Chapter 16

Air Quality and Greenhouse Gas Emissions

16.1 Introduction

This chapter describes existing and future air quality conditions and the potential for greenhouse gas emissions that could occur as a result of implementing the alternatives that could change the long-term operation of the Central Valley Project (CVP) and State Water Project (SWP) as evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect CVP and SWP water deliveries which could indirectly affect air quality.

16.2 Terminology

Important air quality and greenhouse gas emission terminology used in this chapter are defined by the U.S. Environmental Protection Agency (USEPA) and the California Air Resources Board (ARB), as summarized below.

- **Attainment Area:** A geographic area considered to have air quality as good as or better than the national and/or state ambient air quality standards. An area may be an attainment area for one pollutant and a non-attainment area for others (USEPA 2006).
- **California Ambient Air Quality Standard (CAAQS):** A legal limit that specifies the maximum level and time of exposure in the outdoor air for a given air pollutant and which is protective of human health and public welfare (California Health and Safety Code section 39606b). CAAQS are recommended by the California Office of Environmental Health Hazard Assessment and adopted into regulation by the ARB. CAAQS are the standards which must be met per the requirements of the California Clean Air Act (ARB 2010).
- **Criteria Pollutant:** An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set (ARB 2010). The criteria pollutants are ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and lead (Pb).
- **Greenhouse Gases (GHGs):** Atmospheric gases (such as carbon dioxide (CO_2), methane (CH_4), hydrofluorocarbons (HFC), nitrous oxide (N_2O), O_3, perfluorocarbons (PFC), sulfur hexafluoride (SF_6), and water vapor) that slow the passage of re-radiated heat through the Earth's atmosphere (ARB 2010).

Six of the GHGs are the subject of reductions under the Kyoto Protocol and California Assembly Bill 32 are CO_2, CH_4, N_2O, HFC, PFC, and SF_6.

- **National Ambient Air Quality Standard (NAAQS):** Standards established by USEPA that apply for outdoor air throughout the United States (USEPA 2006).
- **Nonattainment Area:** A geographic area identified by the USEPA and/or ARB as not meeting either NAAQS or CAAQS for a given pollutant (ARB 2010).
- **Precursor:** In photochemistry, a compound antecedent to a pollutant. For example, volatile organic compounds (VOC) and NO_x react in sunlight to form the criteria pollutant ozone. As such, VOCs and NO_x are precursors to O_3 (USEPA 2006).
- **Reactive Organic Gas (ROG):** A photochemically reactive chemical gas composed of non-methane hydrocarbons (HCs) that may contribute to the formation of smog (ARB 2010). ROG may also be referred to as non-methane organic gases, VOCs, or HCs.
- **State Implementation Plan (SIP):** A plan prepared by states and submitted to USEPA describing how each area will attain and maintain NAAQS. SIPs include the technical foundation for understanding the air quality (e.g., emission inventories and air quality monitoring), control measures and strategies, and enforcement mechanisms (ARB 2010).
- **Toxic Air Contaminant (TAC):** An air pollutant, identified in regulation by the ARB, which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health. Health effects of TACs may occur at extremely low levels and it is typically difficult to identify levels of exposure that do not produce adverse health effects (ARB 2010).

In California, local air districts have been established to oversee the attainment of air quality standards within air basins as defined by the State. Local air districts administer air quality laws and regulations within the air basins. The local air districts have permitting authority over all stationary sources of air pollutants within their district boundaries and provide the primary review of environmental documents prepared for projects with air quality issues.

16.3 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect future air quality conditions and the potential for GHG emissions. Implementation of the alternatives could affect CVP and SWP water deliveries which could affect air quality related to agricultural operations and fugitive dust generation. Changes in air quality and GHG emissions are analyzed in this EIS relative to appropriate Federal and state agency policies and regulations, as described in Chapter 4, Approach to Environmental Analyses.

Several of the Federal and state laws and regulations that provide quantitative criteria to determine compliance also are summarized in this subsection of this chapter to provide context for information provided in the remaining sections of this chapter, including:

- Federal Clean Air Act
  - National Ambient Air Quality Standards and Federal Air Quality Designations
  - Federal General Conformity Requirements
- California Clean Air Act
- California Assembly Bill 32, California Global Warming Solutions Act of 2006

16.3.1 Federal Clean Air Act

National air quality policies are regulated through the Federal Clean Air Act (FCAA) of 1970 and its 1977 and 1990 amendments. Basic elements of the FCCA include NAAQS for criteria air pollutants, hazardous air pollutants standards, state attainment plans, motor vehicle emissions standards, stationary source emissions standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

16.3.1.1 National Ambient Air Quality Standards and Federal Air Quality Designations

Pursuant to the FCAA, the USEPA established NAAQS for O_3, CO, NO_2, sulfur dioxide (SOx as SO_2), PM_{10}, $PM_{2.5}$, and lead. These pollutants are referred to as criteria pollutants because numerical health-based criteria have been established that define acceptable levels of exposure for each pollutant. The NAAQS and the CAAQS are summarized in Table 16.1 (ARB 2013).

Table 16.1 Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards[a] Primary[b, i]	National Standards[a] Secondary[c, i]	California Standards[d]
Ozone	8 Hour 1 Hour	0.075 ppm –	0.075 ppm –	0.07 ppm 0.09 ppm
Carbon monoxide	8 Hour 1 Hour	9 ppm 35 ppm	– –	9.0 ppm 20 ppm
Nitrogen dioxide[j]	Annual Arithmetic Mean 1 Hour	0.053 ppm 100 ppb	0.053 ppm –	0.30 ppm 0.18 ppm
Sulfur dioxide[e]	Annual Arithmetic Mean 24 Hour 3 Hour 1 Hour	0.030 ppm 0.14 ppm – 75 ppb	– – 0.5 ppm –	– 0.04 ppm – 0.25 ppm
PM_{10}[f]	Annual Arithmetic Mean 24 Hour	– 150 $\mu g/m^3$	– 150 $\mu g/m^3$	20 $\mu g/m^3$ 50 $\mu g/m^3$
$PM_{2.5}$[f]	Annual Arithmetic Mean 24 Hour	12 $\mu g/m^3$ 35 $\mu g/m^3$	15 $\mu g/m^3$ 35 $\mu g/m^3$	12 $\mu g/m^3$ –
Sulfates	24 Hour	–	–	25 $\mu g/m^3$
Lead[g, k]	30 Day Average Calendar Quarter Rolling 3-Month Average	– 1.5 $\mu g/m^3$ 0.15 $\mu g/m^3$	– 1.5 $\mu g/m^3$ 0.15 $\mu g/m^3$	1.5 $\mu g/m^3$ – –
Hydrogen sulfide	1 Hour	–	–	0.03 ppm
Vinyl chloride	24 Hour	–	–	0.01 ppm
Visibility-reducing particles	8 Hour	–	–	See Note[h]

Source: ARB 2012, ARB 2013b.

Notes:

a. National standards, other than ozone, particulate matter, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard.

b. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

c. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

d. California standards for ozone, carbon monoxide, sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter (PM_{10}, $PM_{2.5}$, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

e. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except for areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

f. On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 µg/m^3 to 12.0 µg/m^3. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 µg/m^3, as was the annual secondary standard of 15 µg/m^3. The existing 24-hour PM_{10} standards (primary and secondary) of 150 µg/m^3 also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

g. The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except for areas designated nonattainment for the 1978 standard, where the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

h. In 1989, the ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are “extinction of 0.23 per kilometer” and “extinction of 0.07 per kilometer” for the statewide and Lake Tahoe Air Basin standards, respectively.

i. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

j. To attain the 1-hour national standard, the 3-year average of the annual 98^{th} percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

k. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

µg/m^3 = micrograms per cubic meter.
ppb = parts per billion (by volume).
ppm = parts per million (by volume).

The USEPA designates areas as attainment, nonattainment, or unclassified for individual criteria pollutants depending on whether the areas achieve (i.e., attain) the applicable NAAQS for each pollutant. For some pollutants, there are numerous classifications of the nonattainment designation, depending on the severity of an area's nonattainment status. Areas that lack monitoring data are designated as unclassified areas, and considered as attainment areas for regulatory purposes.

Under the 1977 FCAA amendments, states (or areas within states) with ambient air quality concentrations that do not meet the NAAQS are required to develop and maintain SIPs. These implementation plans constitute a federally enforceable definition of the state's approach and schedule for the attainment of the NAAQS. If a nonattainment area achieves compliance, the area is classified as an attainment maintenance area for 20 years.

16.3.1.2 Federal General Conformity Requirements

The 1977 FCAA amendments state that the Federal government is prohibited from engaging in, supporting, providing financial assistance for, licensing, permitting, or approving any activity that does not conform to an applicable SIP. In the 1990 FCAA amendments, the USEPA included provisions requiring Federal agencies to ensure that actions undertaken in nonattainment or attainment maintenance areas are consistent with applicable SIPs. The process of determining whether a Federal action is consistent with applicable SIPs is called "conformity" determination. A conformity determination is required only for the project alternative that is ultimately selected and approved. The USEPA general conformity regulation applies only to Federal actions that result in emissions of "nonattainment or maintenance pollutants" or their precursors in federally designated nonattainment or maintenance areas. The emission thresholds that trigger requirements of the general conformity regulation for Federal actions emitting nonattainment or maintenance pollutants, or their precursors, are called *de Minimis* levels, as summarized in Table 16.2.

Table 16.2 General Conformity *de Minimis* Levels

Pollutant	Area Type	Tons/Year
Ozone (VOC or NOx)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NOx)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
Carbon monoxide, SO_2 and NO_2	All nonattainment and maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$ Direct emissions, SO_2, NOx (unless determined not to be a significant precursor), VOC or ammonia (if determined to be significant precursors)	All nonattainment and maintenance	100
Lead (Pb)	All nonattainment and maintenance	25

Source: USEPA 2015b

16.3.1.3 California Clean Air Act

The California Clean Air Act (CCAA) provides the State with a comprehensive framework for air quality planning regulation. Prior to passage of the CCAA, Federal law contained the only comprehensive planning framework. The CCAA requires attainment of state ambient air quality standards by the earliest practicable date.

The FCAA requires adoption of SIPs for nonattainment areas to describe actions that will be undertaken to achieve the NAAQS. In addition, the CCAA requires local air districts in nonattainment areas to prepare and maintain Air Quality Management Plans (AQMPs) to achieve compliance with CAAQS. These AQMPs also serve as a basis for preparing the SIP for the State of California, which must ultimately be approved by the USEPA and codified in the Code of Federal Register (CFR).

16.4 Affected Environment

This section describes the area of analysis, ambient air quality and conditions, and GHG emissions in the Study Area.

The air basins and air districts in California, including those in the Study Area, do not specifically align with the Study Area regions, as noted below and in the description of each air basin (ARB 2011a; ARB 2011b).

The discussion in this chapter area is organized by the Study Area regions and air basins. The Study Area regions include the following air basins and counties.

- Trinity River Region is located within portions of the North Coast Air Basin.
  - The Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake to the confluence with the Klamath River; and the area in Humboldt and Del Norte counties along the Klamath River from the confluence with the Trinity River to the Pacific Ocean.
- Central Valley Region is located within portions of the Sacramento Valley, Mountain Counties, San Joaquin Valley, San Francisco Bay Area, Mojave Desert air basins.
  - The Central Valley Region includes all or portions the counties of Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, Solano, Napa, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern that are within the CVP and SWP service areas.
- San Francisco Bay Area Region is located within portions of the San Francisco Bay Area and North Central Coast air basins.
  - The San Francisco Bay Area Region includes portions of Contra Costa, Alameda, Santa Clara, and San Benito counties that are within the CVP and SWP service areas.
- Central Coast Region is located within portions of the South Central Coast Air Basin.
  - The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP.
- Southern California Region is located within portions of the South Central Coast, South Coast, San Diego, Mojave Desert, and Salton Sea air basins.
  - The Southern California Region includes portions of Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties served by the SWP.

16.4.1 Ambient Air Quality

Air quality conditions and potential impacts in the project area are evaluated and discussed qualitatively, rather than quantitatively. The following subsections briefly describe the existing air quality environmental setting by air basin for the project area. The counties within each air basin in the project area are presented in Table 16.3, along with non-attainment designations to characterize existing ambient air quality. Non-attainment designations indicate that concentrations of pollutants measured in ambient air exceed the applicable ambient air quality standards. As shown in Table 16.3, many of the counties included in the project area are designated as nonattainment for the Federal and/or State ozone and particulate matter standards. These air quality issues may be exacerbated under dry conditions because when irrigation water supplies are decreased, there is increased potential for the formation and transport of fugitive dust.

Table 16.3 Pollutants Designated as Nonattainment Pursuant to Federal and State Ambient Air Quality Standards

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
Trinity River Region				
Trinity	North Coast	North Coast Unified	–	–
Humboldt	North Coast	North Coast Unified	–	–
Del Norte	North Coast	North Coast Unified	–	–
Central Valley Region				
Shasta	Sacramento Valley	Shasta	–	Ozone, PM_{10}
Tehama	Sacramento Valley	Tehama	Ozone (Tuscan Buttes area)	Ozone, PM_{10}
Butte	Sacramento Valley	Butte	Ozone and $PM_{2.5}$ in Chico	Ozone, PM_{10}, $PM_{2.5}$
Glenn	Sacramento Valley	Glenn	–	PM_{10}
Colusa	Sacramento Valley	Colusa	–	PM_{10}
Yuba	Sacramento Valley	Feather River	–	Ozone, PM_{10}
Sutter	Sacramento Valley	Feather River	Ozone	Ozone, PM_{10}
Yolo	Sacramento Valley	Yolo-Solano	Ozone, $PM_{2.5}$	Ozone, PM_{10}
Sacramento	Sacramento Valley	Sacramento Metro	Ozone, $PM_{2.5}$	Ozone, PM_{10}

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
Plumas	Mountain Counties	Northern Sierra	–	PM_{10} $PM_{2.5}$ (Portola Valley)
Placer	Sacramento Valley, Mountain Counties, Lake Tahoe	Placer	Ozone, $PM_{2.5}$	Ozone, PM_{10}
El Dorado	Sacramento Valley, Mountain Counties, Lake Tahoe	El Dorado	Ozone, $PM_{2.5}$	Ozone, PM_{10}
San Joaquin	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Stanislaus	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Merced	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Fresno	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Madera	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Kings	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Tulare	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Kern	San Joaquin Valley, Mojave Desert	San Joaquin Valley, Kern	Ozone, $PM_{2.5}$, PM_{10} (East Kern)	Ozone, PM_{10}, $PM_{2.5}$ (San Joaquin Valley Air Basin)
San Francisco Bay Area Region				
Napa	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Solano	Sacramento Valley, San Francisco Bay Area	Yolo-Solano and Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Contra Costa	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Alameda	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Santa Clara	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
San Benito	North Central Coast	Monterey Bay Unified	–	Ozone, PM_{10}
Central Coast Region				
San Luis Obispo	South Central Coast	San Luis Obispo	Ozone (Eastern San Luis Obispo)	Ozone, PM_{10}
Santa Barbara	South Central Coast	Santa Barbara	–	Ozone, PM_{10}
Southern California Region				
Ventura	South Central Coast	Ventura	Ozone	Ozone, PM_{10}
Los Angeles	South Coast, Mojave Desert	South Coast, Antelope Valley	Ozone, $PM_{2.5}$, Lead	Ozone; PM_{10}; $PM_{2.5}$
San Bernardino	South Coast, Mojave Desert	South Coast, Mojave Desert	Ozone, PM_{10}, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Riverside	South Coast, Mojave Desert, Salton Sea	South Coast, Mojave Desert	Ozone, PM_{10}, $PM_{2.5}$	Ozone; PM_{10}; $PM_{2.5}$
Orange	South Coast	South Coast	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
San Diego	San Diego County	San Diego	Ozone	Ozone, PM_{10}, $PM_{2.5}$

Sources: USEPA 2014; ARB 2015

Notes:

a. Areas designated as nonattainment by U.S. Environmental Protection Agency related to National Ambient Air Quality Standards as of January 30, 2015.

b. Areas designated as nonattainment by California Air Resources Board related to California Ambient Air Quality Standards as of April 10, 2014. No changes to the state area designations were proposed for 2014.

16.4.1.1 North Coast Air Basin

The North Coast Air Basin includes Humboldt, Del Norte, Trinity, Mendocino, and north Sonoma counties (ARB 2013a). This air basin is located within the Trinity River Region of the Study Area. The basin is sparsely populated, and stretches along the northern coastline through forested mountains. Prevailing winds blow clean air inland from the Pacific Ocean, and air quality is typically good. Humboldt, Del Norte, and Trinity counties are designated attainment for the federal and state air quality standards (USEPA 2015b, ARB 2014).

16.4.1.2 Sacramento Valley Air Basin

The Sacramento Valley Air Basin encompasses 9 air districts and 11 counties, including: all of Shasta, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Sacramento, and Yolo counties; the westernmost portion of Placer County; and the northeastern half of Solano County. The air basin is bounded by tall mountains, including the Coast Range to the west, the Cascade Range to the north, and the Sierra Nevada Range to the east. This air basin is located within the northern portion of the Central Valley Region of the Study Area.

Winters are wet and cool, and summers are hot and dry. When air stagnates, or is trapped by an inversion layer in the valley, ambient pollutant concentrations can reach or exceed threshold levels. On-road vehicles are the largest source of smog-forming pollutants, and particulate matter emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a).

To characterize the existing ambient air quality in the Sacramento Valley Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} have exceeded the CAAQS but are below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, Glenn and Colusa counties have been redesignated as attainment for the California ozone standards (ARB 2014). In addition, Sacramento County has been redesignated as attainment for the California $PM_{2.5}$ standards (ARB 2014). No other changes in air quality nonattainment designations have been recorded (USEPA 2014; ARB 2014).

16.4.1.3 Mountain Counties Air Basin

The Mountain Counties Air Basin includes the mountainous areas of the central and northern Sierra Nevada Mountains, from Plumas County south to Mariposa County, including Plumas, Sierra, Nevada, Central Placer, West El Dorado, Amador, Calaveras, Tuolumne, and Mariposa counties (ARB 2013a). This air basin includes portions of the central-eastern Central Valley Region of the Study Area; as well as areas located to the east of the Study Area.

Sparsely populated, motor vehicles are the primary source of emissions in the air basin. Air quality issues often result when eastward surface winds transport pollution from more populated air basins to the west and south. Wood smoke from stoves and fireplaces contribute to elevated ambient PM_{10} concentrations during winter. Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa counties are designated as nonattainment for the Federal and State ozone standards (ARB 2014). Plumas, Sierra, Nevada, Placer, El Dorado, and Calaveras counties are designated as nonattainment for the State PM_{10} standards (ARB 2014).

16.4.1.4 San Joaquin Valley Air Basin

The San Joaquin Valley Air Basin encompasses eight counties, including: all of San Joaquin, Stanislaus, Madera, Merced, Fresno, Kings, Tulare counties; and western Kern County. It is bounded on the west by the Coast Range, on the east by the Sierra Nevada, and in the south by the Tehachapi Mountains. This air basin is located within the central and southern portions of the Central Valley Region of the Study Area.

Winters are cool and wet and summers are dry and very hot. The area is heavily agricultural, and hosts other localized industries such as forest products, oil and gas production, and oil refining. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from sources such as agricultural operations and fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). Air quality issues may be exacerbated under dry conditions. When water supplies and irrigation levels are decreased in urban, rural, and agricultural areas, there is increased potential for the formation and transport of fugitive dust.

To characterize the existing ambient air quality for the San Joaquin Valley Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} have exceeded the CAAQS but are below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, no changes in air quality nonattainment designations have been recorded in the San Joaquin Valley Region counties in this study (USEPA 2015; ARB 2014).

16.4.1.4.1 Dust and Particulate Matter in San Joaquin Valley

The San Joaquin Valley Air Pollution Control District (SJVAPCD) is the local regulatory agency with jurisdiction over air quality issues in the San Joaquin Valley area. In response to the area's historical air quality problems with dust and particulate matter, the SJVAPCD was the first agency in the state to regulate emissions from on-field agricultural operations. In 2004, the agency adopted Rule 4550, the Conservation Management Practices rule, and Rule 3190, the Conservation Management Practices Fee rule. To comply with these rules, farmers with 100 acres or more of contiguous land must prepare and implement biennial Conservation Management Plans to reduce dust and particulate matter emissions from on-farm sources, such as unpaved roads and equipment yards, land preparation, harvest activities, and other farming activities. A handbook titled "Agricultural Air Quality Conservation Management Practices for San Joaquin Valley Farms" was published by the agriculture industry in 2004 to provide guidance to farmers on Conservation Management Practices (SJVAPCD 2004a, 2004b). Examples of Conservation Management Practices include activities that reduce or eliminate the need for soil disturbance, activities that protect soil from wind, dust suppressants, alternatives to burning agricultural wastes, and reduced travel speeds on unpaved roads and equipment yards. Lands not currently under cultivation or used for pasture are exempt from Rule 4550, other than recordkeeping to document the exemption. Fees vary depending on the size of the farm, and include an initial application fee, and a biennial renewal fee.

In addition to requirements for on-field agricultural practices, the SJVAPCD rules and regulations address avoidance of nuisance conditions (Rule 4102), prohibitions on opening burning (Rule 4103), and fugitive-dust control (Regulation VIII). Specifically, the SJVAPCD dust-control rules include Rule 8021 for control of PM_{10} from construction, demolition, excavation, extraction, and other earth moving activities; Rule 8031 for control of PM_{10} from handling and storage of bulk materials; Rule 8051 for control of PM_{10} from disturbed open areas; Rule 8061 for control of PM_{10} from travel on paved and unpaved roads; Rule 8071 for control of PM_{10} from unpaved vehicle and equipment traffic areas; and Rule 8081 for off-field agricultural sources, such as bulk materials handling and transport and travel on unpaved roads. Each of these rules requires fugitive dust control, often through application of water, gravel, or chemical dust stabilizers.

16.4.1.5 San Francisco Bay Area Air Basin

The San Francisco Bay Area Air Basin consists of a single air district and nine counties, including: all of Napa, Marin, San Francisco, Contra Costa, Alameda, San Mateo, and Santa Clara counties; the southern portion of Sonoma County; and the southwestern portion of Solano County (ARB 2013a). The hills of the Coast Range bound the San Francisco and San Pablo bays and the inland valleys of the air basin. This air basin includes the San Francisco Bay Area Region of the Study Area.

The San Francisco Bay Area Air Basin includes the second largest urban area in California, hosting industry, airports, international ports, freeways, and surface streets. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). Air quality in the San Francisco Bay Area is often good as sea breezes blow clean air from the Pacific Ocean into the air basin, but transport of pollutants from the San Francisco Bay

Area can exacerbate air quality problems in the downwind portions of the San Francisco Bay Area Air Basin; as well as in the Sacramento Valley and San Joaquin Valley air basins.

To characterize the existing ambient air quality for the San Francisco Bay Area Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} exceeded the CAAQS in 2008 but were below the CAAQS in 2007 and 2009. Concentrations of PM_{10} were below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, no changes in air quality nonattainment designations have been recorded in the San Francisco Bay Region counties in this study (USEPA 2015; ARB 2014).

16.4.1.6 North Central Coast Air Basin

The North Central Coast Air Basin includes Santa Cruz, San Benito and Monterey counties (ARB 2013a). This air basin includes San Benito County which is located within the San Francisco Bay Area Region of the Study Area.

The North Central Coast Air Basin is in attainment for all NAAQS, and is designated as nonattainment for the State ozone and PM_{10} standards (ARB 2014). Though separated by the Santa Cruz Mountains and Coast Ranges to the north, wind can transport air pollution from the San Francisco Bay Area Air Basin and contribute to elevated ozone concentrations in the area (ARB 2013a).

16.4.1.7 South Central Coast Air Basin

The South Central Coast Air Basin includes San Luis Obispo, Santa Barbara and Ventura counties. It is bordered by the Pacific Ocean on the south and west and lies just north of the highly populated South Coast Air Basin. This air basin includes the Central Coast Region and the northern Southern California Region of the Study Area.

Sources of pollutants in the air basin include power plants, oil production and refining, vehicle travel, and agricultural operations. San Luis Obispo, Santa Barbara, and Ventura counties are designated as nonattainment for the State ozone and PM_{10} standards. Eastern San Luis Obispo and Ventura counties are designated as nonattainment for the Federal ozone standard (USEPA 2015). Wind patterns link Ventura and Santa Barbara counties, resulting in pollutant transport between the South Central Coast and South Coast air basins. San Luis Obispo County is separated from these counties by mountains, and the air quality in San Luis Obispo County is linked more with conditions in the San Francisco Bay Area Air Basin and San Joaquin Valley Air Basin. Additionally, air emissions from the South Coast Air Basin can be blown offshore, and then carried to the coastal cities of the South Central Coast Air Basin. Under some conditions, the reverse air flow can carry pollutants from the South Central Coast Air Basin to the South Coast Air Basin and contribute to ozone violations there (ARB 2013a).

16.4.1.8 South Coast Air Basin

The South Coast Air Basin is California's largest metropolitan region. The area includes the southern two-thirds of Los Angeles County, all of Orange County, and the western urbanized portions of Riverside and San Bernardino counties. The South Coast Air Basin is bounded by the Pacific Ocean on the west and by mountains on the other three sides. This air basin includes the western-central portion of the Southern California Region of the Study Area.

The area includes industry, airports, international ports, freeways, and surface streets. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). One-third of the state's total criteria pollutant emissions are generated within the basin (ARB 2013a). The pollutant emissions and fugitive dust generated in the South Coast Air Basin affects other air basins. For example, fugitive dust generated in the South Coast Air Basin contributes to poor air quality in the Salton Sea Air Basin and the Coachella Valley portion of Riverside County (USGS 2014).

The persistent high pressure system and frequent low inversion heights caused by the surrounding mountains on three sides of the air basin trap pollutants in the air basin (ARB 2013a). Sunny weather contributes to smog formation. Portions of the South Coast Air Basin are designated as nonattainment for the Federal and State ozone, PM_{10}, and $PM_{2.5}$ standards (ARB 2014; USEPA 2015). Wind often transports air pollutants from the South Coast Air Basin to nearby air basins.

16.4.1.9 Mojave Desert Air Basin

The sparsely populated Mojave Desert Air Basin covers most of California's high desert and is made up of eastern Kern and Riverside counties and northern Los Angeles and San Bernardino counties. The San Gabriel and San Bernardino mountains lie to the south, separating the Mojave Desert Air Basin from the South Coast Air Basin. To the northwest, the Tehachapi Mountains separate the Mojave Desert Air Basin from the San Joaquin Valley Air Basin. This air basin includes the southeastern portion of the Central Valley Region and the northeastern portion of the Southern California Region of the Study Area.

The primary sources of air pollution in the air basin are military bases, highways, railroads, cement manufacturing, and mineral processing (ARB 2013a). The Mojave Desert Air Basin also is affected by air quality conditions in the San Joaquin Valley and South Coast air basins. Air from the South Coast Air Basin is transported over the San Gabriel Mountains, heavily impacting the areas of the Mojave Desert Air Basin located to the north of the South Coast Air Basin. The

Mojave Desert Air Basin also is located downwind of the San Joaquin Valley Air Basin; and the winds pass through the Tehachapi Mountains carrying air emissions from the San Joaquin Valley Air Basin. Due to the impacts from the South Coast Air Basin, the worst air quality in the Mojave Desert Air Basin is along the southern edge that borders the South Coast Air Basin. This is also where most of the population within the Mojave Desert Air Basin is located (ARB 2013a).

Portions of the Mojave Desert Air Basin are designated as nonattainment for the Federal and State ozone and PM_{10} standards (ARB 2014; USEPA 2015).

16.4.1.10 San Diego Air Basin

The San Diego Air Basin is in the southwest corner of California and comprises all of San Diego County. This air basin includes the southwestern portion of the Southern California Region of the Study Area.

The population and emissions are concentrated in the western portion of the air basin, which is bordered on the west by the Pacific Ocean. The climate is relatively mild near the ocean, with higher temperatures and seasonal variations further inland (ARB 2013a).

The air basin includes industrial facilities, airports, an international port, freeways, and surface streets. The San Diego Air Basin is designated as nonattainment for the Federal ozone standard and the State ozone, PM_{10}, and $PM_{2.5}$ standards (ARB 2014). Air quality in the San Diego Air Basin is impacted not only by local emission sources, but also from transport of air emissions from the South Coast Air Basin and Mexico.

16.4.1.11 Salton Sea Air Basin

The Salton Sea Air Basin is in the southeast corner of California and includes all of Imperial County and central Riverside County. The air basin is characterized by flat terrain and the Salton Sea surrounded by high mountains to the west, north, and east. The southern portion of the air basin extends towards the Gulf of California. The flat terrain and strong temperature differentials created by intense heating and cooling patterns produce moderate winds and deep thermal circulation systems which disperse local air emissions (DWR 2006). This air basin includes the northeastern portion of the Southern California Region of the Study Area.

The primary sources of air pollution are from vehicles and equipment exhaust and particulate matter from disturbed soils and wind erosion. The Salton Sea Air Basin is designated as nonattainment for the Federal and State ozone and PM_{10} standards (ARB 2014; USEPA 2015). Portions of the Salton Sea Air Basin located outside of the Study Area near Calexico also are in nonattainment for $PM_{2.5}$ standards.

16.4.2 Existing Greenhouse Gases and Emissions Sources

This subsection presents an overview of the greenhouse effect and climate change, and potential sources of GHG emissions and information related to climate change and GHG emissions in California. GHG emissions and their climate-related impacts are not limited to specific geographic locations, but occur on global or regional scales. GHG emissions contribute cumulatively to the overall heat-trapping capability of the atmosphere, and the effects of the warming, such as climate change, are manifested in different ways across the planet.

16.4.2.1 Greenhouse Gas Emissions Regulations and Analyses

Global warming is the name given to the increase in the average temperature of the Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Warming of the climate system is now considered to be unequivocal (DWR 2010) with global surface temperature increasing approximately 1.33°F over the last one hundred years. Continued warming is projected to increase global average temperature between 2 and 11 degrees Fahrenheit (°F) over the next one hundred years.

The causes of this warming have been identified as both natural processes and as the result of human actions. The Intergovernmental Panel on Climate Change (IPCC) concludes that variations in natural phenomena such as solar radiation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward. However, after 1950, increasing GHGs concentrations resulting from human activity such as fossil fuel burning and deforestation have been responsible for most of the observed temperature increase. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

Increases in GHG concentrations in the Earth's atmosphere are thought to be the main cause of human-induced climate change. GHGs naturally trap heat by impeding the exit of solar radiation that has hit the Earth and is reflected back into space. Some GHGs occur naturally and are necessary for keeping the Earth's surface inhabitable. However, increases in the concentrations of these gases in the atmosphere during the last hundred years have decreased the amount of solar radiation that is reflected back into space, intensifying the natural greenhouse effect and resulting in the increase of global average temperature (DWR 2010).

The principal GHGs considered in this EIS are CO_2, CH_4, N_2O, SF_6, PFC, and HFC, in accordance with the California Health and Safety Code section 38505(g) (DWR 2010). Each of the principal GHGs has a long atmospheric lifetime (one year to several thousand years). In addition, the potential heat-trapping ability of each of these gases varies significantly from one another, and also vary over time. For example, CH_4 is 25 times as potent as CO_2; while SF_6 is 32,800 times more potent than CO_2 with a 100-year time horizon (IPCC 2007).

The primary man-made processes that release these gases include: burning of fossil fuels for transportation, heating and electricity generation; agricultural practices that release CH_4, such as livestock grazing and crop residue decomposition; and industrial processes that release smaller amounts of high global warming potential gases such as SF_6, PFCs, and HFCs (DWR 2010). Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove CO_2 from the air and altering the Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed.

16.4.2.2 An Overview of the Greenhouse Effect

The greenhouse effect is a natural phenomenon that is essential to keeping the Earth's surface warm (DWR 2010). Like a greenhouse window, GHGs allow sunlight to enter and then prevent heat from leaving the atmosphere. Solar radiation enters the Earth's atmosphere from space. A portion of this radiation is reflected by particles in the atmosphere back into space, and a portion is absorbed by the Earth's surface and emitted back into space. The portion absorbed by the Earth's surface and emitted back into space is emitted as lower-frequency infrared radiation. This infrared radiation is absorbed by various GHGs present in the atmosphere. While these GHGs are transparent to the incoming solar radiation, they are effective at absorbing infrared radiation emitted by the Earth's surface. Therefore, some of the lower-frequency infrared radiation emitted by the Earth's surface is retained in the atmosphere, creating a warming of the atmosphere.

16.4.2.2.1 Global Climate Trends and Associated Impacts

The rate of increase in global average surface temperature over the last hundred years has not been consistent (DWR 2010). The last three decades have warmed at a much faster rate than the previous seven decades – on average 0.32°F per decade. Eleven of the twelve years from 1995 to 2006, rank among the twelve warmest years in the instrumental record of global average surface temperature since 1850.

Increased global warming has occurred concurrent with many other changes have occurred in other natural systems (DWR 2010). Global sea levels have risen on average 1.8 millimeters per year; precipitation patterns throughout the world have shifted, with some areas becoming wetter and other drier; tropical storm activity in the North Atlantic has increased; peak runoff timing of many glacial and snow fed rivers has shifted earlier; as well as numerous other observed conditions. Though it is difficult to prove a definitive cause and effect relationship between global warming and other observed changes to natural systems, there is high confidence in the scientific community that these changes are a direct result of increased global temperatures.

16.4.2.2.2 Overview of Greenhouse Gas Emission Sources

Naturally occurring GHGs include water vapor, CO_2, methane, and nitrous oxide. Water vapor is introduced to the atmosphere from oceans and the natural biosphere. Water vapor introduced directly to the atmosphere from agricultural or other activities is not long lived, and thus does not contribute substantially to a warming effect (NAS 2005). Carbon and nitrogen contained in CO_2, methane, and nitrous oxide naturally cycle from gaseous forms to organic biomass through processes such as plant and animal respiration and seasonal cycles of plant growth and decay (USEPA 2012). Although naturally occurring, the emissions and sequestration of these gases are also influenced by human activities, and in some cases, are caused by human activities (anthropogenic). In addition to these GHGs, several classes of halogenated substances that contain fluorine, chlorine, or bromine also contribute to the greenhouse effect. However, these compounds are the product of industrial activities for the most part.

Each of the GHGs has a different capacity to trap heat in the atmosphere, with some of these gases being more effective at trapping heat than others. For calculating emissions, ARB (ARB 2007) uses a metric developed by the IPCC to account for these differences and to provide a standard basis for calculations. The metric, called the global warming potential (GWP), is used to compare the future climate impacts of emissions of various long-lived GHGs. The GWP of each GHG is indexed to the heat-trapping capability of CO_2, and allows comparison of the global warming influence of each GHG relative to CO_2. The GWP is used to translate emissions of each GHG to emissions of carbon dioxide equivalents, or CO_2e. In this way, emissions of various GHGs can be summed, and total GHG emissions can be inventoried in common units of metric tons per year of CO_2e. Most international inventories, including the United States inventory, use GWP values from the IPCC Fourth Assessment Report, per international consensus (IPCC 2007; USEPA 2012).

CO_2 is a byproduct of burning fossil fuels and biomass, as well as land-use changes and other industrial processes (USEPA 2012). It is the principal anthropogenic GHG that contributes to the Earth's radiative balance, and it represents the dominant portion of GHG emissions from activities that result from the combustion of fossil fuels (e.g., construction activities, electrical generation, and transportation).

16.4.2.3 California Climate Trends and Greenhouse Gas Emissions

Maximum (daytime) and minimum (nighttime) temperatures are increasing almost everywhere in California but at different rates. The annual minimum temperature averaged over all of California has increased 0.33°F per decade during the period 1920 to 2003, while the average annual maximum temperature has increased 0.1°F per decade (DWR 2010).

With respect to California's water resources, the most significant impacts of global warming have been changes to the water cycle and sea level rise. Over the past century, the precipitation mix between snow and rain has shifted in favor of more rainfall and less snow, and snow pack in the Sierra Nevada is melting earlier in the spring (DWR 2010). The average early spring snowpack in the Sierra Nevada has decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage. These changes have significant implications for water supply, flooding, aquatic ecosystems, energy generation, and recreation throughout the state.

During the same period, sea levels along California's coast have risen. The Fort Point tide gauge in San Francisco was established in 1854 and is the longest continually monitored gauge in the United States. Sea levels measured at this gauge and two other west coast gauges indicate that the sea levels have risen at an average rate of about 7.9 inches/century (0.08 inch/year) over the past 150 years (BCDC 2011). Continued sea level rise associated with global warming may threaten coastal lands and infrastructure, increase flooding at the mouths of rivers, place additional stress on levees in the Sacramento-San Joaquin Delta, and intensify the difficulty of managing the Sacramento-San Joaquin Delta as the heart of the state's water supply system (DWR 2010).

16.4.2.3.1 Potential Effects of Global Climate Change in California

Warming of the atmosphere has broad implications for the environment. In California, one of the effects of climate change could be increases in temperature that could affect the timing and quantity of precipitation. California receives most of its precipitation in the winter months, and a warming environment would raise the elevation of snow pack and result in reduced spring snowmelt and more winter runoff. These effects on precipitation and water storage in the snow pack could have broad implications on the environment in California.

The following are some of the potential effects of a warming climate in California (California Climate Change Portal 2007):

- Loss of snowpack storage will cause increased winter runoff that generally would not be captured and stored because of the need to reserve flood capacity in reservoirs during the winter.
- Less spring runoff would mean lower early summer storage at major reservoirs, which would result in less hydroelectric power production.
- Higher temperatures and reduced snowmelt would compound the problem of providing suitable cold water habitat for salmonid species. Lower reservoir levels would also contribute to this problem, reducing the flexibility of cold water releases.
- Sea level rise would affect the Delta, worsening existing levee problems, causing more saltwater intrusion, and adversely affecting many coastal marshes and wildlife reserves. Release of water to streams to meet water quality requirements could further reduce storage levels.
- Increased temperatures would increase the agricultural demand for water and increase the level of stress on native vegetation, potentially allowing for an increase in pest and insect epidemics and a higher frequency of large, damaging wildfires.

16.4.2.3.2 Current California Emission Sources

The recent California's GHG emission inventory was released on April 6, 2012, with data updated through October 2011. The GHG emissions in California have been estimated for each year from 2000 to 2009, and are reported for several large sectors of emission sources. The estimates for 2009 are summarized in Table 16.4, reported by sector as millions of tons per year of CO_2 (ARB 2011e).

Table 16.4 California Greenhouse Gas Emissions by Sector in 2009

Sector	Total Emissions (million tons/year of CO_2e)	Percent of Statewide Total Gross Emissions[a]
Agriculture	32.1	7
Commercial and Residential	43	9.4
Electric Power	103.6	22.7
Forestry (excluding CO_2 sinks)	0.2	< 1.0
Industrial	81.4	17.8
Recycling and Waste	7.3	1.6
Transportation	172.9	37.9
High Global Warming Potential substance and ozone-depleting substance use[b]	16.3	3.6
Total	**456.8**	**100**
Forestry Net Emissions	-3.8	–

Source: ARB 2011e.

Notes:

a. Based on the 456.8 million tons/year of CO_2e Total Gross Emissions estimate.

b. High Global Warming Potential substance and ozone-depleting substance use are not attributed to an individual sector.

Total gross statewide GHG emissions in 2009 were estimated to be 456.8 million tons per year of CO_2e. The two largest sectors contributing to emissions in California are transportation and electric power (the latter sector includes both in-state generation and imported electricity). The agricultural sector represents only 7 percent of the total gross statewide emissions.

The agricultural sector includes manure management, enteric fermentation, agricultural residue burning, and soils management. The forestry sector contributes to overall emissions, but is a net sink of emissions.

The California Global Warming Solutions Act of 2006 (California Assembly Bill 32) requires California to reduce statewide emissions to 1990 levels by 2020.

In December 2007, ARB adopted an emission limit for 2020 of 427 million tons per year of CO_2e. Increases in the stateside renewable energy portfolio and reductions in importation of coal-based electrical power will contribute to meeting California's near-term GHG emission reduction goals. The ARB estimates that a reduction of 169 million metric tons net CO_2e emissions below business-as-usual would be required by 2020 to meet the 1990 levels (ARB 2007). This amounts to approximately a 30 percent reduction from projected "business-as-usual" levels in 2020.

16.5 Impact Analysis

This section describes the potential mechanisms and analytical methods for change in air quality and GHG emissions; results of the impact analysis; potential mitigation measures; and cumulative effects.

16.5.1 Potential Mechanisms for Change and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact analysis considers changes in air quality and GHG emissions related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could directly or indirectly change air quality and GHG emissions due to use of engines or electricity that operate groundwater wells, changes in cropping patterns, or odor emissions.

16.5.1.1 Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants

Changes in CVP and SWP operations under the alternatives could change the use of individual engines to operate groundwater wells. The CVHM model is used to evaluate changes in groundwater conditions in the Central Valley, as described in Chapter 7, Groundwater Resources and Groundwater Quality. To evaluate the potential for changes in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants, results from the CVHM model that indicate changes in groundwater withdrawals due to changes in CVP and SWP operations. However, it is not known how many of the groundwater pumps use electricity and how many use diesel engines. The diesel engines have the potential to emit criteria air pollutants and precursors, and toxic air contaminants.

Most of the groundwater wells in the Central Valley use electrical pumps. As reported in a recent environmental assessment, approximately 14 to 15 percent of the pumps used diesel fuel in 2003 (Reclamation 2013a). It is assumed for this EIS, that the portion of groundwater pumps that use electricity would remain approximately at 85 percent. Therefore, it is assumed that increases or decreases in groundwater pumping would be indicative of an increase or decrease in the use of diesel engines in the Central Valley as well as in the San Francisco Bay Area, Central Coast, and Southern California regions. Changes in CVP and SWP operations would not result in changes in groundwater pumping in the Trinity River Region; therefore, this analysis does not address Trinity River Region.

16.5.1.2 Changes in Exposure of Sensitive Receptors to Particulate Matter

Changes in CVP and SWP operations under the alternatives could change the potential for dust generation on irrigated lands that would be idled due to reduced CVP and SWP water supplies. However, as described in Chapter 12, Agricultural Resources, irrigated acreage under Alternatives 1 through 5 would be similar to irrigated acreage under both the No Action Alternative and the Second Basis of Comparison. Therefore, there would be no change in potential for dust generation. Therefore, these changes are not analyzed in this EIS.

16.5.1.3 Changes in Exposure of Sensitive Receptors to Odor Emissions from Wetlands

Restoration of seasonal floodplains and tidally-influenced wetlands could result in additional odors at surrounding sensitive receptors near the restoration locations. However, these actions would occur in a similar manner under the No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison, as described in Chapter 3, Description of Alternatives. Therefore, odor emissions would be the same under all of the alternatives and the Second Basis of Comparison. Therefore, this change is not analyzed in this EIS.

16.5.1.4 Changes in GHG Emissions due to Changes in Energy Generation or Use

Changes in CVP and SWP operations under the alternatives could change CVP and SWP energy generation and use, and the associated GHG emissions. In addition, operational changes could also affect the use of energy by CVP and SWP water users through the implementation of regional and local alternative water supplies, such as recycling or desalination. When CVP and SWP water deliveries decline, CVP and SWP net energy generation changes; and water users are anticipated to increase use of groundwater, recycled water, and/or desalinated water from existing facilities or facilities that are reasonably foreseeable to be constructed by 2030. When CVP and SWP water deliveries increase, CVP and SWP net energy generation would change; and water users are anticipated to reduce use of alternate water supplies either due to economic considerations or to allow the amount of stored water to increase under a conjunctive use pattern. It is not known whether the changes in CVP and SWP net energy generation would be similar to the changes in energy use for alternate regional and local water supplies.

Potential changes in GHG emissions due to changes in CVP and SWP energy generation or use, and the evaluation of potential for changes in use of energy by CVP and SWP water users to implement alternative water supplies, are analyzed broadly and qualitatively across the overall study area. Some of the changes in energy use and generation will occur across the CVP and SWP system, others may require additional energy resources. Specific locations of the energy sources and users have not been defined.

16.5.1.5 Effects due to Cross Delta Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years.

Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water (groundwater substitution); idle crops; or substitute crops that uses less water in order to reduce normal consumptive use of surface water.

Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities. These conditions generally occur drier water year types when the flows from upstream reservoirs plus unregulated flows are adequate to meet the Sacramento Valley water demands and the CVP and SWP export allocations. In non-wet years, the CVP and SWP water allocations would be less than full contract amounts; therefore, capacity may be available in the CVP and SWP conveyance facilities to move water from other sources.

Projecting future air quality conditions related to water transfer activities is difficult because specific water transfer actions required to make the water available, convey the water, and/or use the water would change each year due to changing hydrological conditions, CVP and SWP water availability, specific local agency operations, and local cropping patterns. Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in conditions related to water transfer actions (Reclamation 2014c). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

16.5.2 Conditions in Year 2030 without Implementation of Alternatives 1 through 5

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to air quality that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

16.5.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in warmer temperatures, more short-duration high-rainfall events, and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries under the No Action Alternative and the Second Basis of Comparison. However, the CVP and SWP water deliveries would be less under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies, which could result in more crop idling which could result in increased dust generation.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans. Development under the general plans would be required to be implemented in accordance with adopted air quality management plans.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects. These projects would increase energy demand and could be associated with increased greenhouse gas emissions.

Under the No Action Alternative and the Second Basis of Comparison, there are several major variables with varying degrees of uncertainty. These variables include future population growth in the air basins, the extent and emissivity of various emissions sources from existing and future activities, and the success of the local jurisdictions and others in implementing effective air emissions control measures. It is assumed that air quality in 2030 will be similar to the conditions described in the Affected Environment even with population growth because the current air quality management plans were developed with consideration of future growth by at least 2030. It is anticipated that the non-attainment areas will reduce the contaminants to a level of attainment in accordance with adopted air quality management plans. In addition, it is assumed that the California Renewables Portfolio Standard (RPS) will be implemented by 2020. The RPS was established in accordance with California Senate Bill 1078 in 2002, Senate Bill 107 in 2006, and Senate Bill 2 in 2011 to require investor-owned utilities, electric service providers, and community-choice aggregators (e.g., local agencies that purchase or generate electricity for their community) to provide at least 33 percent of their total energy procurement from renewable energy sources by 2020.

Increased groundwater use and related groundwater elevation reductions could occur due to reduction in CVP and SWP water supplies. The increased pumping would increase demand for electricity, and potentially, greenhouse gas emissions. As described above, approximately 15 percent of groundwater pumps rely upon diesel fuels. Increased groundwater pumping could result in increased emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants from increased use of diesel engines.

The No Action Alternative and the Second Basis of Comparison would include restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass. Operation of wetlands restoration projects could result in periodic odors due to anaerobic decomposition of organic matter in portions of the wetlands. As a result, odorous compounds, such as ammonia and hydrogen sulfide, are generated and may be released into the environment. Marshes and wetlands can also be a source of odors during some time periods when ponds or shallow water areas undergo algal or vegetative growth. Marshes, wetlands, shallow water areas, or canals may require periodic maintenance to inhibit algal or vegetative growth, and avoid conditions conducive to anaerobic digestion. The occurrence and severity of odor impacts depend on numerous factors, including the nature, frequency, and intensity of the source; wind speed and direction; and the presence of sensitive receptors. Although odors rarely cause any physical harm, they can still be unpleasant to some individuals.

16.5.3 Evaluation of Alternatives

Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

16.5.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

16.5.3.1.1 Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

As described in Chapter 7, Groundwater Resources and Groundwater Quality, groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under the No Action Alternative as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under the No Action Alternative, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to air quality were identified as increased emissions of air pollutants due to the use of diesel engines for groundwater pumps that were used to provide transfer water through groundwater substitution programs. The analysis indicated that the effects could be reduced to avoid substantial impacts through the use of electric engines or reducing the amount of groundwater substitution. Other identified effects were considered to be not substantial or beneficial as related to crop idling to provide transfer water in the seller's service area; and reduction of groundwater pumping that could use diesel engines or dust generation from crop idled lands in the purchaser's service area.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison.

16.5.3.1.2 San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under No Action Alternative as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in additional use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

16.5.3.1.3 Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under the No Action Alternative as compared to the Second Basis of Comparison would result in a reduction of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would decline and net energy generated for use by others generally would increase.

In addition to changes in CVP and SWP energy generation and use and the associated GHG emissions, CVP and SWP operations under the No Action Alternative as compared to the Second Basis of Comparison could potentially increase use of energy by CVP and SWP water users to implement regional and local alternate water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could result in increased GHG emissions.

16.5.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because CVP and SWP operations conditions under Alternative 1 are identical to conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

16.5.3.2.1 Alternative 1 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 8 percent under Alternative 1 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under

Alternative 1, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative, and that impacts on air quality would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 11 percent and 21 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 1 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes CVP and SWP operations under Alternative 1 as compared to the No Action Alternative would result in an increase of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would increase and net energy generated for use by others generally would decline.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 1 as compared to the No Action Alternative could potentially decrease the use of energy by CVP and SWP water users due to less need to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. As the need for alternative water supplies is decreased, the associated energy demand

and GHG emissions would also be decreased under Alternative 1 as compared to the No Action Alternative.

16.5.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

16.5.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative, as described in Chapter 3, Description of Alternatives; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

16.5.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to air quality and GHG emission conditions under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 16.5.3.1, No Action Alternative.

16.5.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

16.5.3.4.1 Alternative 3 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 6 percent under Alternative 3 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under Alternative 3, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of

Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative, and that impacts on air quality would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 9 percent and 17 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 3 as compared to the No Action Alternative would result in an increase of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would increase and net energy generated for use by others generally would decline.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 3 as compared to the No Action Alternative could potentially decrease the use of energy by CVP and SWP water users due to less need to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. As the need for alternative water supplies is decreased, the associated energy demand and GHG emissions would also be decreased under Alternative 3 as compared to the No Action Alternative.

16.5.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar (within a 5 percent change) under Alternative 3 as compared to the Second Basis of Comparison. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the Second Basis of Comparison, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 3 and the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 and the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the Second Basis of Comparison.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 3 as compared to the Second Basis of Comparison would result in a decrease of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would decrease and net energy generated for use by others generally would increase.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 3 as compared to the Second Basis of Comparison could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could result in increased GHG emissions.

16.5.3.5 Alternative 4

The air quality and GHG emissions under Alternative 4 would be identical to the air quality and GHG emissions under the Second Basis of Comparison; therefore, Alternative 4 is only compared to the No Action Alternative.

16.5.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 is identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Therefore, changes in air quality and GHG emissions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 16.5.3.2.1, Alternative 1 Compared to the No Action Alternative.

16.5.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

16.5.3.6.1 Alternative 5 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar under Alternative 5 as compared to the No Action Alternative. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 5 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 and the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the No Action Alternative.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 5 as compared to the No Action Alternative would result in similar CVP and SWP water deliveries to areas located south of the Delta except in April and May when exports would decline. Therefore, annual energy use would decrease and net energy generated for use by others generally would increase.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 5 as compared to the No Action Alternative could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could result in increased GHG emissions.

16.5.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under Alternative 5 as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under Alternative 5, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the Second Basis of Comparison, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be reduced under Alternative 5 as compared to the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in increased use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 5 as compared to the Second Basis of Comparison would result in a decrease of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would decrease and net energy generated for use by others generally would increase.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 5 as compared to the Second Basis of Comparison could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could result in increased GHG emissions.

16.5.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 16.5 and 16.6.

Table 16.5 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions.	None needed
Alternative 2	No effects on air quality.	None needed
Alternative 3	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 6 percent in the Central Valley, 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.	None needed

Table 16.6 Comparison of Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
No Action Alternative	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.
Alternative 1	No effects on air quality.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.	Not considered for this comparison.
Alternative 4	No effects on air quality.	Not considered for this comparison.
Alternative 5	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.

16.5.3.8 Potential Mitigation Measures

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in changes in air quality. Therefore, there would be no adverse impacts to air quality; and no mitigation measures are required.

16.5.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison include climate change and sea level rise, implementation of general plans, and completion of ongoing projects and programs (see Chapter 3, Description of Alternatives). The effects of these items were analyzed quantitatively and qualitatively, as described in the Impact Analysis of this chapter. The discussion below focuses on the qualitative effects of the alternatives and other past, present, and reasonably foreseeable future projects identified for consideration of cumulative effects (see Chapter 3, Description of Alternatives).

16.5.3.9.1 No Action Alternative and Alternatives 1 through 5

Continued coordinated long-term operation of the CVP and SWP under the No Action Alternative would result in reduced CVP and SWP water supply availability as compared to recent conditions due to climate change and sea level rise by 2030. These conditions are included in the analysis presented above.

Future water resource management projects considered in cumulative effects analysis could increase water supply availability, as described in Chapter 5, Surface Water Resources and Water Supplies; and reduce air quality impacts in the San Francisco Bay Area, Central Coast, and Southern California regions by providing additional water supplies that could be stored in existing reservoirs.

There also are several ongoing programs that could result in reductions in CVP and SWP water supply availability due to changes in flow patterns in the Sacramento and San Joaquin rivers watersheds and the Delta that could reduce availability of CVP and SWP water deliveries as well as local and regional water supplies, as described in Chapter 5, Surface Water Resources and Water Supplies. Reduction in available surface water supplies as compared to projected water supplies under the No Action Alternative and Alternatives 1 through 5 could result in adverse air quality conditions if groundwater pumping is increased as surface water availability is reduced.

There would be no adverse air quality impacts associated with implementation of the alternatives as compared to the No Action Alternative or the Second Basis of Comparison. Therefore, Alternatives 1 through 5 would not contribute cumulative impacts to air quality.

16.6 References

ARB (California Air Resources Board). 2007. *Draft California Greenhouse Gas Inventory (millions of metric tonnes of* CO_2 *equivalent) – By IPCC Category*. November 19.

ARB (California Air Resources Board). 2010. *Glossary of Air Pollution Terms*. October 19. Site accessed February 4, 2011. http://www.arb.ca.gov/html/gloss.htm.

ARB (California Air Resources Board). 2011a. *Air Basin and County Map Boundaries*. Site accessed February 7, 2011. http://www.arb.ca.gov/desig/adm/basincnty.htm.

ARB (California Air Resources Board). 2011b. *California Map for Local Air District Websites*. Site accessed February 7, 2011. http://www.arb.ca.gov/capcoa/dismap.htm.

ARB (California Air Resources Board). 2011c. *Attachment D, Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document*. August 19.

ARB (California Air Resources Board). 2011d. *iADAM Air Quality Data Statistics*. Site accessed January 26 and 27, 2011. http://www.arb.ca.gov/adam/.

ARB (California Air Resources Board). 2011e. *California's 2000-2009 Greenhouse Gas Emissions Inventory Technical Support Document*. December.

ARB (California Air Resources Board). 2012. *Ambient Air Quality Standards*. June 7.

ARB (California Air Resources Board). 2013a. California Air Basins. Sacramento, California. Site accessed March 6, 2013. http://www.arb.ca.gov/knowzone/basin/basin.swf.

ARB (California Air Resources Board). 2013b. *Ambient Air Quality Standards*. June 4.

ARB (California Air Resources Board). 2014. Final Regulation Order, Area Designations for State Ambient Air Quality Standards. Chapter 1. Air Resources Board. Subchapter 1.5. Air Basins and Air Quality Standards. Article 1.5. Area Pollutant Designations. April 10.

BCDC (Bay Conservation and Development Commission). 2011. *Draft Staff Report. Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline*. September 23.

California Climate Change Portal. 2007. *Potential Effects of Global Warming on California Water and Forest Resources*.

DWR (Department of Water Resources). 2006. *Salton Sea Ecosystem Restoration Draft Program Environmental Impact Report*. October.

DWR (Department of Water Resources). 2010. *Model CEQA Climate Change Discussion and Impact Analysis Section, California Department of Water Resources Internal Guidance Document*. *CEQA Climate Change Committee*. January.

IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007, The Physical Science Basis*.

NAS (National Academy of Sciences). 2005. *Understanding and Responding to Climate Change, Highlights of National Academies Reports*. October.

Reclamation (Bureau of Reclamation). 2013a. *Environmental Assessment 2013 Water Transfers*. May.

Reclamation (Bureau of Reclamation). 2013b. *Record of Decision, Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority, 2014-2038*. July 30.

Reclamation (Bureau of Reclamation). 2013n. *Shasta Lake Water Resources Investigation Draft Environmental Impact Statement*. June.

Reclamation (Bureau of Reclamation). 2014a. *Findings of No Significant Impact, 2014 Tehama-Colusa Canal Authority Water Transfers*. April 22.

Reclamation (Bureau of Reclamation). 2014b. *Findings of No Significant Impact, 2014 San Luis & Delta-Mendota Water Authority Water Transfers*. April 22.

Reclamation (Bureau of Reclamation). 2014c. *Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report, Public Draft*. September.

SJVAPCD (San Joaquin Valley Air Pollution Control District). 2004a. *Agricultural Air Quality Conservation Management Practices for San Joaquin Valley Farms.*

SJVAPCD (San Joaquin Valley Air Pollution Control District). 2004b. *List of Conservation Management Practices*. May 20.

USEPA (U.S. Environmental Protection Agency). 2006. *Terms of the Environment, Glossary, Abbreviations, and Acronyms*. Site accessed February 4, 2011. http://www.epa.gov/OCEPAterms/aterms.html.

USEPA (U.S. Environmental Protection Agency). 2012. *Glossary of Climate Change Terms*. Site accessed December 18, 2012. http://epa.gov/climatechange/glossary.html.

USEPA (U.S. Environmental Protection Agency). 2013. *Currently Designated Nonattainment Areas for All Criteria Pollutant, California, As of December 14, 2012*. Site accessed January 24, 2013. http://www.epa.gov/air/oaqps/greenbk/ancl.html#CALIFORNIA.

USEPA (U.S. Environmental Protection Agency) 2014. *Green Book – Currently Designated Nonattainment Areas for All Criteria Pollutants, As of December 5, 2013*. Site accessed June 22, 2014. http://www.epa.gov/oaqps001/greenbk/ancl.html.

USEPA (U.S. Environmental Protection Agency) 2015a. *General Conformity De Minimis Level*. Site accessed June 7, 2015. http://www.epa.gov/oaqps001/genconform/deminimis.html.

USEPA (U.S. Environmental Protection Agency) 2015b. *Green Book – Currently Designated Nonattainment Areas for All Criteria Pollutants, As of January 30, 2015.*

USGS (U.S. Geological Survey). 2014. *Effects of Climatic Variability and Land Use on American Drylands*. Site accessed June 22, 2014. http://esp.cr.usgs.gov/projects/sw/swdust/salton_sea.html.