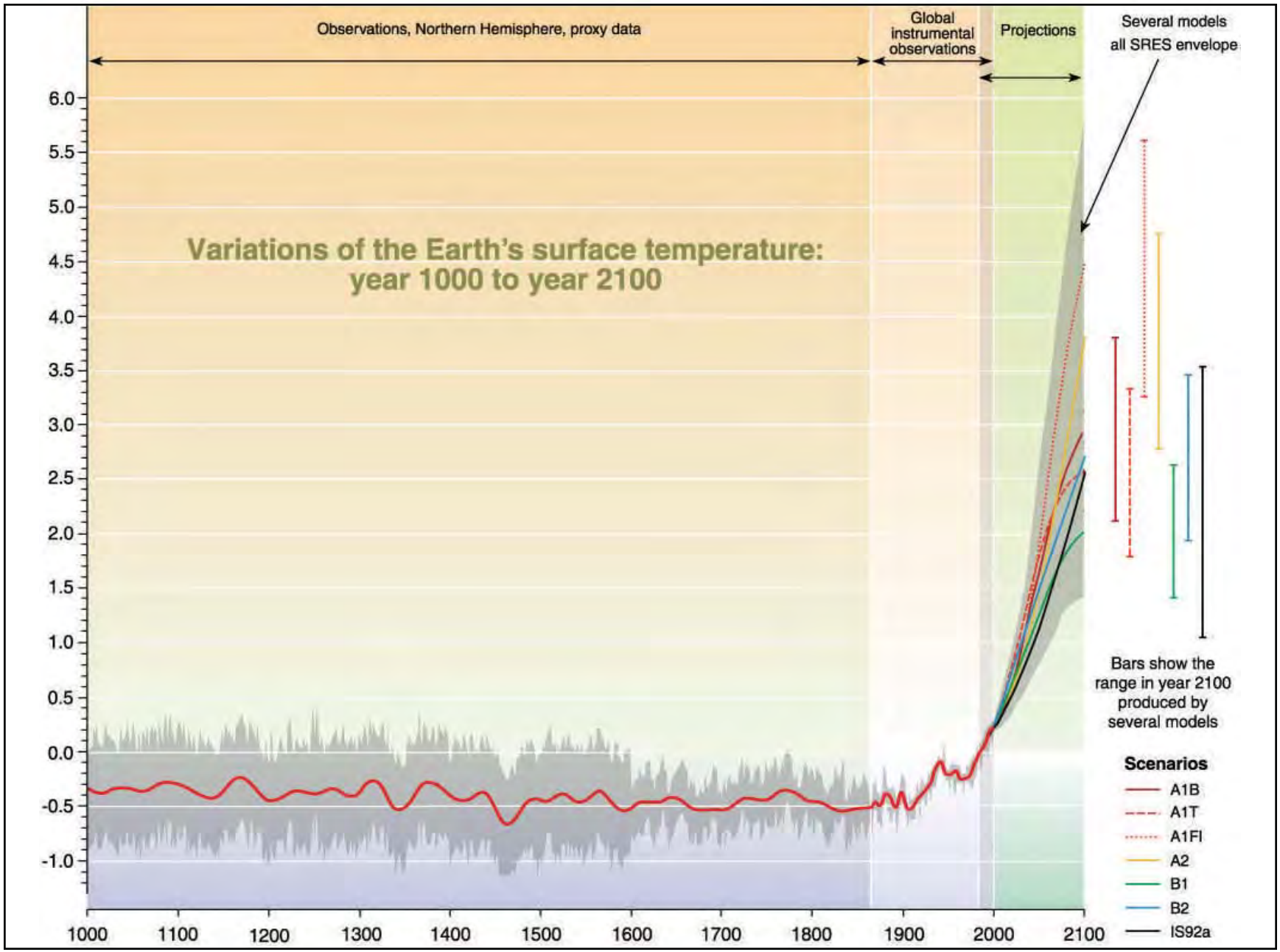

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FIGURE 6
Surface Temperature Scenarios

Water supplies could also be adversely affected by saltwater intrusion associated with anticipated sea level rises (see below).

- **Public Health.** Although the change in statewide average temperature may not appear to be large, the incidence of extreme temperature events, particularly high temperatures, is anticipated to increase. It is these extreme conditions that pose the greatest health risk. Higher temperatures are expected to increase the frequency, duration, and severity of conditions conducive to the formation of air pollutants, particularly ozone. Furthermore, increased temperatures will be favorable for conditions that lead to increases in wildfires, which emit large quantities of particulate matter.

  By 2100, models indicate that under the worst-case emission trends there could be up to 100 more days with temperatures over 90 °F in Los Angeles and over 95 °F in Sacramento. Such temperature extremes, particularly in densely populated urban centers, could cause a marked increase in heat-related death, particularly due to dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory diseases. Increased demand for air conditioning would put additional stresses on the state's energy supplies. Increased temperatures could also lead to increases in disease vectors such as mosquitoes.

- **Agriculture.** California agriculture is the largest and most diverse industry in the nation producing more than half of the country's fruits and vegetables. The anticipated climate changes will have widespread affects on the quantity and quality of agricultural products produced in the state. Many fruit and nut trees are particularly sensitive to changes in temperature. High temperatures can stress dairy cows reducing milk production. Rising temperatures will affect the State's ecosystems and will likely shift or increase the range of noxious and invasive weeds. Further, increased temperatures would be beneficial to certain pests and pathogens that otherwise do not survive the winter months, thus leading to an increase in areas subject to infestation as well as increasing the frequency and severity of damaging outbreaks.

- **Forests and Landscapes.** Global climate change is expected to increase the frequency and severity of wildfires, and to alter the distribution and character of natural vegetation. Alpine and sub-alpine ecosystems are the most threatened in the state and are expected to decline by as much as 60 to 80 percent by the end of the century as temperatures continue to increase. Conifer forests may decline by as much as 18 percent by the end of the century, with corresponding economic impacts resulting from decreased forest production and recreation. Overall, much of California's native ecosystems may transition to plants and animals more suited to warmer conditions.

- **Sea Level Rise.** California has more than 1,100 miles of coastline along the Pacific Ocean. These coastlines are also home to unique ecosystems that are considered some of the world's most threatened. These regions will be increasingly threatened by rising sea levels, more intense coastal storms, and warmer water temperatures. Sea

levels have risen about seven inches in the last century. Projections indicate that with increased global temperatures sea levels could rise between 22 and 35 inches by the end of the century. Sea level increases of this magnitude would inundate coastal areas with salt water, accelerate coastal erosion, threaten vital levees and inland water systems, and disrupt wetlands and vital habitats.

Increased sea levels combined with storm surges from severe storms could cause widespread damage along the coast, including levee breaches in low-lying areas such as the San Francisco Bay Delta. Rising sea levels will also reduce beach areas. Increased storms could also accelerate beach erosion leading to significant monetary expenditures on beach replenishment projects in an attempt to maintain the beaches.

It is also important to note that even if GHG emissions were to be eliminated or dramatically reduced, it is projected that the effect of those emissions would continue to affect global climate for centuries. Figure 7 schematically illustrates this persistence effect.

All of the effects outlined above could dramatically impact the economy of the State through increased costs associated with water management strategies, public health costs, agricultural losses or increased pest management costs, and damage resulting from severe storms, wildfires, and sea level rises. Such effects are not limited to the state and similar or related effects are anticipated for other parts of the country and around the earth. These effects are anticipated to impact both national and worldwide population distributions and economies as populations attempt to shift from areas that become uninhabitable or infertile, or in response to disease outbreaks and shortages. Overall, continued global climate change will likely affect every person on the planet in some way.

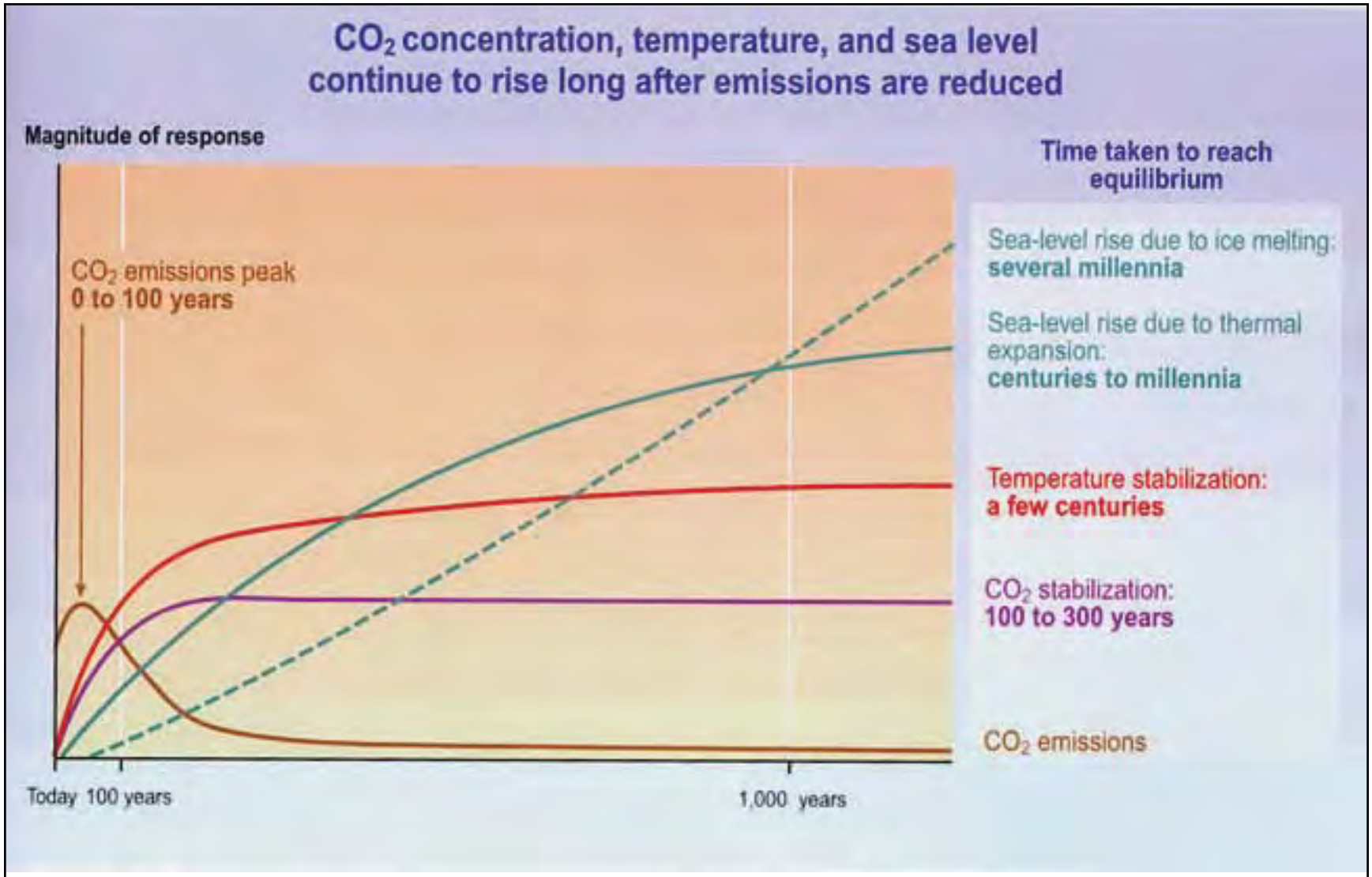
6.0 Global, National, and State GHG Emissions

Estimates of global emissions of GHGs are provided by the UNFCCC for nations that are and are not included in Annex I to the Convention (Annex I and Non-Annex I Parties; see discussion in Section 3.1 below). Given the complexity of estimating global emissions, emission estimates are not available for all countries for all years. Table 2 shows the total equivalent CO_2 emissions for all parties included in Annex I to the Convention (Annex I Parties, made up of 41 nations) for the years 1990, 1995, and 2000 through 2004 (UNFCCC 2006).

TABLE 2
TOTAL AGGREGATE ANTHROPOGENIC EMISSIONS OF CO_2, CH_4, N_2O, HFCs, PFCs, AND SF_6 INCLUDING EMISSIONS/REMOVALS FROM LAND USE, LAND-USE CHANGE, AND REFORESTRY (Tg CO_2 Equivalent)

1990	1995	2000	2001	2002	2003	2004
16,516	15,500	15,709	15,538	15,267	15,291	16,077

Source: IPCC 2001



After CO_2 emissions are reduced and atmospheric concentrations stabilize, surface air temperature continues to rise by a few tenths of a degree per century for a century or more. Thermal expansion of the ocean continues long after CO_2 emissions have been reduced, and melting of ice sheets continues to contribute to sea-level rise for many centuries. This figure is a generic illustration for stabilization at any level between 450 and 1,000 ppm, and therefore has no units on the response axis. Responses to stabilization trajectories in this range show broadly similar time courses, but the impacts become progressively larger at higher concentrations of CO_2.

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FIGURE 7
Persistence Effect

Land-use change and forestry often act as sinks, thus reducing a nation's total GHG emissions. Because nations that are not included in Annex I to the Convention (Non-Annex I Parties comprised of 122 nations) are largely developing countries, emissions data for these countries are more sporadic and incomplete. The most recent emissions data from non-Annex I Parties indicate that total emissions from these nations were approximately 11,931 Tg CO_2 equivalent, including land use-change and forestry (UNFCCC 2005). As such, using the most recent data available for Annex I and Non-Annex I Parties, 2004 global emissions of GHGs were approximately 28,008 Tg CO_2 equivalent, including land-use change and forestry.

Each year, the U.S. EPA prepares an inventory of GHG emissions and sinks report. The report provides information on GHG emissions and sink sources and is used to develop policies and track progress. Inventories are submitted to the UN. The most recent final report, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007*, was completed in April 2009 (U.S. EPA 2009). The 2010 update is currently undergoing public review. The U.S. EPA also provides guidance for states to develop GHG inventories. The *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004* completed in December 2006, including subsequent revisions to the in-state electricity production estimates, is the most recent report for California (State of California 2006b, 2007). Tables 3 and 4 summarize the national GHG emissions in 1990, 1995, 2000, and 2005 through 2007, and State GHG emissions from 1990 through 2004, respectively.

TABLE 3
NET NATIONAL GHG EMISSIONS
(Tg CO_2 Equivalent)

Year	CO_2	CH_4	N_2O	HFCs, PFCs, and SF_6[1]	Total[2]	National Population[3]	Total (Mg CO_2 Eq) per Capita
1990	4,235.3	616.6	315.0	90.5	5,257.3	249,464,396	21.1
1995	4,556.9	615.8	334.1	105.5	5,612.3	262,803,276	21.4
2000	5,237.7	591.1	329.2	132.8	6,290.7	282,194,308	22.3
2005	4,968.1	561.7	315.9	140.2	5,985.9	295,895,897	20.2
2006	4,964.4	582.0	312.1	142.1	6,000.6	298,754,819	20.1
2007	5,040.8	585.3	311.9	149.5	6,087.5	301,621,157	20.2

SOURCE: U.S. EPA 2009
[1]Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride
[2]Totals may vary from the sum of the sources due to independent rounding
[3]U.S. Census Bureau 2009
Tg = terragrams = one million metric tons; Mg = megagrams = one metric ton

TABLE 4
NET CALIFORNIA GHG EMISSIONS
(Tg CO_2 Equivalent)

Year	CO_2	CH_4	N_2O	HFCs, PFCs, and SF_6[1]	Total[2]	California Population[3]	Total (Mg CO_2 Eq) per Capita
1990	301.6	26.0	32.7	7.1	367.4	29,950,111	12.3
1991	293.4	24.9	30.4	7.4	356.1	30,414,114	11.7
1992	299.9	23.8	30.5	7.9	362.2	30,875,920	11.7
1993	295.3	25.4	31.5	8.4	360.5	31,147,208	11.6
1994	313.9	25.4	30.0	8.9	378.2	31,317,179	12.1
1995	297.7	26.2	31.9	9.3	365.1	31,493,525	11.6
1996	302.3	25.5	30.8	11.4	370.0	31,780,829	11.6
1997	312.3	24.2	28.8	12.6	378.0	32,217,708	11.7
1998	330.3	25.3	29.2	8.9	393.7	32,682,794	12.0
1999	333.3	26.3	29.4	9.9	398.9	33,145,121	12.0
2000	352.6	26.4	31.4	10.5	420.9	34,004,051	12.4
2001	357.8	26.7	30.8	11.2	426.5	34,525,902	12.4
2002	351.0	27.1	34.5	12.0	424.6	34,963,856	12.1
2003	328.4	27.5	33.9	12.9	402.7	35,376,833	11.4
2004	342.9	27.9	33.3	14.2	418.3	35,721,991	11.7

SOURCE: State of California 2007
[1]Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride
[2]Totals may vary from the sum of the sources due to independent rounding
[3]US Census Bureau 2009
Tg = terragrams = one million metric tons; Mg = megagrams = one metric ton

Net GHG emissions are gross emissions minus GHG sinks. As seen in Tables 3 and 4, in 2000, California emitted approximately 421 million metric tons of GHGs compared to approximately 6,291 million metric tons of GHG emissions for the nation as a whole, or about 6.7 percent of the nation's emissions. Tables 3 and 4 also illustrate that although California emits a substantial portion of the nation's GHGs, California's per capita emissions are roughly half the national average. In fact, as illustrated in Figure 8, California has the fourth lowest emission per capita of CO_2 in the nation. According to the data presented in Tables 3 and 4, per capita emissions over the 15-year period illustrated have remained relatively flat. This would imply that the increase in total GHG emissions over time is primarily a result of the increasing population of the state and country, and not due to increased per capita emissions.

Figure 8 compares total GHG emissions from California and the United States to other major emitting countries in the world.

As seen in Figure 9, in 2002 the United States was the largest emitter of GHGs in the world, with China ranking second and California ranking as the 16th largest emitter of GHGs globally. Recent data indicate that China may have surpassed the United States as the greatest emitter of GHGs globally (Environmental News Network 2007), although on a per

Source: State of California 2006b

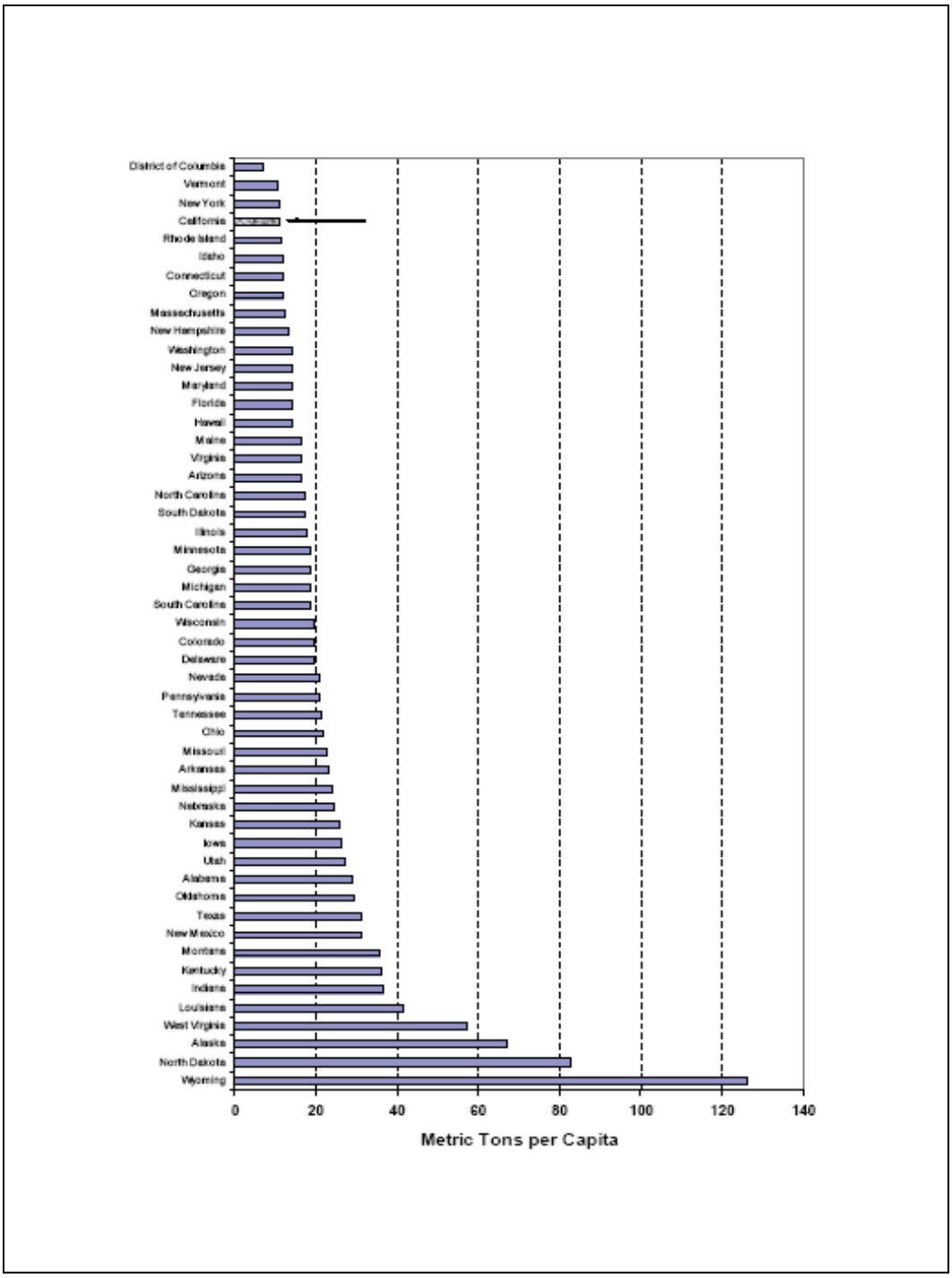

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FIGURE 8
CO_2 Emissions from
Fossil Fuels per Capita (2001)

Source: State of California 2006b

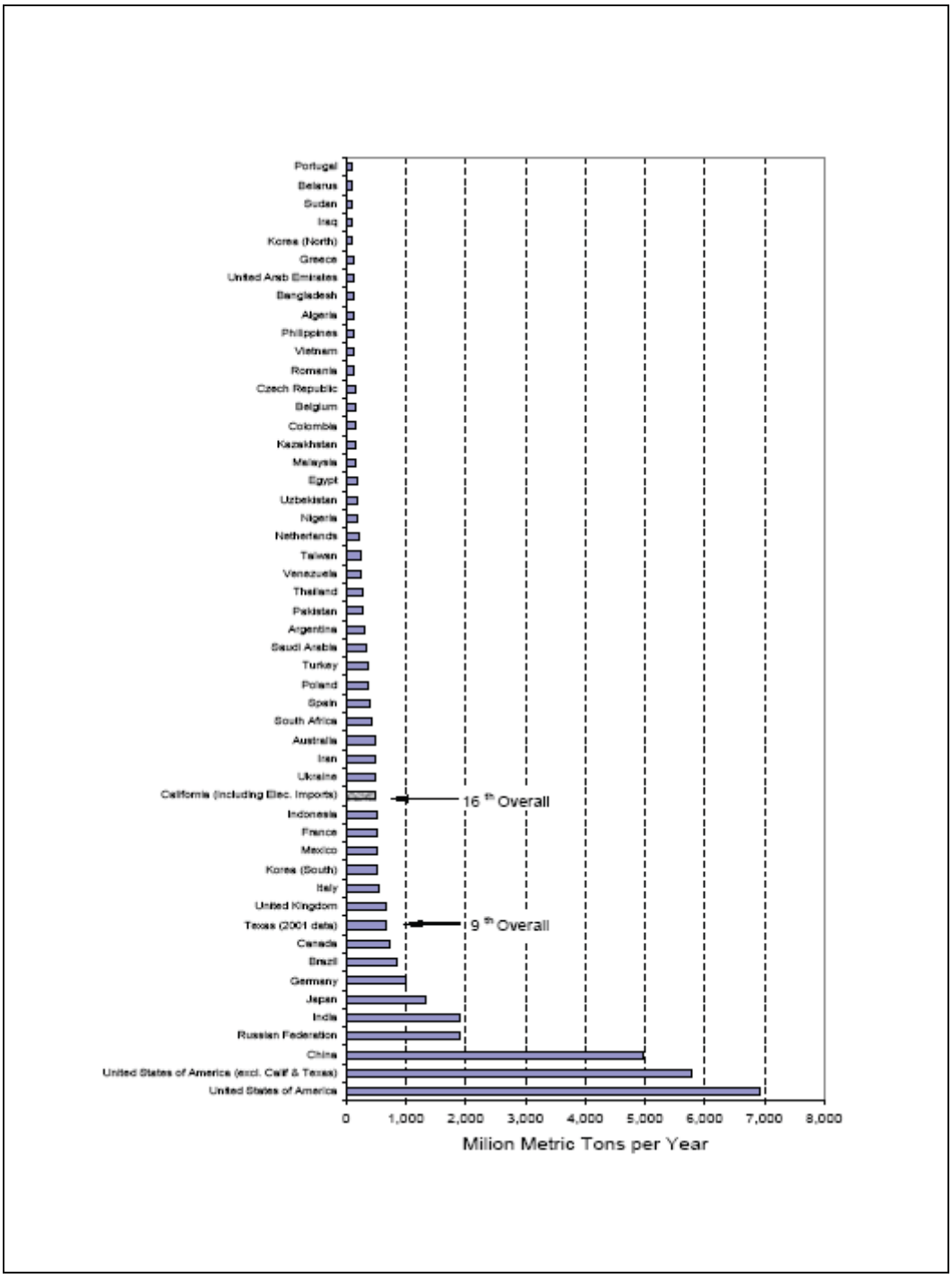

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FIGURE 9
Global Greenhouse Gas
Emission Comparison (2002 data)

capita basis China remains well below the United States and California with a per capital CO_2 emission rate around 3 metric tons per year in 2001 (State of California 2006b).

It is important to note that given the global nature of global climate change, it is the total emissions of GHGs to the atmosphere that is important, not necessarily the per capita or total emissions from any single country. However, per capita emissions provide a relative benchmark by which to evaluate emissions.

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2007e *High GWP Gases and Climate Change.* Obtained from the EPA Climate Change website at http://www.epa.gov/highgwp/scientific.html on May 18, 2007.

2007f *Temperature Changes.* Obtained from the EPA Climate Change website at http://www.epa.gov/climatechange/science/recenttc.html on May 18, 2007.

2009 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007. April 15.

ATTACHMENT 2

Chula Vista Green Building Standards and Increased Energy Efficiency Standards Ordinances

Chula Vista Green Building Standards

Per Chula Vista Municipal Code Chapter 15.12, Green Building Standards, the following green building measures shall apply to all new residential construction, remodels, additions, and alterations, and to all new nonresidential construction, remodels, additions, and tenant improvements.

Definitions

"Building Official" means the officer or other designated authority charged with the administration and enforcement of this chapter, or duly authorized representative.

"Composite wood products" include hardwood plywood, particleboard, and medium density fiberboard. Composite wood products does not include hardboard, structural plywood, structural panels, structural composite lumber, oriented strand board, glued laminated timber as specified in "Structural Glued Laminated Timber" (ANSI A190.1-2002) or prefabricated wood I-joists.

"Energy Code" means the California Energy Code, as adopted and amended by the City in Chapter 15.26 of the Municipal Code.

"Green Building" means a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.

"Infiltration" means an uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors and through any other exterior or demising partition or pipe or duct penetration.

"MERV" means filter minimum efficiency reporting value, based on ASHRAE 52.2-1999.

"Moisture content" means the weight of the water in wood expressed in percentage of the weight of the oven-dry wood.

"Outdoor Air" (Outside air) means air taken from outdoors and not previously circulated in the building.

"VOC" means volatile organic compound and is broadly defined as a chemical compound based on carbon chains or rings with vapor pressures greater than 0.1 millimeters of mercury at room temperature. These compounds typically contain hydrogen and may contain oxygen, nitrogen and other elements. See California Code of Regulations (CCR) Title 17, Section 94508(a).

Standards

Buildings and building sites shall be designed to include the following green building measures:

A. Storm Water Management and Discharge Control. Municipal Code Section 14.20

B. Construction Waste Reduction, Disposal and Recycling. Municipal Code Section 8.25.095

C. Energy Efficiency. Buildings shall meet the requirements of the Chula Vista Municipal Code Section15.26

D. Air Sealing.

1. Joints and openings. Openings in the building envelope separating conditioned space from unconditioned space must be sealed by a method acceptable to the building official.
2. Other openings. Whole house exhaust fans shall have insulated louvers or covers that close when the fan is off. Covers or louvers shall have a minimum insulation value of R-4.2.

E. Water Use

1. Indoor Water Use

a. 20% Savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 20% shall be provided. The reduction in potable water use shall be demonstrated by one of the following methods.

i. A calculation demonstrating a 20% reduction in the building "water use baseline" as established in Table 1 shall be provided, or

ii. Each plumbing fixture and fitting shall meet the 20% reduced flow rate specified in Table 2

b. Multiple showerheads serving one shower shall not exceed the maximum flow rates specified in the 20% reduction column contained in Table 2 or the shower shall be designed to only allow one showerhead to be in operation at a time.

TABLE 1
WATER USE BASELINE

Fixture Type	**Flow-rate[2]**	**Duration**	**Daily uses**	**Occupants [3,4]**
Showerheads	2.5 gpm @ 80 psi	8 min.	1	X
Showerheads Residential	2.5 gpm @ 80 psi	8 min.	1	X
Lavatory Faucets Residential	2.2 gpm @ 60 psi	0.25 min.	3	X
Kitchen Faucets	2.2 gpm @ 60 psi	4 min.	1	X
Replacement Aerators	2.2 gpm @ 60 psi			X
Wash Fountains	2.2 [rim space (in.) / 20 gpm @ 60 psi]			X
Metering Faucets	0.25 gallons/cycle	.25 min.	3	X
Metering Faucets for Wash Fountains	.25 [rim space (in.) / 20 gpm @ 60 psi]	.25 min.		X
Gravity tank type Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Flushometer Tank Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Flushometer Valve Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Electromechanical Hydraulic Water Closets	1.6 gallons/flush	1 flush	1 male[1] 3 female	X
Urinals	1.0 gallons/flush	1 flush	2 male	X

Fixture "Water Use" = Flow rate x Duration x Occupants x Daily uses

[1] Except for low-rise residential occupancies, the daily use number shall be increased to three if urinals are not installed in the room.

[2] The Flow-rate is from the CEC Appliance Efficiency Standards, Title 20 California Code of Regulations; where a conflict occurs, the CEC standards shall apply.

[3] For low rise residential occupancies, the number of occupants shall be based on two persons for the first bedroom, plus one additional person for each additional bedroom.

[4] For non-residential occupancies, refer to Table A, Chapter 4, 2007 California Plumbing Code, for occupant load factors.

TABLE 2
FIXTURE FLOW RATES

Fixture Type	Flow-rate	Maximum flow rate at 20% Reduction
Showerheads	2.5 gpm @ 80 psi	2 gpm @ 80 psi
Lavatory Faucets Residential	2.2 gpm @ 60 psi	1.8 gpm @ 60 psi
Kitchen Faucets	2.2 gpm @ 60 psi	1.8 gpm @ 60 psi
Wash Fountains	2.2 [rim space (in.) / 20 gpm @ 60 psi]	1.8 [rim space (in.) / 20 gpm @ 60 psi]
Metering Faucets	0.25 gallons/cycle	0.2 gallons/cycle
Metering Faucets for Wash Fountains	0.25 [rim space (in.) / 20 gpm @ 60 psi]	0.20 [rim space (in.) / 20 gpm @ 60 psi]
Gravity tank type Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Flushometer Tank Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Flushometer Valve Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Electromechanical Hydraulic Water Closets	1.6 gallons/flush	1.28 gallons/flush[1]
Urinals	1.0 gallons/flush	0.8 gallons/flush

[1] Includes water closets with an effective flush rate of 1.28 gallons or less when tested per ASME A112.19.2 and ASME A112.19.14.

F. Pollutant Control

1. Covering of duct openings and protection of mechanical equipment during construction. At the time of rough installation until final startup of the heating and cooling equipment, all duct and other related air distribution component openings shall be covered to reduce the amount of dust or debris which may collect in the system.

2. Finish material. Finish materials shall comply with the following:

a. Adhesives and sealants. Adhesives used on the project shall meet the following requirements:

i. Aerosol adhesives shall meet the requirements of California Code of Regulations, Title 17, commencing with Section 94507.

ii. Adhesives, adhesive primers, and bonding primers shall comply with Table 3

Table 3
Adhesive VOC Limit. Less Water and Less Exempt Compounds in Grams per Liter

Architectural Applications	VOC Limit
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250

b. Paints and coatings. Architectural paints and coatings shall comply with Table #4

Table 4
Coating VOC Limits
Grams of VOC Per Liter of Coating, Less Water and Less Exempt Compounds

Coating Category	Limit
Bond Breakers	350
Clear Wood Finishes	275
Varnish	275
Sanding Sealers	275
Lacquer	275
Clear Brushing Lacquer	275
Concrete-Curing Compound	100
Dry-Fog Coatings	150
Fire-Proofing Exterior Coatings	350
Flats	50
Floor Coatings	50
Graphic Arts (Sign) Coatings	500
Industrial Maintenance (IM) Coatings	100
High Temperature IM Coatings	420
Zinc-Rich IM Primers	100
Japans/Faux Finish Coatings	350
Magnesite Cement Coatings	450
Mastic Coatings	300
Metallic Pigmented Coatings	500
Multi-Color Coatings	250
Nonflat Coatings	50
Pigmented Lacquer	275
Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	100
Quick-Dry Enamels	50
Quick-Dry Primers, Sealers, and Undercoaters	100
Recycled Coatings	250
Roof Coatings	50
Roof Coatings, Aluminum	100
Roof Primers, Bituminous	350
Rust Preventative Coatings	100
Shellac	
Clear	730
Pigmented	550
Specialty Primers	100
Stains	100
Interior	250
Swimming Pool Coatings	
Repair	340
Other	340
Waterproofing Sealers	100
Waterproofing Concrete/Masonry Sealers	100
Wood Preservatives	
Below-Ground	350
Other	350

Verification of compliance with this section shall be provided at the request of the building official. Documentation may include, but not limited to, the following:

a. Manufacturers product specification.
b. Field verification of on-site product containers.

3. Carpet systems.
   a. All carpet installed in the building interior shall meet the testing and product requirements of one of the following:
      i. Carpet and Rug Institute's Green Label or Green Label Plus Program.
      ii. CA Dept. of Public Health Standard Practice for the testing of VOCs (Specification 01350).
      iii. Department of General Services, California Gold Sustainable Carpet Standard.
      iv. Scientific Certifications Systems Indoor Advantage™ Gold.
   b. Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.
   c. Carpet adhesive. All carpet adhesive shall meet the requirements of Table 3.

4. Composite wood products. Hardwood, plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in Table 5.

Table 5
Formaldehyde Limits
Maximum formaldehyde emissions in parts per million

Phase 1		Phase 2			
Product	Current Limits	Jan 1, 2010	Jan 1, 2011	Jan 1, 2012	Jul 1, 2012
Hardwood Plywood Veneer Core	0.08	0.05			
Hardwood Plywood Composite Core	0.08				0.05
Particle Board	0.18		0.09		
Medium Density Fiberboard	0.21		0.11		
Thin Medium Density Fiberboard (max. thickness of 8 mm)	0.21			0.13	

Documentation. Verification of compliance with this section shall be provided as requested by the building official. Documentation shall include at least one of the following.

a. Product certifications and specifications.
b. Chain of custody certifications.
c. Other methods acceptable to the building official.

G. Indoor Moisture Control

1. Moisture content of building materials. Building materials with visible signs of water damage shall not be installed. Wall and floor framing shall not be enclosed when the framing members exceed 19% moisture content. Moisture content shall be verified in compliance with the following.

   a. Moisture content shall be determined with either a probe-type or a contact-type moisture meter.

b. Moisture readings shall be taken at a point 2 feet to 4 feet from the grade stamped end of each piece to be verified.
c. At least three random moisture readings shall be performed on wall and floor framing with documentation acceptable to the building official provided at the time of approval to enclose the wall and floor framing.

H. Indoor Air Quality and Exhaust
1. Bathroom exhaust fans. Mechanical exhaust fans required in rooms containing a bathtub, shower, or tub shower combination shall be ENERGY STAR compliant and shall terminate outside the building.

2. Filters. Heating and air conditioning filters shall be rated at MERV 6 or higher. Duct system design shall account for pressure drop across the filter.

I. Operation and Maintenance manual. At time of final inspection of a new residential or commercial building, the builder shall place in the building an Operation and Maintenance manual that is acceptable to the Building official. It shall contain directions to the owner or occupant that the manual shall remain with the building throughout the life cycle of the structure.

ORDINANCE NO. 3140

ORDINANCE OF THE CITY OF CHULA VISTA ADDING CHAPTER 15.12, GREEN BUILDING STANDARDS, TO THE CHULA VISTA MUNICIPAL CODE

The City Council of the City of Chula Vista does ordain as follows:

SECTION I. Findings. The City Council finds as follows:

1. The City of Chula Vista has a long standing commitment to leadership in green building standards, sustainable design and construction practices, water and other resource conservation and the reduction of greenhouse gas emissions. The City has committed to reducing its citywide greenhouse gas (GHG) emissions to 20% below 1990 levels by 2010.

2. GHG reduction has been mandated by Governor Schwarzenegger through executive orders and in his signing into law AB 32 in 2006. AB 32 requires a reduction of GHG emissions to 1990 levels by 2020.

3. A 2005 Greenhouse Gas Emissions Inventory indicated that Chula Vista's annual citywide greenhouse gas levels had increased by 35% since 1990 due primarily to residential growth.

4. According to studies published by the United States Green Building Council, the construction, demolition and operation of buildings in the United States collectively consume up to 39% of the total energy used, 12% of all fresh water supply, and 40% of all raw materials used in the United States. Buildings also generate 39% of total emission of greenhouse gases.

5. The California Building Standards Commission (CBSC) and the Department of Housing and Community Development (HCD) developed and approved a California Green Building Standards Code (CGBSC) gleaned from nationally recognized programs and based on an open public adoption process.

6. Green building design, construction, and operation can have a significant positive effect on resource conservation, energy efficiency, waste and pollution generation, and the health and productivity of a building's occupants over the life of the building. Requiring commercial and residential projects to incorporate green building measures is necessary and appropriate to achieve the public health and welfare benefits of green building.

7. Modifications to the California Building Standards, as detailed in this Ordinance, are reasonably necessary due to local climatic conditions. As a result of high summer ambient temperatures and periods of heat waves, average load demand and peak load demand of energy used in Chula Vista is an important factor concerning public safety and adverse economic impacts of power outages or power reductions. Reduction of total and peak energy use will have local and regional benefits in the reduction of energy costs for the building owner, additional available system energy capacity, and a reduction in greenhouse gas emissions.

SECTION II. That Chapter 15.12 is added to the Chula Vista Municipal Code and reads as follows:

Chapter 15.12
Green Building Standards

Sections:

Section 15.12.001 Purpose

The purpose of this Chapter is to enhance the public health and welfare by promoting the environmental and economic health of the City through the design, construction, maintenance, operation and deconstruction of buildings and other site development by incorporating green building practices into all development. The green building provisions referred to in this Chapter are designed to achieve the following goals:

A. Increase energy efficiency in buildings;
B. Encourage water and resource conservation;
C. Reduce waste generated by construction projects;
D. Provide durable buildings that are efficient and economical to own and operate;
E. Promote the health and productivity of residents, workers, and visitors to the city.

Section 15.12.005 Scope

The provisions of this Chapter shall apply to all new residential construction, remodels, additions, and alterations, and to all new nonresidential construction, remodels, additions, and tenant improvements for which a building permit has been applied for on or after the effective date of this Chapter ("Covered Projects").

Section 15.12.010 Definitions

For the purposes of this Chapter, the following words have the meanings shown in this section. Where a term is not defined in this section, but is defined in Chapter 15.06, or the technical codes Chapters 15.08, 15.10, 15.16, 15.24, 15.26, and 15.28, such term shall have the meaning ascribed to it in Chapter 15.06, or the technical codes Chapters 15.08, 15.10, 15.16, 15.24, 15.26, and 15.28. Where terms are not defined, they shall have their ordinarily accepted meanings within the context with which they are used. Words used in the singular include the plural, and the plural the singular. Words used in the masculine gender include the feminine, and the feminine include the masculine.

"Building Official" means the officer or other designated authority charged with the administration and enforcement of this chapter, or duly authorized representative.

"Chula Vista Green Building Standards" means the green building measures that have been adopted by City Council, and which may be amended from time to time.

"Green Building" means a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.

Section 15.12.015 Conflicting Provisions

When conflicts occur between this Chapter and other chapters, codes or laws, those provisions providing the greater safety to life shall govern. In other conflicts where sanitation, life safety or fire safety are not involved, the most restrictive provisions shall govern. If there is a conflict with a state or federal law, the higher authority would prevail; if the laws are consistent but the local is more restrictive, the more restrictive would govern.

When there is a conflict between a general requirement and a specific requirement, the specific requirement shall apply.

Section 15.12.020 Administration

The Building Official is authorized and directed to enforce all the provisions of this chapter and to adopt and enforce rules and regulations supplemental to this chapter as may be deemed necessary to clarify the application of the provisions of this chapter. Such interpretations, rules and regulations shall be in conformity with the intent and purpose of this chapter.

Section 15.12.025 Alternate Materials, Methods of Design and Methods of Construction

The provisions of this chapter are not intended to prevent the use of any material, method of design or method of construction not specifically prescribed by this chapter, provided an alternate has been approved and its use authorized by the Building Official.

The Building Official may approve an alternate, provided the Building Official finds that the proposed design is satisfactory and complies with the provisions of this chapter and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this chapter.

The Building Official may require documentation necessary to make findings for approval. The details of an action granting approval of an alternate shall be recorded and entered in the files of the Building Division.

Section 15.12.030 Green Building Standards

Buildings and building sites covered under Section 15.12.005 shall be designed to include Green Building measures, which have been adopted by City Council resolution as the "Chula Vista Green Building Standards," and which may be amended from time to time.

Section 15.12.035 Administrative Procedures

A. Submittal of Documents. As part of the application for a building permit, construction plans and specifications shall indicate in the general notes or individual detail drawings the Green Building Standards and product specifications and methods of construction that are required by this Chapter.

The Building Official may require the applicant to retain the services of a consultant having expertise in Green Building and/or energy efficiency techniques to review and evaluate complex systems and/or alternate methods or materials of construction and provide recommendations as to compliance with the requirements of this Chapter. The cost of such consultant shall be paid by the applicant.

B. Approval of Permit Application. Notwithstanding any other provision of this code, no building permit shall be issued for any covered project until the Building Official has determined that the plans and specifications submitted for the building permit are in compliance with the requirements of this Chapter.

C. Compliance Verification. The Building Official shall verify that the Green Building measures and specifications indicated on the permitted plans and construction documents are being implemented at foundation, framing, electrical, plumbing, mechanical, and any other required inspections, and prior to issuance of a final certificate of occupancy. Additional inspections may be conducted as needed to ensure compliance with this chapter. During the course of construction and following completion of the project, the city may require the applicant to provide information and documents showing use of products, equipment, and materials specified on the permitted plans and documents.

If, at any stage of construction, the Building Official determines that the project is not being constructed in accordance with the permitted plans and documents, a Stop Order may be issued pursuant to CVMC Section 15.06.060.D. At the discretion of the Building Official, the stop work order may apply to the portion of the project impacted by noncompliance or to the entire project. The stop work order shall remain in effect until the Building Official determines that the project will be brought into compliance with the permitted plans and documents and this Chapter.

Prior to final building approval or issuance of a certificate of occupancy, the Building Official shall review the information submitted by the applicant and determine whether the applicant has constructed the project in accordance with the permitted plans and documents. If the Building Official determines that the applicant has failed to construct the project in accordance with the permitted plans and documents, then the final building approval and final certificate of occupancy may be withheld, until the Building Official determines that the project is in compliance with this Chapter.

Section 15.12.040 Appeal

The Board of Appeals and Advisors as established by Chapter 2.26 is hereby designated to hear and decide appeals of orders, decisions, or determinations made by the Building Official relative to the application and interpretation of this Chapter. The Board shall render all decisions and findings in writing to the Building Official and provide a copy to the appellant. The decision of the Board is final.

SECTION III. EFFECTIVE DATE.

This ordinance will take effect and be in force thirty days after final passage.

Presented by

Gary Halbert, P.E., AICP
Deputy City Manager/Development Services Director

Approved as to form by

Bart C. Miesfeld
City Attorney

PASSED, APPROVED, and ADOPTED by the City Council of the City of Chula Vista, California, this 6th day of October 2009, by the following vote:

AYES:	Councilmembers:	Bensoussan, Castaneda, Ramirez, Thompson and Cox
NAYS:	Councilmembers:	None
ABSENT:	Councilmembers:	None

Cheryl Cox, Mayor

ATTEST:

Donna R. Norris, CMC, City Clerk

STATE OF CALIFORNIA)
COUNTY OF SAN DIEGO)
CITY OF CHULA VISTA)

I, Donna R. Norris, City Clerk of Chula Vista, California, do hereby certify that the foregoing Ordinance No. 3140 had its first reading at a regular meeting held on the 15th day of September 2009 and its second reading and adoption at a regular meeting of said City Council held on the 6th day of October 2009; and was duly published in summary form in accordance with the requirements of state law and the City Charter.

Executed this 6th day of October 2009.

Donna R. Norris, CMC, City Clerk

Jan. 26, 2010

(KLB)

ORDINANCE NO. 3149

ORDINANCE OF THE CITY OF CHULA VISTA AMENDING CHAPTER 15.26 OF THE CHULA VISTA MUNICIPAL CODE AND ADDING SECTION 15.26.030, INCREASED ENERGY EFFICIENCY STANDARDS

The City Council of the City of Chula Vista does ordain as follows:

SECTION I. Findings. The City Council finds as follows:

1. Modifications to the California Building Standards and Building Energy Efficiency Standards, as detailed in this Ordinance, are reasonably necessary due to local climatic conditions. As a result of high summer ambient temperatures and periods of heat waves, average load demand and peak load demand of energy used in Chula Vista is an important factor concerning public safety and adverse economic impacts of power outages or power reductions. Reduction of total and peak energy use, as a result of incremental energy conservation measures required by this Ordinance, will have local and regional benefits in the cost-effective reduction of energy costs for the building owner, additional available system energy capacity, and a reduction in greenhouse gas emissions.

2. The increased energy efficiency standards required by Section 15.26.030 will require the diminution of energy consumption levels permitted by the 2008 Building Energy Efficiency Standards and are determined to be cost effective based on a cost-effectiveness study by Gabel Associates, LLC.

SECTION II. That Chapter 15.26 of the Chula Vista Municipal Code is hereby amended to read as follows:

Chapter 15.26
ENERGY CODE

Sections:
15.26.010 California Energy Code adopted by reference.
15.26.020 Outdoor lighting zones.
15.26.030 Increased Energy Efficiency Standards

15.26.010 California Energy Code adopted by reference.
The City of Chula Vista adopts, by reference, that certain document known as the California Energy Code, set forth in Title 24, Part 6, of the California Code of Regulations, as copyrighted by, and as may be amended from time to time by, the California Building Standards Commission. That California Energy Code is adopted as the energy code of the City of Chula Vista for the purpose of regulating building design and construction standards to increase efficiency in the use of energy for new residential and nonresidential buildings, excepting such portions as are modified, or amended by this Chapter to exceed the California Energy Code, set forth in Title 24, Part 6. Chapter 15.06 CVMC shall serve as the administrative, organizational and enforcement rules and regulations for this Chapter.

15.26.020 Outdoor lighting zones.
Pursuant to Section 10-114 (c) of the California Code of Regulations, Title 24, Part 1, the city has adopted an outdoor lighting zones map amending state default lighting zones as applied to certain areas of the City. The location of outdoor lighting zones in the City are per the adopted Outdoor Lighting Zones Map, dated September 2, 2005, and kept on file with the City Planning and Building Department.

15.26.030 Increased Energy Efficiency Standards

A. Scope. The provisions of this Section shall apply to all new residential construction, additions, remodels and alterations, and to all new non-residential construction, additions, remodels and alterations except as follows:
   a. Additions, remodels or alterations to existing low-rise (three stories or less) residential buildings where the addition, remodel or alteration is less than or equal to1,000 square feet of conditioned floor area are exempt from the provisions of this Section.
   b. Additions, remodels or alterations to existing high-rise residential (more than three stories), non-residential or hotel/motel buildings where the addition, remodel or alteration is less than or equal to10,000 square feet of conditioned floor area are exempt from the provisions of this Section.

   Compliance with the California Energy Code is always required even if the increased energy efficiency standards specified in this Section do not apply.

B. Definitions. Terms used in this Section are as defined in the California Energy Code and Chapter 15.06, 19.06 and 19.48 of the Municipal Code.

C. Requirements. In addition to the requirements of the California Energy Code, applications for building permits covered under Section 15.26.030 (A) shall comply with the following:
   a. For Climate Zone 7:
      i. All new low-rise residential buildings or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditioned floor area shall use at least 15% less Time Dependent Valuation (TDV) Energy than the 2008 Building Energy Efficiency Standards allows.
      ii. All new non- residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non- residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area shall use at least 15% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

   b. For Climate Zone 10:
      i. All new low-rise residential buildings or additions, remodels or alterations to existing low-rise residential buildings where the additions, remodels or alterations are greater than 1,000 square feet of conditioned floor area shall use at least 20% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

ii. All new non-residential, high-rise residential or hotel/motel buildings, or additions, remodels or alterations to existing non- residential, high-rise residential or hotel/motel buildings where the additions, remodels or alterations are greater than 10,000 square feet of conditioned floor area shall use at least 15% less TDV Energy than the 2008 Building Energy Efficiency Standards allows.

D. Compliance. No building permit shall be issued unless the permit application demonstrates compliance with the requirements of Section 15.26.030 based on the performance approach as specified in the 2008 Building Energy Efficiency Standards using a California Energy Commission approved energy compliance software program.

E. Compliance Credit Option for Buildings within Sectional Planning Area (SPA) Plan Projects.

For building construction within Sectional Planning Area (SPA) Plan project areas whose SPA is approved subsequent to the effective date of this Ordinance, the developer may meet a portion of the requirements set forth under Section 15.26.030C, provided the SPA Plan has met the qualifying energy savings thresholds for community design and site planning features pursuant to the requirements as set forth in the SPA's approved Air Quality Improvement Plan (AQIP). If the approved AQIP has met the qualifying thresholds, the applicant may request and receive an energy savings credit towards a portion of the requirements specified in Section 15.26.030C subject to approval by the Director of Development Services, provided the project fully complies with the 2008 Building Energy Efficiency Standards (Title 24, Part 6) which are in effect at the time of permitting, and conforms to applicable guidelines in effect at the time of the request for credit.

F. Technical Assistance. The building official may require the applicant to retain the services of a consultant having expertise in energy efficiency techniques to review and evaluate complex systems and/or alternate methods of compliance and provide recommendations as to compliance with the requirements of Section 15.26.030. The cost of such consultant shall be paid by the applicant.

G. Expiration. Section 15.26.030 shall expire upon the date the 2008 Building Energy Efficiency Standards are no longer in effect.

SECTION III. EFFECTIVE DATE.

This ordinance will take effect and be in force thirty days after final passage.

Presented by

Gary Halbert, P.E., AICP
Deputy City Manager/Development Services Director

Approved as to form by

Bart C. Miesfeld
City Attorney

PASSED, APPROVED, and ADOPTED by the City Council of the City of Chula Vista, California, this 26th day of January 2010, by the following vote:

AYES:	Councilmembers:	Bensoussan, Castaneda, Ramirez, Thompson and Cox
NAYS:	Councilmembers:	None
ABSENT:	Councilmembers:	None

Cheryl Cox, Mayor

ATTEST:

Donna R. Norris, CMC, City Clerk

STATE OF CALIFORNIA)
COUNTY OF SAN DIEGO)
CITY OF CHULA VISTA)

I, Donna R. Norris, City Clerk of Chula Vista, California, do hereby certify that the foregoing Ordinance No. 3149 had its first reading at a regular meeting held on the 20th day of October 2009 and its second reading and adoption at a regular meeting of said City Council held on the 26th day of January 2010; and was duly published in summary form in accordance with the requirements of state law and the City Charter.

Executed this 26th day of January 2010.

Donna R. Norris, CMC, City Clerk

ATTACHMENT 3

GHG Emissions Calculations

BAU GHG EMISSIONS (i.e., WITHOUT REDUCTION MEASURES)

Emission Source	CO2	N20	CH4	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	112,991.36	358.08	66.71	113,416.15
Electricity Usage Emissions	2,682.16	11.91	0.47	97,099.72
Natural Gas Usage Emissions	31,759.48	180.50	12.78	31,952.76
Water Usage Emissions	4,672.12	0.04	0.07	4,693.69
Solid Waste Emissions				8,370.33
Construction Emissions				51,545.36
Global Warming Potential	1.00	310.00	21.00	
Total CO2 Eq Emissions				**307,078.01**

TARGET: 20 PERCENT REDUCTION IN BAU **245,662.41**

PROJECT REDUCED GHG EMISSIONS

Emission Source	CO2	N20	CH4	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	68,020.94	1.91	0.70	68,276.67
Electricity Usage Emissions	1,877.51	8.34	0.33	67,969.80
Natural Gas Usage Emissions	22,231.63	126.35	8.95	22,366.93
Water Usage Emissions	3,737.70	0.03	0.05	3,754.95
Solid Waste Emissions				8,370.33
Construction Emissions				51,545.36
Global Warming Potential	1.00	310.00	21.00	
Total CO2 Eq Emissions				**222,284.04**

Reduction in BAU:

39.800	percent
30.000	percent
30.000	percent
20.000	percent
0.000	percent
0.000	percent
27.613	percent TOTAL
84,793.96	MTCO2E TOTAL reduction

BAU non-vehicular:	193,661.86	MTCO2E
Project non-vehicular:	154,007.38	MTCO2E
Reduction in BAU non-vehicular	39,654.48	MTCO2E
percent reduction non-vehicular	20.48	%

OTAY RANCH
GHG CALCULATIONS

BAU VEHICLE EMISSIONS CALCULATIONS

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT):	113,073.00	trips
Average Trip Length:	5.80	miles (SANDAG 2009)
VMT per Day:	655,823.40	miles
VMT per Year:	239,375,541.00	miles
Total Gallons of Fuel (per day):	34,884.22	
Total Gallons of Fuel (per year):	12,732,741.54	gallons per year

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	249,103,355.54	2,204.62	112,991.36	1.00	112,991.36
CH4	7,003.01	2,204.62	3.18	21.00	66.71
N2O	2,546.55	2,204.62	1.16	310.00	358.08
TOTAL metrics tons of CO2 Eq per Year:					113,416.15

PROJECT VEHICLE EMISSIONS CALCULATIONS

Accounting for State Regulations and Project-Specific Trip Lengths

Parameters

Average Fuel Economy:	18.80	miles per gallon (mpg)
Average Daily Traffic (ADT) - Village 8 West:	43,564.00	trips
Average Trip Length - Village 8 West:	4.62	miles (SANDAG 2010b)
VMT per Day - Village 8 West:	201,265.68	miles per day
Average Daily Traffic (ADT) - Village 9:	56,123.00	trips
Average Trip Length - Village 9:	5.08	miles (SANDAG 2010b)
VMT per Day - Village 9:	285,104.84	miles per day
Average Daily Traffic (ADT) - RTP Village 10:	13,386.00	trips
Average Trip Length - RTP Village 10:	5.80	miles (SANDAG 2009)

OTAY RANCH
GHG CALCULATIONS

VMT per Day - RTP Village 10:	77,638.80	miles per day
Total ADT (combining Village 8W, 9 and RTP)	113,073.00	Total ADT
Total VMT per Day:	564,009.32	miles per day
Total VMT per Year:	205,863,401.80	mils per year
Total Gallons of Fuel per Day:	30,000.50	
Total Gallons of Fuel:	10,950,180.95	gallons

Vehicle Emission Factors (pounds/gallon)

CO2	19.56400
CH4	0.00055
N2O	0.00020

Vehicle Emissions (accounting for Project average trip lengths)

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	214,229,340.04	2,204.62	97,172.78	1.00	97,172.78
CH4	6,022.60	2,204.62	2.73	21.00	57.37
N2O	2,190.04	2,204.62	0.99	310.00	307.95
TOTAL metrics tons of CO2 Eq per Year:					97,538.09

Reduced Vehicle Emissions (accounting for State regulations in addition to shorter Project average trip lengths)

Low Carbon Fuel Standards	Reduce emissions from transportation fuels by 10 percent
AB 1493 Pavley I	Reduce emissions acorss passenger fleet by 18 percent

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	149,960,538.03	2,204.62	68,020.94	1.00	68,020.94
CH4	4,215.82	2,204.62	1.91	21.00	40.16
N2O	1,533.03	2,204.62	0.70	310.00	215.56
TOTAL metrics tons of CO2 Eq per Year:					**68,276.67**

Percent Reduction in BAU	0.397998723

ELECTRICITY EMISSIONS CALCULATIONS

BAU

Residential Parameters

Single-Family Consumption per Unit per Month:	590.88	kWh per consumer per month average		
Single-Family Consumption per Unit per Year:	7,090.56	kWh per consumer per year		
Number of Single-Family Units:	887.00	units		
Single-Family Total Consumption (kWh):	6,289,326.72	kWh per year		
Single-Family Total Consumption (MWh):	6,289.33	MWh per year		
Multi-Family Consumption per Unit per Month:	360.39	kWh per consumer per month average		
Multi-Family Consumption per Unit per Year:	4,324.68	kWh per consumer per year		
Number of Multi-Family Units:	5,163.00	units		
Multi-Family Total Consumption (kWh)):	22,328,322.84	kWh per year		
Multi-Family Total Consumption (MWh):	22,328.32	MWh per year		
Combined Residential Total Consumption (kWh):	28,617,649.56	kWh per year		
Combined Residential Total Consumption (MWh):	28,617.65	MWh per year		
[Project Reduction of 30 Percent =	20,032.35	MWh per year]		

School Parameters

Annual Consumption per Square Foot:	6.35	kWh per/square foot/year	6.35	kWh/size/year for elementary school
Total School Acreage:	51.40	acres		
Total School Square Footage:	2,238,984.00	square feet		
Total School Consumption (kWh):	14,217,548.40	kWh		
Total School Consumption (MWh):	14,217.55	MWh		
[Project Reduction of 30 Percent =	9,952.28	MWh per year		

University Parameters

Annual Consumption per Square Foot:	11.32	kWh per/square foot/year	11.35	kWh/size/year for colleges
Total University Acreage:	50.00	acres		
Total University Square Footage:	2,178,000.00	square feet		
Total University Consumption (kWh):	24,654,960.00	kWh		
Total University Consumption (MWh):	24,654.96	MWh		
[Project Reduction of 30 Percent =	17,258.47	MWh per year		

Park Parameters

Annual Consumption per Square Foot:	9.38	kWh per square foot per year for health or racquet club	0.00	for city park or recreational swimming pool
Total Park Acreage:	55.40	acres	9.38	for health club
Total Park Square Footage:	2,413,224.00	square feet		
Total Park Consumption (kWh):	22,636,041.12	kWh	9.38	for racquet club historic
Total Park Consumption (MWh):	22,636.04	MWh		
[Project Reduction of 30 Percent =	15,845.23	MWh per year		

Community Purpose Parameters

Annual Consumption per Square Foot:	9.38	kWh per square foot per year for place of worship	9.38	kWh/size/year for place of worship historic
Total Community Purpose Acreage:	10.80	acres	9.38	kWh/size/year for place of health club
total Community Purpose Square Footage:	470,448.00	square feet		
Total Community Purpose Consumption (kWh):	4,412,802.24	kWh		
Total Community Purpose Consumption (MWh):	4,412.80	MWh		
[Project Reduction of 30 Percent =	3,088.96	MWh per year		

Commercial Parameters

Annual Consumption per Square Foot:	14.10	kWh per square foot per year
Total Commercial Square Feet:	1,800,000.00	square feet
Total Commercial Consumption (kWh):	25,380,000.00	kWh
Total Commercial Consumption (MWh):	25,380.00	MWh
[Project Reduction of 30 Percent =	17,766.00	MWh per year

Industrial Parameters

Annual Consumption per Square Foot:	17.60	kWh per square foot per year
Total Industrial Square Feet:	2,221,560.00	square feet
Total Industrial Consumption (kWh):	39,099,456.00	kWh
Total Industrial Consumption (MWh):	39,099.46	MWh
[Project Reduction of 30 Percent =	27,369.62	MWh per year

Total Combined Annual Consumption in MWh:	159,018.46	MWh per year
[Project Reduction of 30 Percent =	111,312.92	MWh per year]

OTAY RANCH
GHG CALCULATIONS

Electricity Generation Emission Factors (pounds/MWh)

CO2	1,340.0000
CH4	0.0111
N2O	0.0192

Residential Electricity Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	38,347,650.41	2,204.62	17,394.20	1.00	17,394.20	
CH4	317.66	2,204.62	0.14	21.00	3.03	
N2O	549.46	2,204.62	0.25	310.00	77.26	
TOTAL metrics tons of CO2 Eq per Year:					17,474.49	
[Project Reduction of 30 Percent =					12,232.14	MTCO2Eq per year]

School Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	19,051,514.86	2,204.62	8,641.62	1.00	8,641.62	
CH4	157.81	2,204.62	0.07	21.00	1.50	
N2O	272.98	2,204.62	0.12	310.00	38.38	
TOTAL metrics tons of CO2 Eq per Year:					8,681.51	
[Project Reduction of 30 Percent =					6,077.06	MTCO2Eq per year]

University Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	33,037,646.40	2,204.62	14,985.62	1.00	14,985.62	
CH4	273.67	2,204.62	0.12	21.00	2.61	
N2O	473.38	2,204.62	0.21	310.00	66.56	
TOTAL metrics tons of CO2 Eq per Year:					15,054.79	
[Project Reduction of 30 Percent =					10,538.35	MTCO2Eq per year]

Park Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	30,332,295.10	2,204.62	13,758.50	1.00	13,758.50	
CH4	251.26	2,204.62	0.11	21.00	2.39	
N2O	434.61	2,204.62	0.20	310.00	61.11	
TOTAL metrics tons of CO2 Eq per Year:					13,822.00	MTCO2Eq per year]
[Project Reduction of 30 Percent =					9,675.40	

Community Purpose Electricity Emissions

Total Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	5,913,155.00	2,204.62	2,682.16	1.00	2,682.16	
CH4	48.98	2,204.62	0.02	21.00	0.47	
N2O	84.73	2,204.62	0.04	310.00	11.91	
TOTAL metrics tons of CO2 Eq per Year:					2,694.54	
[Project Reduction of 30 Percent =						1,886.18 MTCO2Eq per year]

Commercial Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	34,009,200.00	2,204.62	15,426.31	1.00	15,426.31	
CH4	281.72	2,204.62	0.13	21.00	2.68	
N2O	487.30	2,204.62	0.22	310.00	68.52	
TOTAL metrics tons of CO2 Eq per Year:					15,497.51	
[Project Reduction of 30 Percent =					10,848.26	MTCO2Eq per year]

Industrial Electricity Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq	
CO2	52,393,271.04	2,204.62	23,765.18	1.00	23,765.18	
CH4	434.00	2,204.62	0.20	21.00	4.13	
N2O	750.71	2,204.62	0.34	310.00	105.56	
TOTAL metrics tons of CO2 Eq per Year:					23,874.88	MTCO2Eq per year]
[Project Reduction of 30 Percent =					16,712.41	

Total Combined Electricity Emissions

Total Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	213,084,732.81	2,204.62	96,653.59	1.00	96,653.59
CH4	1,765.10	2,204.62	0.80	21.00	16.81

OTAY RANCH
GHG CALCULATIONS

N2O	3,053.15	2,204.62	1.38	310.00	429.32
TOTAL metrics tons of CO2 Eq per Year:					**97,099.72**
[Project Reduction of 30 Percent =					**67,969.80** MTCO2Eq per year]

PROJECT GHG REDUCTIONS

Consume 30 percent less energy than BAU by	111,312.92	MWh per year electricity consumption
exceeding Title 24 Year 2005 by 30 percent:	**67,969.80**	MTCO2Eq per year generation
Diffference between Project and BAU:	29,129.92	MTCO2Eq per year
Percent Reduction in BAU:	30.00	percent

NATURAL GAS EMISSIONS CALCULATIONS
BAU

Residential Parameters						
Single Family Consumption per Unit per Month:	5,198.70	cubic feet per month	per RASS			
Single Family Consumption per Unit per Year:	62,384.40	cubic feet per year				
Single Family Units:	887.00	units				
Multi-Family Consumption per Unit per Month:	3,128.97	cubic feet per month				
Multi-Family Consumption per Unit per Year:	37,547.64	cubic feet per year				
Multi-Family Units:	5,163.00	units				
Total Residential Consumption (cubic feet):	249,193,428.12	cubic feet per year				
Total Residential Consumption (million cubic feet):	249.19	million cubic feet per year				
[Project Reduction of 30 percent =	174.44	million cubic feet per year]				
School Parameters			per CEUS	conversion:		
School Consumption per Square Foot per Year:	15.50	cubic feet	16.00	kBtu/sqft/year		
School Consumption per Square Foot per Month:	1.29	cubic feet	16,000.00	Btu/sqft/year		
Total School Acreage:	51.40	acres	0.155	hundred cubic feet/year	103,225.806	
Total School Square Footage:	2,238,984.00	square feet	15.50	cubic feet/year		
Total School Consumption (cubic feet):	34,704,252.00	cubic feet per year				
Total School Consumption (million cubic feet):	34.70	million cubic feet per year				
[Project Reduction of 30 Percent =	24.29	million cubic feet per year				
University Parameters			per CEUS	conversion:		
University Consumption per Square Foot per Year:	41.72	cubic feet	42.97	kBtu/sqft/year		
University Consumption per Square Foot per Month:	3.48	cubic feet	42,970.00	Btu/sqft/year		
Total University Acreage:	50.00	acres	0.417	hundred cubic feet/year		
Total University Square Footage:	2,178,000.00	square feet	41.72	cubic feet/year		
Total University Consumption (cubic feet):	90,862,776.70	cubic feet per year				
Total University Consumption (million cubic feet):	90.86	million cubic feet per year				
[Project Reduction of 30 Percent =	63.60	million cubic feet per year				
Park Parameters			per CEUS	conversion:		
Park Consumption per Square Foot per Year:	3.00	cubic feet	3.10	kBtu/sqft/year		
Park Consumption per Square Foot per Month:	0.25	cubic feet	3,100.00	Btu/sqft/year	103,333.333	
Total Park Acreage:	55.40	acres	0.03	hundred cubic feet/year		
Total Park Square Footage:	2,413,224.00	square feet	3.00	cubic feet/year		
Total Park Consumption (cubic feet):	7,239,672.00	cubic feet per year				
Total Park Consumption (million cubic feet):	7.24	million cubic feet per year				
[Project Reduction of 30 Percent =	5.07	million cubic feet per year				
Community Purpose Parameters			per CEUS	conversion:		
Community Consumption per Square Foot per Year:	33.20	cubic feet	34.20	kBtu/sqft/year		
Community Consumption per Square Foot per Month:	2.77	cubic feet	34,200.00	Btu/sqft/year	103,012.048	
Total Community Purpose Acreage:	10.80	acres	0.33	hundred cubic feet/year		
total Community Purpose Square Footage:	470,448.00	square feet	33.20	cubic feet/year		
Total Community Consumption (cubic feet):	15,618,873.60	cubic feet per year				
Total Community Consumption (million cubic feet):	15.62	million cubic feet per year				
[Project Reduction of 30 Percent =	10.93	million cubic feet per year				
Commercial Parameters						
Retail Consumption per Square Foot per Month:	2.90	cubic feet	per CEUS			
Retail Consumption per Square Foot per Year:	34.80	cubic feet				
Retail Amount:	1,800,000.00	square feet				
Office Consumption per Square Foot per Month:	2.00	cubic feet per month				
Office Consumption per Square Foot per Year:	24.00	cubic feet per year				
Office Amount:	0.00	square feet				
Total Office Consumption (cubic feet):	62,640,000.00	cubic feet per year				
Total Office Consumption (million cubic feet):	62.64	million cubic feet per year				
[Project Reduction of 30 percent =	43.85	million cubic feet per year]				
Industrial Parameters						
Consumption per Consumer per Month:	241,611.00	cubic feet per consumer per r	per EIA (U.S. Energy Information Administration, 2006)			
Consumption per Consumer per Year:	2,899,332.00	cubic feet per consumer per year				
Industrial Amount	2,221,560.00	square feet				
Minimum Lot Area:	52,272.00	square feet*	*For lot area = 2 acres (Zoning Ordinance)			
Maximum Number of Consumers:	42.50	Consumers	FAR = 0.6			
Total Consumption (cubic feet):	123,221,610.00	cubic feet per year	(2 acres)(43,560 sq ft per acre)(0.6) = 52,272 sq ft			
Total Industrial Consumption (million cubic feet):	123.22	million cubic feet per year				
[Project Reduction of 30 percent =	86.26	million cubic feet per year]				
Total Combined Annual Consumption:	583.48	million cubic feet per year				
[Project Reduction of 30 percent =	408.44	million cubic feet per year]				

Natural Gas Combustion Emission Factors (pounds/million cubic feet)

CO2	120,000.0
CH4	2.3
N2O	2.2

Residential Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	29,903,211.37	2,204.62	13,563.87	1.00	13,563.87
CH4	573.14	2,204.62	0.26	21.00	5.46
N2O	548.23	2,204.62	0.25	310.00	77.09
TOTAL metrics tons of CO2 Eq per Year:					13,646.41

[Project Reduction of 30 percent = 9,552.49 MTCO2Eq per year]

School Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	4,164,510.24	2,204.62	1,888.99	1.00	1,888.99
CH4	79.82	2,204.62	0.04	21.00	0.76
N2O	76.35	2,204.62	0.03	310.00	10.74
TOTAL metrics tons of CO2 Eq per Year:					1,900.49

[Project Reduction of 30 percent = 1,330.34 MTCO2Eq per year]

University Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	10,903,533.20	2,204.62	4,945.76	1.00	4,945.76
CH4	208.98	2,204.62	0.09	21.00	1.99
N2O	199.90	2,204.62	0.09	310.00	28.11
TOTAL metrics tons of CO2 Eq per Year:					4,975.86

[Project Reduction of 30 percent = 3,483.10 MTCO2Eq per year]

Park Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	868,760.64	2,204.62	394.06	1.00	394.06
CH4	16.65	2,204.62	0.01	21.00	0.16
N2O	15.93	2,204.62	0.01	310.00	2.24
TOTAL metrics tons of CO2 Eq per Year:					396.46

[Project Reduction of 30 percent = 277.52 MTCO2Eq per year]

Community Purpose Facility Natural Gas Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	1,874,264.83	2,204.62	850.15	1.00	850.15
CH4	35.92	2,204.62	0.02	21.00	0.34
N2O	34.36	2,204.62	0.02	310.00	4.83
TOTAL metrics tons of CO2 Eq per Year:					855.33

[Project Reduction of 30 percent = 598.73 MTCO2Eq per year]

Commercial Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	7,516,800.00	2,204.62	3,409.56	1.00	3,409.56
CH4	144.07	2,204.62	0.07	21.00	1.37
N2O	137.81	2,204.62	0.06	310.00	19.38
TOTAL metrics tons of CO2 Eq per Year:					3,430.31

[Project Reduction of 30 percent = 2,401.22 MTCO2Eq per year]

Industrial Natural Gas Emissions

Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	14,786,593.20	2,204.62	6,707.08	1.00	6,707.08
CH4	283.41	2,204.62	0.13	21.00	2.70
N2O	271.09	2,204.62	0.12	310.00	38.12
TOTAL metrics tons of CO2 Eq per Year:					6,747.90

[Project Reduction of 30 percent = 4,723.53 MTCO2Eq per year]

Total Combined Natural Gas Emissions

Total Emissions	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	70,017,673.49	2,204.62	31,759.48	1.00	31,759.48
CH4	1,342.01	2,204.62	0.61	21.00	12.78
N2O	1,283.66	2,204.62	0.58	310.00	180.50
TOTAL metrics tons of CO2 Eq per Year:					**31,952.76**

[Project Reduction of 30 percent = **22,366.93** MTCO2Eq per year]

PROJECT GHG REDUCTIONS

Exceed Title 24 Year 2005 by 30 percent:

30 percent reduction in BAU CO2Eq 22,366.93

Consume 30 percent less energy than BAU

OTAY RANCH
GHG CALCULATIONS

WATER EMISSIONS CALCULATIONS
BAU

Residential Parameters

Single Family Demand per Unit per Day:	500.00	gallons per day (gpd)
Single Family Demand per Unit per Year:	182,500.00	gallons per year (gpy)
Single Family Units:	887.00	units
Multi-Family Demand per Unit per Day:	255.00	gallons per day (gpd)
Multi-Family Demand per Unit per Year:	93,075.00	gallons per year (gpy)
Multi-Family Units:	5,163.00	units
Total Daily Residential Water Demand (gal):	1,760,065.00	gallons per day (gpd)
Total Annual Residential Water Demand (gal):	642,423,725.00	gallons per year (gpy)
	642,423,725.00	check

School/Educational Parameters

School Demand per Acre per Day:	1,785.00	gallons per day (gpd)
School Demand per Acre per Year:	651,525.00	gallons per year (gpy)
School Acres Amount:	51.40	acres
Total Daily Schools Water Demand (gal):	91,749.00	gallons per day (gpd)
Total Annual Schools Water Demand (gal):	33,488,385.00	gallons per year (gpy)
	33,488,385.00	check

University Parameters

University Demand per Acre per Day:	1,785.00	gallons per day (gpd)
University Demand per Acre per Year:	651,525.00	gallons per year (gpy)
University Acres Amount:	50.00	acres
Total Daily University Water Demand (gal):	89,250.00	gallons per day (gpd)
Total Annual University Water Demand (gal):	32,576,250.00	gallons per year (gpy)
	32,576,250.00	check

Park Parameters

Park Demand per Acre per Day:	2,155.00	gallons per day (gpd)
Park Demand per Acre per Year:	786,575.00	gallons per year (gpy)
Park Acres Amount:	55.40	acres
Total Daily Park Water Demand (gal):	119,387.00	gallons per day (gpd)
Total Annual Park Water Demand (gal):	43,576,255.00	gallons per year (gpy)
	43,576,255.00	check

Commercial Parameters

Commercial Demand per Square Foot per Day:	0.14	gallons per day (gpd)
Commercial Demand per Square Foot per Year:	51.10	gallons per year (gpy)
Commercial Amount:	1,800,000.00	square feet

OTAY RANCH
GHG CALCULATIONS

Total Daily Commerical Water Demand (gal):	252,000.00	gallons per day (gpd)
Total Annual Commercial Water Demand (gal):	91,980,000.00	gallons per year (gpy)
	91,980,000.00	check
Community Purpose Facility		
Community Demand per Acres per Day:	893.00	gallons per day (gpd)
Community Demand per Acre per Year:	325,945.00	gallons per year (gpy)
Community Facility Amount:	10.80	acres
Total Daily CommunityWater Demand (gal):	9,644.40	gallons per day (gpd)
Total Annual Community Water Demand (gal):	3,520,206.00	gallons per year (gpy)
	3,520,206.00	check
Industrial Parameters		
Industrial Demand per Square Foot per Day:	0.07	gallons per day (gpd)
Industrial Demand per Square Foot per Year:	25.55	gallons per year (gpy)
Industrial Amount	2,221,560.00	square feet
Total Daily Industrial Water Demand (gal):	155,509.20	gallons per day (gpd)
Total Annual Industrial Water Demand (gal):	56,760,858.00	gallons per year (gpy)
	56,760,858.00	check
Total Combined Daily Water Demand:	2,477,604.60	gallons per day (gpd)
Total Combined Annual Water Demand:	904,325,679.00	gallons per year (gpy)
	904,325,679.00	check
Parameters		
Daily Water Use:	2,477,604.60	gallons
Annual Water Use:	904,325,679.00	gallons
Embodied Energy Rate:	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh):	7,686,768.2715	kWh per year
Total Annual Water Energy Use (in MWh):	7,686.77	MWh per year
	7,686.77	check
Electricity Generation Emission Factors (pounds/MWh)		
CO2		
CH4	1,340.0000	
N2O	0.0111	
	0.0192	

Water Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	10,300,269.48	2,204.62	4,672.12	1.00	4,672.12
CH4	85.32	2,204.62	0.04	21.00	0.81
N2O	147.59	2,204.62	0.07	310.00	20.75

OTAY RANCH
GHG CALCULATIONS

TOTAL metrics tons of CO2 Eq per Year:	**4,693.69**

Water UnitBAU

OTAY RANCH
GHG CALCULATIONS

WATER EMISSIONS CALCULATIONS
PROJECT GHG REDUCTIONS

Residential Parameters

Single Family Demand per Unit per Day:	400.00	gallons per day (gpd)
Single Family Demand per Unit per Year:	146,000.00	gallons per year (gpy)
Single Family Units:	887.00	units
Multi-Family Demand per Unit per Day:	204.00	gallons per day (gpd)
Multi-Family Demand per Unit per Year:	74,460.00	gallons per year (gpy)
Multi-Family Units:	5,163.00	units
Total Daily Residential Water Demand (gal):	1,408,052.00	gallons per day (gpd)
Total Annual Residential Water Demand (gal):	513,938,980.00	gallons per year (gpy)

School/Educational Parameters

School Demand per Acre per Day:	1,428.00	gallons per day (gpd)
School Demand per Acre per Year:	521,220.00	gallons per year (gpy)
School Acres Amount:	51.40	acres
Total Daily Schools Water Demand (gal):	73,399.20	gallons per day (gpd)
Total Annual Schools Water Demand (gal):	26,790,708.00	gallons per year (gpy
	26,790,708.00	check

University Parameters

University Demand per Acre per Day:	1,428.00	gallons per day (gpd)
University Demand per Acre per Year:	521,220.00	gallons per year (gpy)
University Acres Amount:	50.00	acres
Total Daily University Water Demand (gal):	71,400.00	gallons per day (gpd)
Total Annual University Water Demand (gal):	26,061,000.00	gallons per year (gpy
	26,061,000.00	check

Park Parameters

Park Demand per Acre per Day:	1,724.00	gallons per day (gpd)
Park Demand per Acre per Year:	629,260.00	gallons per year (gpy)
Park Acres Amount:	55.40	acres
Total Daily Park Water Demand (gal):	95,509.60	gallons per day (gpd)
Total Annual Park Water Demand (gal):	34,861,004.00	gallons per year (gpy)
	34,861,004.00	check

Commercial Parameters

Commercial Demand per Square Foot per Day:	0.11	gallons per day (gpd)
Commercial Demand per Square Foot per Year:	40.88	gallons per year (gpy)
Commercial Amount:	1,800,000.00	square feet

OTAY RANCH
GHG CALCULATIONS

Total Daily Commerical Water Demand (gal):	201,600.00	gallons per day (gpd)
Total Annual Commercial Water Demand (gal):	73,584,000.00	gallons per year (gpy)

Community Purpose Facility

Facility Demand per Acre per Day:	714.40	gallons per day (gpd)
Facility Demand per Acre per Year:	260,756.00	gaLlons per year (gpy)
Facility Acres Amount:	10.80	acres
Total Daily Facility Water Demand (gal):	7,715.52	gallons per day (gpd)
Total Facility Park Water Demand (gal):	2,816,164.80	gallons per year (gpy)
	2,816,164.80	check

Industrial Parameters

Industrial Demand per Square Foot per Day:	0.06	gallons per day (gpd)
Industrial Demand per Square Foot per Year:	20.44	gallons per year (gpy)
Industrial Amount	2,221,560.00	square feet
Total Daily Industrial Water Demand (gal):	124,407.36	gallons per day (gpd)
Total Annual Industrial Water Demand (gal):	45,408,686.40	gallons per year (gpy)

Total Combined Daily Water Demand:	1,982,083.68	gallons per day
Total Combined Annual Water Demand:	723,460,543.20	gallons per year
	723,460,543.20	check

Parameters

Daily Water Use:	1,982,083.68	gallons
Annual Water Use:	723,460,543.20	gallons
Embodied Energy:	0.0085	kWh per gallon
Total Annual Water Energy Use (in kWh):	6,149,414.62	kWh
Total Annual Water Energy Use (in MWh):	6,149.41	MWh

Electricity Generation Emission Factors (pounds/MWh)

CO2	1,340.0000
CH4	0.0111
N2O	0.0192

Water Emissions

	Pounds	Pounds per Metric Ton	Metric Tons	GWP	CO2 Eq
CO2	8,240,215.59	2,204.62	3,737.70	1.00	3,737.70
CH4	68.26	2,204.62	0.03	21.00	0.65
N2O	118.07	2,204.62	0.05	310.00	16.60

TOTAL metrics tons of CO2 Eq per Year:	**3,754.95**

OTAY RANCH
GHG CALCULATIONS

SOLID WASTE EMISSIONS CALCULATIONS
BAU/PROJECT

Residential Parameters

Single Family Pounds Generated per Unit per Day:	11.40	pounds
Single Family Pounds Generated per Unit per Year:	4,161.00	pounds
Number of Single Family Units:	887.00	units
Total Single Family Pounds Generated per Year:	3,690,807.00	
Multi Family Pounds Generated per Unit per Day:	8.60	pounds
Multi Family Pounds Generated per Unit per Year:	3,139.00	pounds
Number of Multi Family Units:	5,163.00	units
Total Multi Family Pounds Generated per Year:	16,206,657.00	
Total Residential Pounds Generated per Year:	19,897,464.00	pounds
Total Residential Tons Generated per Year:	9,948.73	tons

School and University Parameters

Tons Generated per 1000 Square Feet (SF) per Year:	1.30	tons/1000SF/year
Tons Generated per Square Feet per Year:	0.0013	tons/SF/year
Pounds Generated per Square Feet per Day:	2.60	pounds
Number of Square Feet:	4,416,984.00	square feet (SF)
Number of 1000 Square Feet:	4,416.98	1000 SF
Total School Tons Generated per Year:	5,742.08	tons

Park Parameters

Tons Generated per Park Acre per Year:	4.76	tons/acre/year
Pounds Generated per Park Acre per Year:	9,520.00	pounds/acre/year
Number of Acres:	55.40	acres
Total Park Tons Generated per Year:	263.70	tons

Community Purpose Parameters

Tons Generated per 1000 SF per Year:	5.70	tons/1000SF/year	
Tons Generated per Square Feet per Year:	0.0057	tons/SF/year	
Pounds Generated per Square Feet per Day:	11.40	pounds	
Number of Square Feet:	470,448.00	square feet (SF)	10.8 acres
Number of 1000 Square Feet:	470.45	1000 SF	
Total Community Purpose Tons Generated per Year:	2,681.55	tons	

Commercial Parameters

Pounds Generated per Square Foot per Day:	0.046	pounds
Pounds Generated per Square Feet per Year:	16.79	pounds
Total Commercial Square Feet:	1,800,000.00	square feet
Total Pounds Generated per Year:	30,222,000.00	pounds
Total Office Tons Generated per Year:	15,111.00	tons

OTAY RANCH
GHG CALCULATIONS

Industrial Parameters

Pounds Generated per Square Foot per Day:	0.046	pounds
Pounds Generated per Square Foot per Year:	16.79	pounds
Total Industrial Square Feet:	2,221,560.00	square feet
Total Pounds Generated per Year:	37,299,992.40	pounds
Total Industrial Tons Generated per Year:	18,650.00	tons

Total Combined Tons Generated per Year: **52,397.07** tons

Material	WARM Input Catergory	Percent Generated	Percent Recovered	Percent Landfilled
Paper	Mixed Paper (General)	31.0%	55.5%	44.5%
Glass	Glass	4.9%	23.1%	76.9%
Metals	Mixed Metals	8.4%	34.6%	65.4%
Plastics	Mixed Plastics	12.0%	7.1%	92.9%
Rubber and Leather	Mixed MSW	3.0%	14.3%	85.7%
Textiles	Mixed MSW	5.0%	15.3%	84.7%
Wood	Dimensional Lumber	6.6%	9.6%	90.4%
Other	Mixed MSW	1.7%	25.6%	74.4%
Food Scraps	Food Scraps	13%	2.5%	97.5%
Yard Trimming	Yard Trimmings	13.2%	64.7%	35.3%
Miscellaneous Inorganic Waste	Mixed MSW	1.5%	0.0%	100.0%
TOTAL		100.0%		

Enter These Values Into the EPA WARM Model

Material	WARM Input Catergory	Tons Generated	Tons Recovered	Tons Landfilled
Paper	Mixed Paper (General)	16,243.1	9,014.9	7,228.2
Glass	Glass	2,567.5	593.1	1,974.4
Metals	Mixed Metals	4,401.4	1,522.9	2,878.5
Plastics	Mixed Plastics	6,287.6	446.4	5,841.2
Rubber and Leather	Mixed MSW	1,571.9	224.8	1,347.1
Textiles	Mixed MSW	2,619.9	400.8	2,219.0
Wood	Dimensional Lumber	3,458.2	332.0	3,126.2
Other	Mixed MSW	890.8	228.0	662.7
Food Scraps	Food Scraps	6,654.4	166.4	6,488.1
Yard Trimming	Yard Trimmings	6,916.4	4,474.9	2,441.5
Miscellaneous Inorganic Waste	Mixed MSW	786.0	0.0	786.0
TOTAL		52,397	17,404	34,993
		5,868.5	853.7	5,014.8

Enter WARM Value Here:

TOTAL metrics tons of CO2 Eq per Year: **8,370.33** CO2 Eq

OTAY RANCH
GHG CALCULATIONS

CONSTRUCTION EMISSIONS CALCULATIONS
BAU and PROJECT GHG CALCULATIONS

Residential Parameters

Emissions per Residential Unit Construction:	0.077	MTCO2E per unit per year
Number of Residential Units being Constructed:	6,050.00	units
Total Annual Residential Construction Emissions:	465.85	MTCO2E per year

Commercial Parameters

Emissions per Commercial Square Foot Construction:	0.006	MTCO2E per square foot per year
Commercial Amount Being Constructed:	1,800,000.00	square feet
Total Annual Commerical Construction Emissions:	10,800.00	MTCO2E per year

Community Purpose Facility Parameters

Emissions per Square Foot of CPFConstruction:	0.006	MTCO2E per square foot per year
CPF Amount Being Constructed (Total Acres):	10.80	acres
CPF Amount Being Constructed (Acres)[1]:	8.64	acres
CPF Structure Amount Being Constructed (Square Feet)[1]:	376,358.40	square feet
Total Annual CPF Construction Emissions:	2,258.15	MTCO2E per year

CPF = Community Purpose Facility

[1] = Determined by multiplying total CPF acreage by coverage ratio of 0.80:1.

School Parameters

Emissions per Square Foot of School Construction:	0.006	MTCO2E per square foot per year
School Amount (Total Acres):	51.40	acres
School Amount Being Constructed (Acres)[1]:	41.12	acres
School Structure Amount Being Constructed (Square Feet)[1]:	1,791,187.20	square feet
Total Annual School Construction Emissions:	10,747.12	MTCO2E per year

[1] = Determined by multiplying total school acreage by coverage ratio of 0.80:1.

University Parameters

Emissions per Square Foot of University Construction:	0.006	MTCO2E per square foot per year
University Amount (Total Acres):	50.00	acres
University Amount Being Constructed (Acres)[1]:	40.00	acres
University Structure Amount Being Constructed (Square Feet)[1]:	1,742,400.00	square feet
Total Annual University Construction Emissions:	10,454.40	MTCO2E per year

[1] = Determined by multiplying total school acreage by coverage ratio of 0.80:1.

OTAY RANCH
GHG CALCULATIONS

Park Parameters

Emissions per Square Foot of Park Structure Construction:	0.006	MTCO2E per square foot per year
Park Amount Being Constructed (Acres):	55.40	acres
Park Amount Being Constructed w/Structure (Acres)*:	13.85	acres
Park Structure Amount Being Constructed (Square Feet)*:	603,306.00	square feet
Total Annual Park Structure Construction Emissions:	3,619.84	MTCO2E per year

*Determined by multiplying total park acreage by structure coverage ratio of 0.25:1.

Industrial Parameters

Emissions per Industrial Square Foot Construction:	0.006	MTCO2E per square foot per year
Industrial Amount Being Constructed:	2,200,000.00	square feet
Total Annual Industrial Construction Emissions:	13,200.00	MTCO2E per year

Total Annual Combined Construction Emissions: **51,545.36** MTCO2E per year

CUMULATIVE PROJECT EMISSIONS CALCULATIONS:

BAU GHG EMISSIONS SUMMARY

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	113,416.15
Electricity Usage Emissions	97,099.72
Natural Gas Usage Emissions	31,952.76
Water Usage Emissions	4,693.69
Solid Waste Emissions	8,370.33
Construction Emissions	51,545.36
Total CO2 Eq Emissions	307,078.01

PROJECT REDUCED GHG EMISSIONS SUMMARY

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	68,276.67
Electricity Usage Emissions	67,969.80
Natural Gas Usage Emissions	22,366.93
Water Usage Emissions	3,754.95
Solid Waste Emissions	8,370.33
Construction Emissions	51,545.36
Total CO2 Eq Emissions	222,284.04

CUMULATIVE PROJECTS GHG EMISSIONS SUMMARIES

ASSUMING BAU ASSUMPTIONS - Multiply BAU Emissions by 1.5

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	170,124.22
Electricity Usage Emissions	145,649.58
Natural Gas Usage Emissions	47,929.14
Water Usage Emissions	7,040.53
Solid Waste Emissions	12,555.50
Construction Emissions	77,318.04
Total CO2 Eq Emissions	**460,617.01**

ASSUMING PROJECT REDUCTIONS - Multiply Propoposed Project Emissions by 1.5

Emission Source	Total CO2 Eq Emissions (metric tons/year)
Vehicular Emissions	102,415.00
Electricity Usage Emissions	101,954.71
Natural Gas Usage Emissions	33,550.40
Water Usage Emissions	5,632.43
Solid Waste Emissions	12,555.50
Construction Emissions	77,318.04
Total CO2 Eq Emissions	**333,426.06**

Percent Reduction in BAU 27.6131674 percent

ATTACHMENT 4

SANDAG Trip Length Calculations

CVSB(Chula Vista Southbay)- 2030 Base

SUMMARY OF AVERAGE TRIP LENGTH IN MILES BY MODE - TOTAL TAZ 4391

MODE	HOME WORK	HOME COLL	HOME SCHL	HOME OTHER	NON HOME	SERVE PASS	TOTAL
Off-Peak Period							
Total Auto	7.26	1.32	3.33	4.67	4.13	3.57	4.36
>Drive Alone	6.80	1.32	3.37	4.44	3.97	3.49	4.33
>>Non-Toll	6.19	1.32	3.37	4.39	3.95	3.49	4.23
>>Toll	20.11	24.38	9.05	12.99	12.12	13.85	17.17
>Carpool-2 Person	10.65	1.32	3.28	4.93	4.36	3.59	4.49
>>Non-Toll/Non-HOV	4.00	1.31	3.26	3.84	3.50	3.30	3.56
>>Non-Toll/HOV	24.23	23.83	9.49	15.24	17.07	14.27	16.71
>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>Carpool-3+ Person	10.59	1.32	3.34	4.92	4.35	3.61	4.24
>>Non-Toll/Non-HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>>Non-Toll/HOV	24.18	23.83	9.41	15.37	17.12	14.23	16.23
>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transit	6.88	1.32	2.30	5.50	5.80	0.00	5.58
>Commuter Rail	23.19	0.00	0.00	22.56	24.15	0.00	23.11
>Light Rail	14.56	22.84	8.35	11.98	13.80	0.00	13.41
>BRT	10.84	1.20	2.83	8.87	9.59	0.00	9.46
>Express Bus	16.44	21.38	13.22	13.81	0.00	0.00	14.58
>Local Bus	3.00	1.32	2.11	3.40	3.06	0.00	2.95
>Walk	5.15	1.33	2.28	5.35	5.80	0.00	4.84
>Drive	10.17	1.12	2.73	6.51	0.00	0.00	9.34
>Driven	11.06	1.16	2.93	7.61	0.00	0.00	9.11
School Bus	0.00	0.00	4.77	11.97	6.50	0.00	4.85
Walk	1.27	1.18	1.11	1.24	1.21	0.00	1.16
Bicycle	2.00	1.29	1.45	1.92	2.02	0.00	1.83
Total	7.19	1.32	3.22	4.61	4.12	3.57	4.30
Peak Period							
Total Auto	8.29	1.50	3.15	4.41	5.76	3.45	4.96
>Drive Alone	7.82	1.49	3.18	4.21	5.33	3.36	5.40
>>Non-Toll	6.58	1.49	3.15	3.92	5.21	3.25	4.89
>>Toll	20.70	25.00	8.83	11.95	10.46	10.28	16.88
>Carpool-2 Person	12.02	1.51	3.10	4.63	6.32	3.48	4.82
>>Non-Toll/Non-HOV	4.97	1.47	3.05	3.61	4.37	3.07	3.56
>>Non-Toll/HOV	31.05	26.38	9.91	17.39	19.96	14.71	20.53
>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>Carpool-3+ Person	11.97	1.51	3.16	4.64	6.32	3.50	4.24
>>Non-Toll/Non-HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>>Non-Toll/HOV	30.91	26.38	9.83	17.56	20.01	14.67	18.52

>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transit	10.27	1.81	2.28	4.63	9.02	0.00	8.79
>Commuter Rail	24.42	28.47	0.00	29.22	27.19	0.00	24.55
>Light Rail	15.33	25.14	10.01	12.18	16.77	0.00	15.23
>BRT	13.71	1.52	2.86	6.99	12.48	0.00	12.58
>Express Bus	17.50	21.61	14.12	14.26	0.00	0.00	17.11
>Local Bus	3.35	1.79	2.07	3.04	3.69	0.00	3.09
>Walk	7.03	1.82	2.26	4.31	9.02	0.00	6.03
>Drive	13.64	1.62	2.83	6.81	0.00	0.00	13.40
>Driven	14.22	1.70	2.98	7.16	0.00	0.00	13.14
School Bus	0.00	0.00	4.57	11.28	7.01	0.00	4.60
Walk	1.25	1.18	1.09	1.24	1.29	0.00	1.11
Bicycle	2.05	1.42	1.40	1.94	2.34	0.00	1.78
Total	8.27	1.50	3.04	4.35	5.76	3.45	4.85

Daily Summary

Total Auto	7.83	1.34	3.24	4.62	4.50	3.51	4.55
>Drive Alone	7.36	1.34	3.28	4.39	4.27	3.42	4.66
>>Non-Toll	6.40	1.34	3.27	4.29	4.22	3.36	4.43
>>Toll	20.53	24.88	8.83	12.30	10.97	10.31	16.97
>Carpool-2 Person	11.38	1.35	3.20	4.87	4.80	3.54	4.59
>>Non-Toll/Non-HOV	4.54	1.33	3.17	3.79	3.69	3.18	3.56
>>Non-Toll/HOV	27.53	24.82	9.77	15.61	18.12	14.53	17.96
>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>Carpool-3+ Person	11.33	1.35	3.26	4.86	4.79	3.55	4.24
>>Non-Toll/Non-HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
>>Non-Toll/HOV	27.46	24.82	9.69	15.75	18.19	14.49	17.01
>>Toll/HOV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transit	9.02	1.40	2.29	5.32	6.66	0.00	7.05
>Commuter Rail	24.20	28.47	0.00	23.97	25.96	0.00	24.23
>Light Rail	15.22	23.92	9.01	12.02	14.79	0.00	14.79
>BRT	12.77	1.25	2.84	8.48	10.59	0.00	11.10
>Express Bus	17.42	21.50	13.46	13.97	0.00	0.00	16.50
>Local Bus	3.19	1.39	2.09	3.32	3.18	0.00	3.00
>Walk	6.22	1.41	2.27	5.14	6.66	0.00	5.30
>Drive	12.69	1.20	2.78	6.59	0.00	0.00	12.12
>Driven	13.15	1.25	2.95	7.51	0.00	0.00	11.35
School Bus	0.00	0.00	4.68	11.86	6.63	0.00	4.74
Walk	1.26	1.18	1.10	1.24	1.23	0.00	1.14
Bicycle	2.03	1.31	1.43	1.92	2.08	0.00	1.81
Total	7.78	1.34	3.14	4.56	4.49	3.51	4.48