3.8 Greenhouse Gas Emissions

This section describes the regulatory and environmental setting for greenhouse gas (GHG) emissions. It also describes impacts on GHG emissions that would result from implementation of the *Climate Action 2020: Community Climate Action Plan* (CAP) and includes mitigation for significant impacts, where feasible and appropriate. The CAP itself provides an in-depth review of GHG emissions and forecasts for Sonoma County and the participating jurisdictions; the CAP is hereby incorporated by reference.

Following is a brief description of the terminology and concepts used in this section.

- **Greenhouse Gas**. GHGs encompass the following six gases present in the Earth's lower atmosphere: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and hydrofluorocarbons (HFCs).
- **Greenhouse Effect**. This phenomenon keeps the atmosphere near the Earth's surface warm enough for habitation by humans and other life forms. Visible sunlight passes through the atmosphere without being absorbed. Some of the sunlight striking the Earth is absorbed and converted to heat, which warms the surface. The surface emits infrared radiation to the atmosphere, where some of it is absorbed by GHGs and re-emitted toward the surface; some of the heat is not trapped by GHGs and escapes into space. Human activities that emit additional GHGs to the atmosphere increase the amount of infrared radiation that gets absorbed before escaping into space, thus enhancing the greenhouse effect and amplifying the warming of the Earth (Center for Climate and Energy Solutions 2011). Thus, GHGs play a critical role in maintaining the Earth's temperature.
- **Global Warming and Climate Change**. Increases in fossil fuel combustion and deforestation have exponentially increased concentrations of GHGs in the atmosphere since the Industrial Revolution. Rising atmospheric concentrations of GHGs in excess of natural levels enhance the greenhouse effect, which contributes to *global warming* of the Earth's lower atmosphere and may induce large-scale changes in ocean circulation patterns, precipitation patterns, global ice cover, biological distributions, and other changes to the Earth system that are collectively referred to as *climate change*. The Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation.

Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors), which are primarily pollutants of regional and local concern. Given their long atmospheric lifetimes, GHGs emitted by countless sources worldwide accumulate in the atmosphere. No single emitter of GHGs is large enough to trigger global climate change on its own. Rather, climate change is the result of the individual contributions of countless past, present, and future sources. Therefore, GHG impacts are inherently cumulative, and the analysis below is a cumulative impact analysis.

3.8.1 Environmental Setting

The unique chemical properties of GHGs enable them to become well-mixed within the atmosphere and transported over long distances. Consequently, unlike other resource areas that are primarily concerned with localized project impacts (e.g., within 1,000 feet of a particular project site), the global nature of climate change requires a broader analytic approach. Although this section focuses on GHG emissions generated as a result of the CAP, the analysis considers them in the context of potential state, national, and global GHG impacts.

3.8.1.1 Greenhouse Gases

The primary GHGs are CO_2, CH_4, N_2O, PFCs, SF_6, and HFCs, as defined by California law and identified in the California Environmental Quality Act (CEQA) Guidelines (Health and Safety Code 38505(g); CCR, title 14, section 15364.5). Each of these gases is discussed in detail below except PFCs, which are primarily generated by industrial processes and are not anticipated to be generated by the CAP.

To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology defined in the IPCC Fourth Assessment Report (AR4) reference documents (Intergovernmental Panel on Climate Change 2007b). Therefore, GWP methods from the AR4 are utilized herein. The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2 equivalent (CO_2e). This normalized scale compares the heat-trapping ability of each gas to the same mass of CO_2 (CO_2 has a global warming potential of 1 by definition) calculated over a specified time interval (such as 100 years).

Table 3.8-1 lists the global warming potential of several GHGs, their lifetimes, and abundances in the atmosphere.

Table 3.8-1. Lifetimes and Global Warming Potentials of Several Greenhouse Gases

Greenhouse Gases	Global Warming Potential (100 years)	Lifetime (years)	2014 Atmospheric Abundance
CO_2	1	50–200	394 ppm
CH_4	28	9–15	1,893 ppb
N_2O	265	121	326 ppb
SF_6	23,500	3,200	7.8 ppt
HFC-23	12,400	222	18 ppt
HFC-134a	1,300	13.4	75 ppt
HFC-152a	138	1.5	3.9 ppt

Sources: Myhre et al. 2013; Blasing 2014; National Oceanic and Atmospheric Administration 2014.
CO_2 = carbon dioxide
CH_4 = methane
N_2O = nitrous oxide
SF_6 = sulfur hexafluoride
HFC = hydrofluorocarbon
ppm = parts per million by volume.
ppb = parts per billion by volume.
ppt = parts per trillion by volume.

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75% of all GHG emissions caused by humans. Its atmospheric lifetime of 50–200 years ensures that atmospheric concentrations of CO_2 will remain elevated for decades even after mitigation efforts to reduce GHG concentrations are promulgated (Intergovernmental Panel on Climate Change 2007a). The primary sources of anthropogenic CO_2 in the atmosphere are the burning of fossil fuels (including motor vehicles), gas flaring, cement production, and land use changes (e.g., deforestation, oxidation of elemental carbon). CO_2 can also be removed from the atmosphere by photosynthetic organisms.

Atmospheric CO_2 has increased from a preindustrial concentration of 280 parts per billion (ppb) to 394 parts per million (ppm) (Intergovernmental Panel on Climate Change 2007b; National Oceanic and Atmospheric Administration 2014).

Methane

CH_4, the main component of natural gas, is the second most abundant GHG and has a GWP of 25 (Intergovernmental Panel on Climate Change 2007b). Sources of anthropogenic emissions of CH_4 include growing rice, raising cattle, using natural gas, landfill outgassing, and mining coal (National Oceanic and Atmospheric Administration 2010). Certain land uses also function as both a source and sink for CH_4. For example, the primary terrestrial sources of CH_4 are wetlands, whereas undisturbed, aerobic soils act as a CH_4 sink (i.e., they remove CH_4 from the atmosphere).

Atmospheric CH_4 has increased from a preindustrial concentration of 715 ppb to 1,893 ppb (Intergovernmental Panel on Climate Change 2007b; Blasing 2014).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 298 (Intergovernmental Panel on Climate Change 2007b). Anthropogenic sources of N_2O include agricultural processes (e.g., fertilizer application), nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O also is used in rocket engines, racecars, and as an aerosol spray propellant. Natural processes, such as nitrification and denitrification, can also produce N_2O, which can be released to the atmosphere by diffusion. In the United States, more than 70% of N_2O emissions are related to agricultural soil management practices, particularly fertilizer application.

N_2O concentrations in the atmosphere have increased 18% from preindustrial levels of 270 ppb to 326 ppb (Intergovernmental Panel on Climate Change 2007b; Blasing 2014).

Hydrofluorocarbons

HFCs are anthropogenic chemicals used in commercial, industrial, and consumer products and have high GWPs (U.S. Environmental Protection Agency 2006). HFCs are generally used as substitutes for ozone-depleting substances (ODS) in automobile air conditioners and refrigerants. As seen in Table 3.8-1, the most abundant HFCs, in descending order, are HFC-134a, HFC-23, and HFC-152a.

HFC concentrations in the atmosphere have risen from 0 to more than 64 (HFC-134a) parts per trillion (ppt) since preindustrial times (Intergovernmental Panel on Climate Change 2007b; Blasing 2014).

Sulfur Hexafluoride

SF_6, a human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and also as a tracer chemical for the study of oceanic and atmospheric processes (U.S. Environmental Protection Agency 2006). In 2014, atmospheric concentrations of SF_6 were 7.8 parts per trillion (ppt) and steadily increasing in the atmosphere (Blasing 2014). SF_6 is the most powerful of all GHGs listed in IPCC studies, with a GWP of 23,500 (Myhre et al. 2013).

3.8.1.2 Greenhouse Gas Emissions Inventories

A GHG inventory is a quantification of all GHG emissions and sinks within a selected physical and/or economic boundary. GHG inventories can be performed on a large scale (i.e., for global and national entities) or on a small scale (i.e., for a particular building or person). Although many processes are difficult to evaluate, several agencies have developed tools to quantify emissions from certain sources.

Table 3.8-2 outlines the most recent global, national, and statewide inventories to help contextualize the magnitude of potential CAP-related emissions.

Table 3.8-2. Global, National, State, Regional, and County GHG Emissions Inventories

Emissions Inventory	CO_2e (metric tons)
2010 IPCC Global GHG Emissions Inventory	52,000,000,000
2013 EPA National GHG Emissions Inventory	6,673,000,000
2013 ARB State GHG Emissions Inventory	459,300,000
2007 SFBAAB GHG Emissions Inventory	95,800,000
2010 CAP Sonoma County Inventory	3,700,000

Sources: Intergovernmental Panel on Climate Change 2014, U.S. Environmental Protection Agency 2015; California Air Resources Board 2015; BAAQMD 2008, and the RCPA CAP

CO_2e = carbon dioxide equivalent
IPCC = Intergovernmental Panel on Climate Change
EPA = Environmental Protection Agency
ARB = California Air Resources Board
SFBAAB = San Francisco Bay Area Air Basin

3.8.1.3 Impacts of Climate Change

Climate change is a complex phenomenon that has the potential to alter local climatic patterns and meteorology. Modeling indicates that climate change will result globally and regionally in sea level rise as well as changes in climate and rainfall, among other effects. However, there remains uncertainty in characterizing the precise local climate characteristics and predicting how various ecological and social systems will react to any changes in the existing climate at the local level. Regardless of this uncertainty in precise predictions, it is widely understood that substantial climate change is expected to occur in the future.

Consequently, Sonoma County will be impacted by changing climatic conditions. Research efforts coordinated through the California Air Resources Board (ARB), California Energy Commission (CEC), California Environmental Protection Agency, the University of California system, and others are examining the specific changes to California's climate that will occur as the Earth's surface warms.

Climate change could impact the natural environment in California in the following ways, among others.

- Rising sea levels along the California coastline, particularly in San Francisco and the San Joaquin Delta due to ocean expansion.
- Extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent.
- An increase in heat-related human deaths and infectious diseases, and a higher risk of respiratory problems caused by deteriorating air quality.
- Reduced snow pack and stream flow in the Sierra Nevada, affecting winter recreation and water supplies.
- Potential increase in the severity of winter storms, affecting peak stream flows and flooding.
- Changes in growing season conditions that could affect California agriculture, causing variations in crop quality and yield.
- Changes in distribution of plant and wildlife species due to changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

With respect to central western California, including Sonoma County, climate change effects will be similar to California-wide impacts, and are expected to include the following conditions (PRBO Conservation Science 2011).

- Hotter and drier climate, with average annual temperatures increasing 1.6–1.9°F by 2070 and mean annual rainfall decreasing by 61–188 millimeters.
- Sea level rise by 8.7–12.7 centimeters by 2020–2050 and by 19.2–40.9 centimeters by 2070–2099, potentially affecting or inundating coastal development.
- More frequent and intense wildfires, with the area burned projected to increase by an estimated 10–50% by 2070–2090.
- Decreases in chaparral/coastal scrub (19–43% by 2070) and blue oak woodland/foothill pine (44–55% by 2070); increases in grassland (85–140% by 2070).
- Increased salinity in the San Francisco Bay, with salinity increasing by 1–3 practical salinity units during dry years.
- Increase in estuarine flows into the San Francisco Bay estuary, with winter gains approximately balancing spring-summer losses.
- Increased heat and decreased air quality, with the result that public health will be placed at risk, native plant and animal species may be lost, and there will be an estimated 60% growth in electricity consumption.

Sonoma County Climate Change Impacts

The following information was taken from the *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities* Report (North Bay Climate Adaptation Initiative 2015). Although climate change will likely have varying effects in different parts of the County, the general trend is warming of valley bottoms and cooling in some mountainous areas. Temperatures are projected to increase by 5–15°F

by the end of the century with uncurbed emissions, but by only a few degrees with heavily mitigated emissions.

In the past 20 years, average maximum temperatures have already increased by 2.7°F, and they are expected to continue to rise. Projections show the average temperature to be as high as 15°F warmer by the end of the century if emissions continue unmitigated. The number of extreme heat days (days with a high temperature above 93°F) is projected to increase to 40–80 days per year, compared with the current average of 0–10 days a year.

Precipitation is predicted to be more variable, with bigger, more variable floods. Climate models analyzed in the *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities Report* present a range of precipitation scenarios, the wettest showing a 25% increase in precipitation compared to twentieth century conditions, and the driest projecting a 20% decrease. Although projections of precipitation changes do not give a clear picture of the future, Sonoma County will experience drier soil and plants due to the warmer weather. The warmer weather and more erratic precipitation also increases the risk of wildfire. Other factors that may increase wildfire risk in the County include tree mortality and increases in the extent of flammable invasive species. From 1900 to 2008, sea level has risen 0.08 inch per year in the San Francisco Bay, and the Bay is projected to rise 16.5–65.8 inches by 2100.

Scientific consensus has established a direct connection between GHG emissions and climate change. Projection models for climate change impacts show far more extreme effects under scenarios in which GHG emissions are not mitigated, and much milder effects under scenarios in which emissions are heavily mitigated.

3.8.2 Regulatory Setting

3.8.2.1 Federal

Climate change is widely recognized as an imminent threat to the global climate, economy, and population. The U.S. Environmental Protection Agency (EPA) has acknowledged potential threats imposed by climate change in a Cause or Contribute Finding, which found that GHG emissions contribute to pollution that threatens public health and welfare and was a necessary finding prior to adopting new vehicle emissions standards that reduce GHG emissions. Federal climate change regulation under the federal Clean Air Act (CAA) is also currently under development for both existing and new sources. Despite the actions discussed below, there is still no comprehensive, overarching federal law specifically related to the reduction of GHG emissions.

Update to Corporate Average Fuel Economy Standards (2009/2012)

The Corporate Average Fuel Economy (CAFE) standards incorporate stricter fuel economy standards promulgated by the State of California into one uniform standard. Additionally, automakers are required to cut GHG emissions in new vehicles by roughly 25% by 2016.

EPA, the National Highway Traffic Safety Administration (NHTSA), and ARB issued joint Final Rules for CAFE standards and GHG emissions regulations for 2017 to 2025 model year passenger vehicles, which require an industry-wide average of 54.5 miles per gallon (mpg) in 2025 (National Highway Traffic Safety Administration 2012).

EPA Clean Power Plan (2015)

On June 2, 2014, under President Obama's Climate Action Plan, EPA proposed the Clean Power Plan, which includes national GHG limits for the electric power industry. The rule was adopted on August 3, 2015, and contains state-specific emission-reduction goals and will help cut carbon pollution from the power sector by 32% from 2005 levels by 2030. On February 9, 2016, the United States Supreme Court stayed implementation of the Clean Power Plan pending judicial review.

EPA and NHTSA Fuel Economy for Medium and Heavy Duty Engines and Vehicles (2011/2015)

On August 9, 2011, EPA and NHTSA announced a new national program to reduce GHG emissions and improve fuel economy for new medium- and heavy-duty engines and vehicles sold in the United States. EPA and NHTSA finalized a joint rule (Phase 1) that established a national program consisting of new standards for engines in model years 2014 through 2018, which would reduce CO_2 emissions by about 270 million metric tons and save about 530 million barrels of oil over the life of vehicles built for the 2014 to 2018 model years.

EPA and NHTSA are currently working on Phase 2 standards, which would reduce CO_2 emissions associated with model year 2018 and beyond.

3.8.2.2 State

California has adopted statewide legislation addressing various aspects of climate change, GHG mitigation, and energy efficiency. Much of this establishes a broad framework for the state's long-term GHG and energy reduction goals and climate change adaptation program. The former and current governors of California have also issued several Executive Orders (EOs) related to the state's evolving climate change policy. Summaries of key policies, EOs, regulations, and legislation at the state level that are relevant to the project are provided below.

Executive Orders S-03-05 (2005)

EO S-03-05 is designed to reduce California's GHG emissions to (1) 2000 levels by 2010, (2) 1990 levels by 2020, and (3) 80% below 1990 levels by 2050.

Executive Order B-16-2012 (2012)

EO B-16-2012 establishes benchmarks for reducing transportation-related GHG emissions. It requires agencies to implement the Plug-in Electric Vehicle Collaborative and California Fuel Cell Partnership by 2015 and sets forth targets specific to the transportation section, including the goal of reducing transportation-related GHG emissions to 80% less than 1990 levels.

Executive Order B-30-15 (2015)

EO B-30-15 established a medium-term goal for 2030 of reducing GHG emissions by 40% below 1990 levels and requires ARB to update its current Assembly Bill (AB) 32 Scoping Plan to identify the measures to meet the 2030 target. The executive order supports EO S-03-05, described above, but is currently only binding on state agencies. However, there are current (2015/2016) proposals (Senate Bill [SB] 32) at the state legislature to adopt a legislative target for 2030.

Senate Bill 350 (2015)

SB 350(De Leon, also known as the *Clean Energy and Pollution Reduction Act of 2015*) was approved by the California legislature in September 2015 and signed by Governor Brown in October 2015. Its key provisions are to require the following by 2030: (1) a renewables portfolio standard of 50% and (2) a doubling of efficiency for existing buildings.

Assembly Bill 1493, Pavley Rules (2002, Amendments 2009, 2012)

Known as Pavley I, AB 1493 provided the nation's first GHG standards for automobiles. AB 1493 required ARB to adopt vehicle standards that will lower GHG emissions from new light-duty autos to the maximum extent feasible beginning in 2009. Additional strengthening of the Pavley standards (referred to previously as *Pavley II* and now referred to as the *Advanced Clean Cars* [ACC] measure) was adopted for vehicle model years 2017–2025 in 2012. Together, the two standards are expected to increase average fuel economy to roughly 54.5 mpg in 2025.

Senate Bills 1078/107/X 1-2, Renewables Portfolio Standard and Renewable Energy Resources Act (2002, 2006, 2011)

SBs 1078 and 107, California's Renewables Portfolio Standard (RPS), obligated investor-owned utilities, energy service providers, and Community Choice Aggregations to procure an additional 1% of retail sales per year from eligible renewable sources until 20% is reached by 2010. The California Public Utilities Commission and CEC are jointly responsible for implementing the program. SB X 1-2, called the *California Renewable Energy Resources Act*, obligates all California electricity providers to obtain at least 33% of their energy from renewable resources by 2020. As of 2013, SDG&E's renewable procurement was 23.6%. As noted above, SB 350 increased the RPS to 50% for 2030.

Assembly Bill 32, California Global Warming Solutions Act (2006)

AB 32 codified the state's GHG emissions target by requiring California's global warming emissions to be reduced to 1990 levels by 2020. Since being adopted, ARB, CEC, the California Public Utilities Commission, and the California Building Standards Commission have been developing regulations that will help the state meet the goals of AB 32 and EO S-03-05. The scoping plan for AB 32 identifies specific measures to reduce GHG emissions to 1990 levels by 2020 and requires ARB and other state agencies to develop and enforce regulations and other initiatives to reduce GHG emissions. Specifically, the scoping plan articulates a key role for local governments by recommending that they establish GHG emissions-reduction goals for both their municipal operations and the community that are consistent with those of the state (i.e., approximately 15% below current levels) (California Air Resources Board 2008).

ARB re-evaluated its emissions forecast in light of the economic downturn and updated the projected 2020 emissions to 545 million metric tons of carbon dioxide equivalent ($MTCO_2e$). Two reduction measures (Pavley I and RPS [12–20%]) that were not previously included in the 2008 scoping plan baseline were incorporated into the updated baseline, further reducing the 2020 statewide emissions projection to 507 million $MTCO_2e$. The updated forecast of 507 million $MTCO_2e$ is referred to as the AB 32 2020 baseline. An estimated reduction of 80 million $MTCO_2e$ is necessary to lower statewide emissions to the AB 32 target of 427 million $MTCO_2e$ by 2020 (California Air Resources Board 2014).

ARB approved the *First Update to the Scoping Plan* on May 22, 2014 (California Air Resources Board 2014). The first update includes both a 2020 element and a post-2020 element. The 2020 element focuses on the state, regional, and local initiatives that are being implemented now to help the state meet the 2020 goal. ARB is currently working on a second update to the Scoping Plan to reflect the 2030 target established in EO B-30-15, noting that "California has already made great progress in driving the development of clean technologies thanks to programs developed under AB 32 and other important Legislation; the 2030 target will ensure that success continues beyond 2020" (California Air Resources Board 2015). ARB is expecting to present the final 2030 Target Scoping Plan to the board in the fall of 2016.

Executive Order S-01-07, Low Carbon Fuel Standard (2007)

EO S-01-07, the Low Carbon Fuel Standard (LCFS), mandates (1) that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020, with a reduction in the carbon content of fuel by 0.25% starting in 2011, and (2) that a low carbon fuel standard for transportation fuels be established in California. The EO initiates a research and regulatory process at ARB. The LCFS regulation does not apply to certain transportation applications, including locomotives and Ocean-Going Vessels (OGVs). Note that the majority of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS-related reductions are not included in this analysis of combustion-related emissions of CO_2.

Senate Bill 375—Sustainable Communities Strategy (2008)

SB 375 provides for a new planning process that coordinates land use planning, regional transportation plans (RTPs), and funding priorities in order to help California meet the GHG reduction goals established in AB 32. SB 375 requires RTPs, developed by metropolitan planning organizations, to incorporate a sustainable communities strategy (SCS). The goal of the SCS is to reduce regional vehicle miles traveled through land use planning and consequent transportation patterns. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit-oriented development.

The final reduction targets from ARB require the Metropolitan Transportation Commission/Association of Bay Area Governments (MTC/ABAG) to identify strategies to reduce per capita GHG emissions from passenger vehicles by approximately 7% by 2020 and 15% by 2035 over base year 2005. MTC/ABAG's *Plan Bay Area* details the land use and transportation planning strategies that MTC/ABA propose to reduce light duty/passenger *vehicle miles traveled (VMT*) emissions. *Plan Bay Area* was adopted in 2013 and an update is presently being prepared. Although MTC/ABAG have a transportation planning and funding role in helping to determine what regional transportation investments are made, local land use planning is still the prerogative of local governments.

Cap-and-Trade (2012)

On October 20, 2011, ARB adopted the final cap-and-trade program for California. The California cap-and-trade program is a market-based system with an overall emissions limit for affected sectors. Examples of affected entities include CO_2 suppliers, in-state electricity generators, hydrogen production, petroleum refining, and other large-scale manufacturers and fuel suppliers. The cap-and-trade program is currently regulating more than 85% of California's emissions. Compliance

requirements began according to the following schedule: (1) electricity generation and large industrial sources (2012) and (2) fuel combustion and transportation (2015). Cap-and-trade allowance auction proceeds are used to fund a variety of investments. The first 3-year investment plan prioritizes (1) sustainable communities and clean transportation (including low-carbon freight equipment with specific emphasis on efforts that would be beneficial for disadvantaged communities located near ports, railyards, freeways, and distribution centers), (2) energy efficiency and clean energy, and (3) natural resources and waste diversion. The second 3-year plan (fiscal years 2016–2017 through 2018–2019) was submitted to the Department of Finance in January 2016. Funds are administered through various state departments.

Senate Bill 97 (2007) and State CEQA Guidelines Sections 15064.4, 15126.4, 15183.5

In 2007, the California Legislature enacted SB 97, which required the Office of Planning and Research and the Natural Resources Agency to develop new statewide CEQA guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions" by January 1, 2010. The SB 97 CEQA guidelines do not set a GHG emissions significance threshold, and instead rely on lead agencies to set their own thresholds based on substantial evidence.

The SB 97 CEQA Guidelines require lead agencies to describe, calculate, or estimate the amount of GHG emissions that would result from a project. Moreover, the State CEQA Guidelines emphasize the necessity to determine potential climate change effects of a project and propose mitigation as necessary. They do not prescribe or recommend a specific analysis methodology or provide quantitative criteria for determining the significance of GHG emissions. However, the State CEQA Guidelines do confirm the discretion of lead agencies to determine appropriate significance thresholds, but require the preparation of an environmental impact report (EIR) if "there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with adopted regulations or requirements" (Section 15064.4).

State CEQA Guidelines Section 15126.4, adopted pursuant to SB 97, includes considerations for lead agencies related to feasible mitigation measures to reduce GHG emissions, which may include, among others, measures in an existing plan or mitigation program for the reduction of emissions that are required as part of the lead agency's decision; implementation of project features, project design, or other measures that are incorporated into the project to substantially reduce energy consumption or GHG emissions; offsite measures, including offsets that are not otherwise required, to mitigate a project's emissions; and measures that sequester carbon or carbon-equivalent emissions.

State CEQA Guidelines Section 15183.5 allows the GHG impacts of future projects to be evaluated using an adopted plan for reduction of GHG emissions. Section 15183.5 of the State CEQA Guidelines, which allows for tiering and streamlining the analysis of GHG emissions, is discussed in *Proposed Tiering of Future New Discretionary Development from the CAP* and this EIR under Section 3.8.3.2, *Significance Criteria*, below.

3.8.2.3 Regional and County

The County is part of two distinct air basins and air districts. The boundary between the air basins/districts runs roughly from the southwest corner of the County at Estero Americano,

northeasterly to the northeast corner of Sonoma County at its boundary with Lake and Napa County. The boundary between the two basins/districts crosses US 101 between Windsor and Healdsburg.

The northwestern portions of the County are part of the North Coast Air Basin, consisting of Del Norte, Humboldt, Trinity, Mendocino, and northern Sonoma County. This portion of the County is within the Northern Sonoma County Air Pollution Control District (NSCAPCD). The NSCAPCD is primarily rural and mountainous, containing only two urbanized areas—Healdsburg and Cloverdale. Southern Sonoma County is part of the nine-county San Francisco Bay Air Basin and the Bay Area Air Quality Management District (BAAQMD).

The BAAQMD and NSCAPCD are local air quality agencies responsible for preparing regional air quality plans under the state and federal Clean Air Acts. In addition to planning responsibilities, the local air district has permitting authority over stationary sources of pollutants. Authority over mobile sources of pollutants resides with the ARB.

North Sonoma County Air Pollution Control District Regulations

The NSCAPCD regulations follow the federal permitting for greenhouse gas emissions. A new stationary source or modification or an existing source must comply with an emission analysis and review process, including implementation of Best Available Control Technology for GHG emissions. An existing stationary source must include GHG emissions in its operating permit, as well as all applicable GHG requirements. If the owner or operator does not choose to comply with this rule, then the stationary source must not emit more than 50,000 tons of CO_2e in any 12-month period.

The regulations do not cover mobile sources. GHG emissions from mobile sources are regulated by the ARB.

Bay Area Air Quality Management District CEQA Guidelines

The BAAQMD's (2010) CEQA Guidelines outline advisory thresholds for stationary source and land use development projects. The mass emissions threshold for stationary source projects is 10,000 $MTCO_2e$ per year. For land use development projects, the guidelines establish three potential analysis criteria for determining project significance: compliance with a qualified climate action plan, a mass emissions threshold of 1,100 $MTCO_2e$ per year, a project-level GHG efficiency threshold of 4.6 $MTCO_2e$ per service population (project jobs + projected residents), and a plan-level GHG efficiency threshold of 6.6 $MTCO_2e$ per service population (project jobs + projected residents).

BAAQMD's resolution approving the 2010 CEQA Guidelines at the District's board level has been rescinded pursuant to court order, and to date the resolution has not been readopted. Nonetheless, that litigation does not involve the question of whether the BAAQMD 2010 CEQA Guidelines are supported by substantial evidence. The recent California Supreme Court decision in the *California Building Industry Assoc. v. Bay Area Air Quality Management District* (*BIA vs. BAAQMD*) case concerned whether CEQA applies to impacts of the environment on a project and is not relevant to the BAAQMD guidance regarding GHG emissions.

BAAQMD, like several other districts, looked to AB 32 for policy guidance in deriving a threshold for "cumulatively considerable" GHG impacts, and BAAQMD's approach takes the broad approach that a project's emissions should be deemed significant if they hinder compliance with the emissions reductions mandates found in AB 32. BAAQMD's derivation of numerical thresholds reflects its analysis and judgment regarding the quantities of emissions reductions from stationary sources and

new land use projects that would be consistent with that goal, given ARB's other Scoping Plan measures intended to reach AB 32's goals. In particular, BAAQMD estimated that a 23.9% reduction in GHG emissions could be expected from ARB's "land use driven" AB 32 Scoping Measures, leaving a "gap" of 2.3% in necessary additional GHG emissions reductions to meet AB 32 goals of a 26.2% reduction from statewide land use-driven emissions. BAAQMD estimated that a 2.3% reduction in BAAQMD's projected 2020 emissions projections requires emissions reductions of 1.6 million $MTCO_2e$ per year from the land-use-driven sectors, and used that number to derive a bright-line threshold for individual projects.

The guidelines do not identify a GHG emission threshold for construction-related emissions. However, BAAQMD recommends that GHG emissions from construction be quantified and disclosed, and that a determination regarding the significance of these GHG emissions be made with respect to whether a project is consistent with the AB 32 GHG emission reduction goals. BAAQMD further recommends that best management practices (BMPs) be incorporated to reduce GHG emissions during construction, as feasible and applicable. BMPs may include, but are not limited to, using alternative-fueled (e.g., biodiesel, electric) construction vehicles/equipment for at least 15% of the fleet, using at least 10% of local building materials, and recycling or reusing at least 50% of construction waste or demolition materials.

3.8.2.4 Local

Appendix C, *Local General Plan Goals, Objectives, and Policies*, provides a list of the goals, objectives, and policies in the local general plans of the participating jurisdictions including those related to GHG emissions. These goals, objectives, and policies were reviewed to assess whether the project is consistent with the general plans of participating jurisdictions. Disclosure of this consistency analysis is for informational purposes. An additional purpose of providing a list of relative local policies is, where appropriate, to provide the context within which the CAP will be locally implemented. As described in the CAP, most of the CAP measures represent implementation of many of the priorities outlined in existing local policies.

Inconsistencies with general plan policies are not necessarily considered significant impacts under CEQA unless they are related to physical impacts on the environment that are significant in their own right.

Implementation of the CAP is consistent with the applicable general plan goals, objectives, and policies of the participating jurisdictions in relation to GHG emissions.

3.8.3 Impacts Analysis

3.8.3.1 Methodology

The following analysis is based on a review of the greenhouse gas emissions information contained in the CAP. Effects related to greenhouse gas emissions are analyzed quantitatively, and the analysis focused on the CAP's potential to reduce GHG emissions in the County.

3.8.3.2 Significance Criteria

Approach to Significance Determination

The State CEQA Guidelines Appendix G (14 CCR 15000 et seq.) requires that agencies evaluate the significance of GHG emissions, and contains the following checklist questions.

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

The State CEQA Guidelines do not indicate what amount of GHG emissions would constitute a significant impact on the environment. Instead, they authorize the lead agency to consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence (State CEQA Guidelines Sections 15064.4(a) and 15064.7(c)). The California Supreme Court decision in the *Center for Biological Diversity et al. vs. California Department of Fish and Wildlife, the Newhall Land and Farming Company* (November 30, 2015, Case No. S217763) (hereafter *Newhall Ranch*) case confirmed that "multiple agencies' efforts at framing greenhouse gas significance issues have not yet coalesced into any widely accepted set of numerical significance thresholds." The Supreme Court also concluded the following.

> "Local governments thus bear the primary burden of evaluating a land use project's impact on greenhouse gas emissions. Some of this burden can be relieved by using geographically specific greenhouse gas emission reduction plans to provide a basis for the tiering or streamlining of project-level CEQA analysis."

A number of expert lead agencies throughout the state, including multiple air districts, have drafted and/or adopted varying threshold approaches and guidelines for analyzing GHG emissions and climate change in CEQA documents. The different thresholds include (1) compliance with a qualified GHG reduction strategy, (2) performance-based reductions, (3) numeric "bright-line" thresholds, and (4) efficiency-based thresholds. These approaches are commonly used and/or recommended by expert agencies, including the various air districts.

Newhall Ranch confirmed that when an "agency chooses to rely completely on a single quantitative method to justify a no-significance finding, CEQA demands the agency research and document the quantitative parameters essential to that method." All current CEQA GHG thresholds that are drafted, adopted, or recommended by expert agencies are based on AB 32's requirement to reduce statewide GHG emissions from both existing and new development to 1990 levels by 2020. Neither AB 32 nor the drafted, adopted, or recommended CEQA GHG thresholds address reduction targets beyond 2020. EO B-30-15 has set forth an interim reduction target to reduce GHG emissions by 40% below 1990 levels by 2030. To date, the Legislature has not concurred in that target, and there is no regulatory framework that directly translates state targets into either regionally specific reductions or project-level emissions thresholds. At present, there are also no proposed or adopted significance thresholds for analyzing post-2020 emissions for development projects in California and there is no adopted statewide plan to reduce emissions 40% below 1990 levels by 2030.

Given the scientific evidence that additional GHG reductions are needed through 2050 to stabilize CO_2 concentrations, the Association of Environmental Professionals Climate Change Committee recommended in its *Beyond 2020: The Challenge of Greenhouse Gas Reduction Planning by Local*

Governments in California white paper that CEQA analyses for most land use development projects continue to rely on current thresholds for the immediate future[1] but that general plans and long-term projects should consider "post-2020 emissions consistent with 'substantial progress' along a post-2020 reduction trajectory toward meeting the 2050 target." The *Beyond 2020* white paper further recommends that the "significance determination…should be based on consistency with 'substantial progress' along a post-2020 trajectory."

The purpose of the CAP is to reduce GHG emissions and the resulting decrease of GHG emissions is not a GHG impact. The basis of the CAP target is a set of policies that secure GHG reductions for Sonoma County overall that are consistent with the AB 32 Scoping Plan through 2020 and that are consistent with substantial progress after 2020 toward post-2020 reduction targets. Although the CAP will not directly result in any new emissions, there will continue to be GHG emissions in Sonoma County. As a matter of comparison, the Sonoma County emissions are compared to the BAAQMD plan-level efficiency target of 6.6 $MTCO_2e$/Service Population.

Proposed Tiering of Future New Discretionary Development from the CAP and this EIR

As discussed in Chapter 1 of the CAP, the cities of Cloverdale, Cotati, Healdsburg, Petaluma, Rohnert Park, Sebastopol, Sonoma, the Town of Windsor, and Sonoma County intend to use the CAP to comply with project-level GHG impact analysis requirements under CEQA. Santa Rosa will continue to use its adopted CAP for this purpose.

The State CEQA Guidelines (Section 15183.5) allow the GHG impacts of future projects to be evaluated using an adopted emissions reduction plan, like the CAP, provided that the plan meets specific requirements. The six requirements specified in the State CEQA Guidelines are listed below, with the CAP's compliance described in *italics*.

1. Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area. *The CAP quantifies GHG emissions from all primary sectors within County jurisdictions for 1990, 2010, 2015, 2020, 2040, 2030, and 2050*.
2. Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable. *The CAP establishes a countywide GHG emissions target of 25% below 1990 levels by 2020, a target that goes well beyond the requirements of AB 32 and puts Sonoma County on a trajectory to achieve the even greater GHG reductions needed in the future. The CAP includes a GHG emissions budget for new development that will ensure that the countywide reduction target is met, even with projected population and economic growth. The GHG reduction measures in the CAP will reduce project-specific emissions and thereby ensure that the new-development share of total future emissions is not exceeded. Reducing and limiting emissions from new development is part of an overall strategy that substantially reduces emissions countywide and, therefore, contributions from new development that is consistent with the CAP would not be cumulatively considerable.*
3. Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area. *The CAP analyzes community emissions for the partner*

[1] With the notable exception of the "percent below Business as Usual" approach that the Supreme Court called into question in the Newhall Ranch decision.

communities, including emissions from projected growth and development expected by 2020 and beyond.

4. Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level. *The CAP includes specific measures to achieve the overall reduction target*.
5. Establish a mechanism to monitor the plan's progress toward achieving the GHG emissions level and to require amendment if the plan is not achieving the specified level. *The CAP includes periodic monitoring of plan progress*.
6. Adopt the GHG emissions reduction plan in a public process following environmental review. *This draft EIR has been prepared for the CAP, and the CAP itself will be adopted first by the Regional Climate Protection Authority, followed by adoption of community-specific portions by each local participating jurisdiction. The adoption process will include public outreach and public hearings*.

Once the CAP is adopted, it may be used in the cumulative impacts analysis of later projects, a process known in CEQA as *tiering*. Tiering the GHG analysis from the CAP potentially eliminates the need to prepare a quantitative assessment of GHG emissions on a project-by-project basis, which can help streamline the environmental review and permitting process for these projects. To accomplish this, future project-specific environmental documents must identify all applicable CAP measures and ensure they are binding and enforceable by incorporating measures into the project design and/or identifying CAP measures as project mitigation measures. Future projects that comply with the CAP will have a less-than-significant cumulative impact on GHG emissions and climate change (unless substantial evidence warrants a more detailed review of project-level GHG emissions).

Impacts of Climate Change on Projects Within Sonoma County

The California Supreme Court has recently confirmed that "CEQA generally does not require an analysis of how existing environmental conditions will impact a project's future users or residents." However, an agency must "evaluate existing conditions in order to assess whether a project could exacerbate hazards that are already present." The effects of climate change, such as coastal flooding due to sea level rise, would not be considered as significant impacts under CEQA unless future projects "exacerbate" such physical effects.

3.8.3.3 Impacts and Mitigation Measures

Impact GHG-1: Implementation of the CAP would be consistent with and would support applicable plan, policy, and regulation adopted for the purpose of reducing GHG emissions (beneficial impact).

Sonoma County and all the participating jurisdictions have a GHG emissions reduction goal of 25% below 1990 levels by 2020. This is a far-more aggressive goal than the AB 32 target, which commits to reducing statewide GHG emissions to 1990 levels by 2020.

The County's 1990 backcast, 2010 inventory, and business as usual (BAU) forecast emissions for 2015, 2020, 2040, and 2050 are shown in Table 3.8-3 by major emission sector. The largest source of GHG emissions in 2010 is on-road transportation, followed by building energy. Future BAU

emissions are based on 2010 emissions, expected growth in population, employment, and households in the County.

Table 3.8-3. GHG Inventory and Forecast Results by Emission Sector and Year

Emission Sector	Emissions ($MTCO_2e$)					
	Backcast	Inventory	Forecasts			
	1990	2010	2015 BAU	2020 BAU	2040 BAU	2050 BAU
Building Energy	859,100	1,219,800	1,347,400	1,410,500	1,629,900	1,728,100
On-Road Transportation	1,203,400	1,899,300	2,183,400	2,349,500	2,661,500	2,749,400
Off-Road Equipment	42,900	62,500	68,500	77,300	121,600	126,600
Solid Waste Generation	281,200	133,600	224,900	235,900	285,100	305,700
Wastewater Treatment	14,900	14,500	13,400	13,600	14,800	15,500
Water Conveyance	26,600	3,500	13,000	13,600	17,000	18,400
Agriculture	415,100	325,700	309,600	294,800	234,100	203,700
Santa Rosa 1990 Emissions[1]	1,123,100	—	—	—	—	—
Sonoma County Total (*rounded*)	**3,966,000**	**3,659,000**	**4,160,000**	**4,395,000**	**4,964,000**	**5,147,000**

[1] Santa Rosa's emissions in 1990 are not available from the city's CAP; 1990 emissions were therefore assumed to be equal to 15% below the baseline level of emissions, per the city's CAP. As a result, sector emissions for Santa Rosa in 1990 are not available and are included as a separate line item.

Note: For more details on changes in emissions over time, please refer to Chapter 2 and Appendix B of the CAP.

The near-term focus of the CAP is on how Sonoma County communities will meet a local GHG-reduction target (25% below 1990 levels) in support of the state's goals for 2020 (as described above, the state's goal is to achieve 1990 levels by 2020). Sonoma County communities previously adopted targets to reduce emissions by 25% below 1990 levels by 2015, and actions inspired by those targets have led to significant progress. The County's 2010 emissions were already 8% below 1990 levels. However, projections for 2015 and 2020 reveal that emissions continue to rise and without further action Sonoma County communities will not meet their target.

The CAP describes the reduction measures that would be employed by the Sonoma County communities, through implementation of the CAP, and through a variety of state legislation and regulations. The combination of proposed new strategies identified in the CAP help to reduce the countywide GHG emissions level.

The GHG-reduction measures in the CAP would substantially reduce projected 2020 BAU forecast emissions. The CAP includes measures to address the resultant emissions from building energy, transportation and land use, solid waste generation, water conveyance and wastewater treatment, and livestock and fertilizer. The CAP also includes advanced climate initiatives that would protect and enhance the value of open and working lands, promote sustainable agriculture, increase carbon sequestrations, and educate residents about GHG emissions from the consumption of goods and services. Chapter 3 and Appendix B of the CAP contain detailed descriptions of the GHG-reduction measures.

Implementation of the CAP would result in GHG emissions reductions equivalent to approximately 25% reduction from 1990 baseline emissions, as shown in Table 3.8-4.

Table 3.8-4. Annual GHG Emissions Reductions from CAP Measures ($MTCO_2e$)

Parameter	**Emissions ($MTCO_2e$)**
1990 GHG Emissions Backcast (Baseline)	3,966,000
2020 BAU GHG Emissions Forecast	4,395,000
2020 Community Emissions Reduction Target (25% below 1990 levels)	2,974,500
Total[1] Reductions Needed to Reach Target	**1,420,500**
Total CAP Reductions (does not include Santa Rosa)	865,200
Santa Rosa CAP reductions	558,000
Total[2] County 2020 GHG Reductions	**1,423,200**
Emissions Reductions in Excess of Target (Total[2] – Total[1])	**2,800**
2020 GHG Emissions with CAP	*2,971,720*
AB 32 GHG Emissions Target (1990 level emissions)	*3,966,000*

Note: For additional details on methodology and calculations, please refer to Chapter 2, Chapter 3, and Appendix B of the CAP.

The CAP would be consistent with AB 32, as the GHG emissions for Sonoma County would experience approximately a 25% reduction below 1990 emissions by 2020, whereas the AB 32 target is to reach 1990 emissions levels by 2020. In addition, with CAP implementation, the County's emissions would be 5.8 $MTCO_2e$ per capita,[2] compared to the BAAQMD's recommended plan level threshold for consistency with AB 32 of 6.6 $MTCO_2e$ per capita.

In addition to the near-term emission reduction goal for 2020, the CAP also includes longer term goals of reducing emissions by 40% below 1990 levels by 2030 and by 80% below 1990 levels by 2050, which will necessitate another phase of local climate action after 2020. These long-term goals are intended to keep the County on track for meeting the goals of EO B-30-15 (40% below 1990 levels by 2030) and EO S-03-05 (80% below 1990 emissions by 2050). The CAP would help the County to achieve reductions that are approximately 80% of the way to the 2030 goal in EO-B-30-15. Another way to envision the CAP results is that it would provide reductions sufficient to keep the County on the trend toward the 2030 target up to 2026 (e.g., 80% of the way from 2020 to 2030 on a downward trajectory). As noted above, ARB is presently developing a Scoping Plan Update to identify the strategies necessary statewide to achieve the 2030 statewide goal. At some point after 2020, Sonoma County will need to update the CAP to evaluate the effect of new state actions and to identify the regional and local actions necessary to take the County out to 2030 and beyond.

The implementation of the CAP would meet and exceed state goals to reduce GHG emissions through 2020 and would place the County approximately 80% of the way to meeting 2030 goals. Thus, the CAP would have a beneficial impact on GHG emissions.

Impact GHG-2: Implementation of the CAP would help Sonoma County to be more resilient to the future effects of climate change on Sonoma County (disclosure item only; not a CEQA impact).

The CAP would help to reduce GHG emissions to contribute to cumulative reductions globally to help constrain the severity of changes in the climate in the long run. However, as described in the CAP, while mitigation can help make climate change less severe, changes cannot be avoided entirely.

[2] 2020 GHG Emissions with CAP / 2020 Projected Population = 2,971,720 MTCO2e / 509,766 people = 5.8 $MTCO_2e$ per capita.

Therefore, climate adaptation is a fundamental part of the County's overall climate action program and is discussed in Chapter 6 of the CAP.

There are several key vulnerabilities to climate change that can be broken into three categories: people and social systems, built systems, and natural and working lands. Hotter, drier weather with longer summers, more variable rain, and sea-level rise can each have prolonged effects on these categories. The CAP includes nine goals, listed in Table 3.8-5 below, which will help to increase the adaptive capacity of the community and make Sonoma County climate-ready.

The GHG-reduction measures described in the CAP each have a way of increasing the adaptive capacity of Sonoma County and its resources. In particular, measures in the building energy sector will help conserve energy and expand localized, renewable energy generation, both of which will reduce community reliance on the electrical grid. Because electricity transmission and distribution resources are vulnerable to several expected climate hazards, producing more energy locally will help minimize community disruptions during larger grid power failures. Similarly, measures in the transportation and land use sector will help reduce stress on the aging transportation network by increasing alternative modes of travel, such as walking, biking, and transit. GHG reduction measures in other sectors also provide various resiliency benefits, including water and resource conservation.

To ensure climate change adaptation is adequately incorporated into future planning efforts, the CAP includes measures to guide County and city staff involvement in coordinating, preparing for, and educating the public on the potential impacts that climate change may have on the community.

Table 3.8-5. Climate Change Adaptation Objectives

Goals	Opportunities	Climate Hazards Addressed
Promote healthy, safe communities	Invest in measures to increase community knowledge and capacity to respond and adapt to climate hazards, including improving baseline health, well-being, and financial security, especially in vulnerable populations. Link vulnerable populations to services that reduce safety, health, and financial risks related to climate hazards. Reduce non-climate economic and health stressors.	All hazards, especially those sensitive to demographic and economic changes
Protect water resources	Conserve and reuse water, protect and enhance groundwater recharge areas, capture storm- and flood water, protect streamside areas, invest in natural infrastructure. Reduce non-climate stressors such as hydro-modification, pollution, and overuse of water.	Drought, flooding, and infrastructure failure risks to water quantity and quality
Promote a sustainable, climate-resilient economy	Better define the economic risks of climate change. Communicate to businesses and the broader community about practices that contribute to climate resilience and how to implement them. Reduce non-climate stressors.	All hazards, especially those sensitive to demographic and economic changes
Mainstream the use of climate projections (not just past patterns) in planning, design, and budgeting	Educate and share information among government agencies. Create and promote guidelines for how to use climate information in planning and decision making.	All hazards, especially sea-level rise, drought, wildfire, and flooding

Goals	Opportunities	Climate Hazards Addressed
Protect coastal, bayside, and inland buffer zones	Protect, expand, and enhance wetlands, water source areas, fire management zones, and flood zones. Review/revise land management plans, development codes, parks plans, and prevention and response plans for floods and fires. Reduce non-climate stressors in these areas.	Sea-level rise, changing temperature and rain patterns, drought, wildfire
Promote food system security and agricultural climate preparedness	Promote peer-to-peer agricultural adaptation networking, including the potential to cultivate alternative crops or adopt new agricultural land management strategies. or adopt new agricultural land management strategies.	Changing temperature and rain patterns, drought, higher food prices
Protect infrastructure: buildings, energy systems, communications systems, water infrastructure, and transportation systems	Conduct a risk assessment by evaluating potential climate impacts on key infrastructure, buildings, and transit systems. Invest in strategies to ensure the long-term sustainability and reliability of energy resources or adopt new agricultural land management strategies.	Drought, flooding, wildfire, and extreme heat
Increase emergency preparedness	Support continued interagency emergency planning. Educate the public about climate hazards. Assess and address gaps in vulnerable populations' capacity to respond to extreme events. Reduce non-climate stressors such as forest health problems and provide adequate funding for emergency preparedness and response.	Public health and safety impacts of heat, flooding, and wildfire
Monitor the changing climate and its biophysical effects in real time	Measure actual conditions to validate and/or refine models of climate and climate change effects in order to plan and manage with better information.	All hazards

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