4.7 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

This chapter presents a summary of the current state of climate change science and greenhouse gas (GHG) emissions sources in California; a summary of applicable regulations; quantification of project-generated GHG emissions and discussion about their potential contribution to global climate change; and analysis of the project's resiliency to climate change-related risks.

No comments pertaining to GHG emissions were received during public review of the Notice of Preparation (NOP).

4.7.1 Regulatory Setting

FEDERAL

In *Massachusetts et al. v. Environmental Protection Agency et al.*, 549 U.S. 497 (2007), the U.S. Supreme Court ruled that carbon dioxide (CO_2) is an air pollutant as defined under the federal Clean Air Act and that the U.S. Environmental Protection Agency (EPA) has the authority to regulate GHG emissions.

In 2010, EPA started to address GHG emissions from stationary sources through its New Source Review permitting program, including operating permits for "major sources" issued under Title V of the federal Clean Air Act.

In October 2012, EPA and the National Highway Traffic Safety Administration, on behalf of the U.S. Department of Transportation, issued final rules to further reduce GHG emissions and improve corporate average fuel economy (CAFE) standards for light-duty vehicles for model years 2017 and beyond (77 *Federal Register* [FR] 62624). These rules would increase fuel economy to the equivalent of 54.5 miles per gallon, limiting vehicle emissions to 163 grams of CO_2 per mile for the fleet of cars and light-duty trucks by model year 2025 (77 FR 62630). However, on April 2, 2018, the EPA administrator announced a final determination that the current standards are not appropriate and should be revised. The Safer Affordable Fuel Efficient (SAFE) Vehicles Proposed Rule for Model Years 2021–2026 has been proposed and would freeze the CAFE standards from 2021 to 2026. It is not yet known if the SAFE Rule will be adopted or when they will be implemented (EPA 2018a).

In 2015, EPA unveiled the Clean Power Plan. The purpose of the plan was to reduce CO_2 emissions from electrical power generation by 32 percent relative to 2005 levels within 25 years. EPA is proposing to repeal the Clean Power Plan because of a change to the legal interpretation of Section 111(d) of the federal Clean Air Act, on which the Clean Power Plan was based. The comment period on the proposed repeal closed April 26, 2018.

On March 12, 1996, EPA promulgated a regulation requiring emissions controls for large municipal solid waste (MSW) landfills (61 FR 9905). The regulation is titled "Standards of Performance for Stationary Sources and Guidelines for Control of Existing Sources: MSW Landfills." It includes both New Source Performance Standards (NSPS) that regulate emissions from new landfills and Emission Guidelines that regulate emissions from existing landfills. On August 29, 2016, EPA finalized a new subpart under Section 111(b) of the Clean Air Act to apply NSPS to landfills that commenced construction, reconstruction, or modification after July 17, 2014. The California Air Resources Board (CARB) is required to submit a State Plan for Compliance to EPA.

In March 2000, in response to environmental justice concerns for siting waste transfer and landfill locations EPA published *A Regulatory Standard for Siting and Operating Waste Transfer Stations* (EPA 2000). These regulations include guidance for landfill siting through setting location restrictions to ensure that landfills are built in suitable geological and topographic locations to reduce impacts on residents and other sensitive receptors, and the environment.

Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

EPA published these guidelines to reduce both methane and non-methane organic compound (NMOC) emissions from existing municipal solid waste (MSW) landfills (81 Fed. Reg. 59275 [Aug. 29, 2019]). The guidelines apply to

"existing" MSW landfills that commenced construction, modification, or reconstruction before July 17, 2014, and that have accepted waste at any time since November 8, 1987 or have additional capacity for future waste acceptance. The guidelines require the installation of a landfill gas collection and control system at larger MSW landfills that exceed a specified design capacity and NMOC emission threshold. The guidelines require that each state submit a plan to EPA that identifies how the state intends to meet the federal requirements contained in the guidelines. Further information regarding California's State Plan to implement the Guidelines is presented below. It was developed by the California Air Resources Board (CARB) with the assistance of the air quality management and air pollution control districts and others working together as an ad hoc Landfill 111(d) Workgroup.

Greenhouse Gas Emissions and Fuel Efficiency

In September 2011, EPA, in coordination with the National Highway Traffic Safety Administration (NHTSA), adopted fuel consumption and CO_2 emission standards to reduce GHG emissions of heavy-duty vehicles. These Phase 1 federal standards apply to model year 2014 and newer heavy-duty trucks, tractors, pick-up trucks, vans, and vocational vehicles. The category of specialized vocational vehicles includes delivery trucks, emergency vehicles, and refuse trucks such as the "packer" garbage collection trucks used to transport solid waste to transfer stations and landfills. The Phase 1 regulations do not include standards regarding the trailers pulled by these vehicles for improving aerodynamics and fuel efficiency.

In 2016, working together with NHTSA and CARB, EPA implemented the next phase of federal greenhouse gas (GHG) emissions and fuel-efficiency standards for medium- and heavy-duty vehicles and associated trailers. These federal Phase 2 standards build on the improvements in engine and vehicle efficiency required by the Phase 1 emission standards and aim to achieve further GHG reductions for 2018 and later model year heavy-duty vehicles. The progressively more stringent federal Phase 2 standards are more technology-driven than the Phase 1 standards, in that they require manufacturers to improve existing technologies or develop new technologies for heavy-duty trucks, tractors, and vocational vehicles to achieve the stricter standards. The Phase 2 federal standards were jointly adopted by the U.S. EPA and NHTSA on October 25, 2016. California subsequently enacted its own Phase 2 standards for GHG emissions, which are discussed in further detail below.

STATE

Statewide GHG Emission Targets and the Climate Change Scoping Plan

Reducing GHG emissions in California has been the focus of the State for approximately two decades (State of California 2018). GHG emission targets established by the legislature include reducing statewide GHG emissions to 1990 levels by 2020 (AB 32 of 2006) and reducing them to 40 percent below 1990 levels by 2030 (Senate Bill [SB] 32 of 2016). Executive Order S-3-05 calls for statewide GHG emissions to be reduced to 80 percent below 1990 levels by 2050. Executive Order B-55-18 directs California to achieve carbon neutrality by 2045 and achieve and maintain net negative GHG emissions thereafter. These targets are in line with the scientifically established levels needed in the U.S. to limit the rise in global temperature to no more than two degrees Celsius, the warming threshold at which major climate disruptions, such as super droughts and rising sea levels, are projected; these targets also pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius (United Nations 2015:3).

California's 2017 Climate Change Scoping Plan (2017 Scoping Plan), prepared by CARB, outlines the main strategies California will implement to achieve the legislated GHG emission target for 2030 and "substantially advance toward our 2050 climate goals" (CARB 2017a:1, 3, 5, 20, 25–26). It identifies the reductions needed by each GHG emission sector (e.g., transportation, industry, electricity generation, agriculture, commercial and residential, pollutants with high global warming potential [GWP], and recycling and waste). CARB and other state agencies also released the *2030 Draft Natural and Working Lands Climate Change Implementation Plan* consistent with the carbon neutrality goal of Executive Order B-55-18. The Plan furthers the state's goals through improving the carbon sequestration potential of the state's natural and working lands through improved soil health and forest management strategies.

The State has also passed more detailed legislation addressing GHG emissions associated with industrial sources, transportation, electricity generation, energy consumption, and solid waste generation and diversion, as summarized below.

Short-Lived Climate Pollutant Reduction Strategy

In March 2017, CARB adopted the SLCP Strategy pursuant to Senate Bill (SB) 605 (Lara, Chapter 523, Statutes of 2014) and SB 1383. SLCPs have high GWP values, which is the measure of how much heat a GHG traps in the atmosphere during a specific time horizon relative to CO_2. The *SLCP Strategy* is recognized in CARB's 2017 Scoping Plan as an important measure for achieving statewide GHG emission targets (CARB 2017a:3). The *SLCP Strategy* identifies methane, fluorinated gases, and black carbon as SLCPs of concern, and provides a suite of strategies to reduce emissions of these pollutants. The *SCLP Strategy* includes targets to achieve a 50 percent reduction strategy in the level of statewide disposal of organic waste from the 2014 level by 2020 and a 75 percent reduction in the level of statewide disposal of organic waste from the 2014 level by 2025 (CARB 2017b). The law requires CalRecycle, in consultation with CARB, to adopt regulations for achieving these targets. Additional goals include converting manure and organic wastes to energy and soil amendment products, reducing the disposal of edible food by increasing food recovery, reducing emissions from residential wood stoves, and phasing out the use of fluorinated gases (CARB 2017a). CalRecycle began conducting the rulemaking and regulation process in 2017 and plans to adopt rules in 2019. These rules would not take effect until 2022, but would require jurisdictions, haulers, and generators to consider taking actions to implement programs to comply with these rules on January 1, 2022 (CalRecycle 2018a).

Landfill Methane Control Measures

The capture and control of methane from landfills was part of discrete early action measure in CARB's first Scoping Plan (CARB 2017a:89). CARB approved the Landfill Methane Control Measure in June 2010, with updates as recent as April 2017. This regulation reduces emissions of methane from municipal solid waste landfills in response to Assembly Bill (AB) 32. The regulation requires owners and operators of municipal solid waste landfills to install gas collection and control systems and requires existing and newly installed gas and control systems to operate in an optimal manner. The regulation is overseen by CARB, with enforcement authority granted to local air districts through a memorandum of understanding (MOU).

In May 2017, CARB adopted the California State Plan for Municipal Solid Waste Landfills to implement the federal reporting and emissions compliance requirements of EPA's Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills (summarized above). The plan includes emission standards and compliance target dates, procedures used for determining compliance with the emissions standards, legally enforceable increments of progress towards compliance, source and emission inventories of designated facilities, and provisions for annual emission reporting and progress reports, and a description of public participation in implementation. Throughout the plan, CARB developed MOUs between CARB and air districts across the state regarding implementation and enforcement of regulation to reduce methane emissions from municipal solid waste landfills (CARB 2017c:8).

Solid Waste Diversion Regulations

In 2011, the legislature established a 75 percent statewide solid waste recycling rate goal by 2020 with its passage of AB 341 (Chesboro, Chapter 476, Statutes of 2011). AB 341 directed CalRecycle to develop a strategy to achieve this 75 percent recycling goal. In response, CalRecycle developed the *75 Percent Strategy* which includes five strategies and three additional focus areas for its pursuit to achieve the recycling goal. Strategies include moving organics out of the landfill; expanding the recycling/manufacturing infrastructure; exploring new models for state and local funding of materials management program; promoting state procurement of postconsumer recycle content products; and promoting extended producer responsibility (CalRecycle 2018a). CalRecycle has provided updates to this strategy along with supporting documentation as recently as 2017, which tracks progress towards this goal and summarizes co-benefits from implementation of the *75 Percent Strategy*.

In October 2014, the governor signed AB 1826 (Chesbro Chapter 727, Statues of 2014), requiring local jurisdictions to implement an organic waste recycling program to divert organic waste generated by businesses. The law phases in the mandatory recycling of commercial organics over time. In 2020, CalRecycle is mandated to conduct a formal

review of all jurisdictions to determine the total statewide disposal of organic waste. If CalRecycle finds that the statewide disposal of organic waste has not been reduced by 50 percent of the disposal level in 2014, the requirements of this law will expand, and certain exemptions may be removed (CalRecycle 2018b).

In September 2016, the governor signed SB 1383 (Lara, Chapter 395, Statutes of 2016) establishing methane emissions reduction targets as part of a statewide effort to reduce emissions of short-lived climate pollutants (SLCPs).

CARB's 2017 Scoping Plan acknowledges that greater waste diversion from landfills as a key measure for achieving statewide GHG emission targets (CARB 2017a:5, 89–90).

California Sustainable Freight Action Plan

The California Sustainable Freight Action Plan strives to improve the efficiency of freight transport in California, including the GHG efficiency (California Department of Transportation et al. 2016:5-6). As recognized in the Scoping Plan, the California Sustainable Freight Action Plan is intended to improve freight system efficiency and help the state transition to zero and near-zero emission technologies. The California Sustainable Freight Action Plan is recognized in CARB's 2017 Scoping Plan as a key measure for achieving statewide GHG emission targets (CARB 2017a:25).

California Phase 2 Standards for the Federal GHG Emissions and Fuel Efficiency Requirements for Medium- and Heavy-Duty Engines and Vehicles

After EPA enacted its Phase 2 Standards for medium- and heavy-duty engines, as discussed in the federal regulatory setting above, California enacted its own Phase 2 standards for GHG emissions that align closely with the federal Phase 2 standards except for minor differences. California's Phase 2 standards were officially approved by CARB in February 2018, with the California Office of Administrative Law giving its final approval in February 2019. The California Phase 2 standards became effective April 1, 2019. Reductions in GHGs from California's Phase 2 standards are recognized in CARB's 2017 Scoping Plan (CARB 2017a:25).

Low Carbon Fuel Standard

The Low Carbon Fuel Standard is recognized in CARB's 2017 Scoping Plan as a key regulation for achieving statewide GHG emission targets (CARB 2017a:25). In January 2007, EO S-01-07 established a Low Carbon Fuel Standard (LCFS). The EO calls for a statewide goal to be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020, and that a LCFS for transportation fuels be established for California. The LCSF applies to all refiners, blenders, producers, or importers ("Providers") of transportation fuels in California, including fuels used by off-road construction equipment (Wade, pers. comm., 2017). The LCFS is measured on the total fuel cycle and may be met through market-based methods (e.g., providers exceeding the performance required by an LCFS receive credits that may be applied to future obligations or traded to Providers not meeting LCFS).

In June 2007, CARB adopted the LCFS as a Discrete Early Action item under AB 32 pursuant to Health and Safety Code Section 38560.5, and in April 2009, CARB approved the new rules and carbon intensity reference values with new regulatory requirements taking effect in January 2011. The standards require providers of transportation fuels to report on the mix of fuels they provide and demonstrate they meet the LCFS intensity standards annually. This is accomplished by ensuring that the number of "credits" earned by providing fuels with a lower carbon intensity than the established baseline (or obtained from another party) is equal to or greater than the "deficits" earned from selling higher intensity fuels.

After some disputes in the courts, CARB re-adopted the LCFS regulation in September 2015, and the LCFS went into effect on January 1, 2016.

Renewable Electricity Generation Targets

The State has passed legislation requiring the increasing use of renewables to produce electricity for consumers. California utilities are required to generate 33 percent of their electricity from renewables by 2020 (SB X1-2 of 2011); 52 percent by 2027 (SB 100 of 2018); 60 percent by 2030 (also SB 100 of 2018); and 100 percent by 2045 (also SB 100 of 2018). These regulations are recognized in CARB's 2017 Scoping Plan as critical to achieving statewide GHG emission targets (CARB 2017a:25).

LOCAL

Solano County General Plan

The Solano County General Plan contains the following goals, objectives, and policies that could be applicable to the project (Solano County 2008):

- PF.G-1: Provide adequate public services and facilities to accommodate the level of development planned by the County.
  - PF.P-25: Collaborate with the state, regional, and city agencies and landfill operators to ensure that the capacity of available landfills is sufficient. Prioritize capacity for waste generated within the County. Ensure that programs are designed to meet or exceed state requirements for landfill capacities.
  - PF.P-26: Implement and participate in local and regional programs that encourage source reduction and recycling of solid and hazardous wastes in Solano County.
  - PF.P-27: Require responsible waste management practices, including recycling and composting. Coordinate with service providers to compost green waste and encourage local farmers to use this.
  - PF.P-28: Promote technologies that allow the use and reuse of solid waste, including biomass or biofuel as an alternative energy source.

Solano County Climate Action Plan

The County's General Plan, adopted in 2008, required the County to develop a Climate Action Plan and accompanying Sea Level Rise Strategic Program in through Program HS-1.73. The County's Climate Action Plan was adopted in June 2011 and includes countywide GHG inventory and projections for a baseline year of 2005. In 2005 transportation-related activities contributed to approximately 51 percent of the countywide emissions. Electricity and natural gas consumption contributed 22 percent of the emissions. Agricultural operations made up approximately 21 percent of the inventory, the water sector contributed approximately four percent, and the waste sector accounted for approximately two percent. In compliance with the Scoping Plan, Solano County set a target to reduce countywide GHG emissions by 20 percent below 2005 baseline emission levels by 2020 (Solano County 2011). While this target aligns with the statewide target mandated by AB 32 of 2006 (i.e., reduce statewide emissions to 1990 levels by 2020), the Climate Action Plan has not been updated to establish a countywide target that is aligned with the statewide target mandated by SB 32 of 2016 (i.e., 40 percent below 1990 levels by 2030).

The County's Climate Action Plan sets for measures and actions that, along with State policies, would reduce countywide emissions to meet the 2020 target. Specific measures related to solid waste include:

- Measure E-5: Work with CalRecycle, Bay Area waste agencies, other jurisdictions, and interested private sector parties to develop an agricultural and food waste-to-energy biomass facility in Solano County.
- Measure W-1: Work with the Local Task Force and other organizations to create a zero-waste plan and provide public education regarding zero-waste strategies and implementation.
- Measure W-2: Adopt a Construction and Demolition Ordinance to require 65 percent of construction and demolition debris to be recycled or reused by 2020.
- Measure W-4: Facilitate CalRecycle and CARB's implementation of the Landfill Methane Capture Strategy by requiring landfills to capture methane to the greatest extent feasible.

Solano County Integrated Waste Management Plan

The Solano County Integrated Waste Management Plan was developed pursuant to AB 75, which required each state agency and large state facility to develop such a plan. The following policy in the plan is relevant to the project and climate change:

- Transform the current system of producing, consuming, and disposing of material goods to a new system that conserves natural resources and landfill capacity, and that is sustainable for present and future generates. This

new system shall place the greatest emphasis on reducing the generation of solid waste at the source of generation; secondary emphasis on recycling or composting the maximum feasible amount of that solid waste that is generated; and, finally, disposing of the residue that cannot be reduced, recycled or composted in sanitary landfills that meet current regulatory design criteria for environmental protection.

Yolo-Solano Air Quality Management District Plans and Programs

The Yolo-Solano Air Quality Management District (YSAQMD) maintains a climate protection program for the purposes of analyzing climate change impacts as it pertains to CEQA. YSAQMD is in the process of integrating climate protection plans and programs into existing grant programs, CEQA review, and regulations. YSAQMD recommends that impacts to climate change be evaluated for every CEQA project; however, at the time this Subsequent Environmental Impact Report (SEIR) was prepared, no climate change regulations have been adopted for use at a local level.

4.7.2 Environmental Setting

PHYSICAL SCIENTIFIC BASIS OF GREENHOUSE GAS AND CLIMATE CHANGE

Certain gases in the earth's atmosphere, classified as GHGs, play a critical role in determining the earth's surface temperature. Solar radiation enters the atmosphere from space. A portion of the radiation is absorbed by the earth's surface, and a smaller portion of this radiation is reflected toward space. The absorbed radiation is then emitted from the earth as low-frequency infrared radiation. The frequencies at which bodies emit radiation are proportional to temperature. The earth has a much lower temperature than the sun; therefore, the earth emits lower frequency radiation. Most solar radiation passes through GHGs; however, infrared radiation is absorbed by these gases. As a result, radiation that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on earth.

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Human-generated emissions of these GHGs in excess of natural ambient concentrations are found to be responsible for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth's climate, known as global climate change or global warming. Per the Intergovernmental Panel on Climate Change (IPCC), it is "extremely likely" that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropomorphic increase in GHG concentrations and other anthropomorphic forcing (IPCC 2014:5). This warming is observable considering the 20 hottest years ever recorded occurred within the past thirty years (McKibben 2018). Additionally, the hottest June ever recorded happened in 2019 (Duncan 2019).

Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern. Whereas most pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately one day), GHGs have long atmospheric lifetimes (one year to several thousand years). GHGs persist in the atmosphere long enough to be dispersed around the globe. Although the lifetime of any GHG molecule depends on multiple variables and cannot be determined with perfect certainty, it is understood that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO_2 emissions, approximately 55 percent are estimated to be sequestered through ocean and land uptake every year, averaged over the last 50 years, whereas the remaining 45 percent of human-caused CO_2 emissions remain stored in the atmosphere (IPCC 2013:467).

The quantity of GHGs in the atmosphere responsible for climate change is not precisely known, but it is enormous. No single project alone would measurably contribute to an incremental change in the global average temperature or to global or local climates or microclimates. From the standpoint of CEQA, GHG impacts relative to global climate change are inherently cumulative.

GREENHOUSE GAS EMISSION SOURCES AND SINKS

As discussed previously, GHG emissions are attributable in large part to human activities. CO_2 is the main byproduct of fossil fuel combustion. Methane, a highly potent GHG, primarily results from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions) and is largely associated with agricultural practices (e.g., cattle and other ruminants), hydraulic fracturing, organic material decomposition in landfills, and the burning of forest fires (Black et al. 2017). Nitrous oxide emissions are largely attributable to agricultural practices and soil management. CO_2 sinks, or reservoirs, include vegetation and the ocean, which absorb CO_2 through sequestration and dissolution (CO_2 dissolving into the water); respectively, these are the two of the most common processes for removing CO_2 from the atmosphere.

The total GHG inventory for California in 2016 was 429 million metric tons of CO_2 equivalents ($MMTCO_2e$) (CARB 2018a). This is less than the 2020 target established by Assembly Bill 32 (discussed in Section 4.7.2, "Regulatory Setting") of 431 $MMTCO_2e$ equal to the inventory for 1990 (CARB 2018b:1). Table 4.7-1 summarizes the statewide GHG inventory for California.

Table 4.7-1 Statewide GHG Emissions by Economic Sector

Sector	$MMTCO_2e$ (Percent)
Transportation	176 (41)
Industrial	99 (23)
Electricity generation (in state)	43 (10)
Electricity generation (imports)	26 (6)
Agriculture	34 (8)
Residential	30 (7)
Commercial	21 (5)
Not specified	1 (<1)

Notes: $MMTCO_2e$ = million metric tons of carbon dioxide equivalent

Source: CARB 2018a

EFFECTS OF CLIMATE CHANGE ON THE ENVIRONMENT

According to the IPCC, which was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme, global average temperature will increase by 1.5 degrees Celsius (°C) (2.7 degrees Fahrenheit [°F]) by 2040. This 1.5 °C warming represents a global average indicating that portions of the earth will experience more dramatic warming than others. Oceans, which support high specific heat, will experience less dramatic warming as compared to continents, particularly in inland regions.

According to *California's Fourth Climate Change Assessment*, if global GHGs are reduced at a moderate rate, California will experience average daily high temperatures that are warmer than the historic average by 2.5 °F from 2006 to 2039, by 4.4 °F from 2040 to 2069, and by 5.6 °F from 2070 to 2100; and if GHG emissions continue at current rates then California will experience average daily high temperatures that are warmer than the historic average by 2.7 °F from 2006 to 2039, by 5.8 °F from 2040 to 2069, and by 8.8 °F from 2070 to 2100 (OPR et al. 2019:23). The potential effects of this warming in California are well documented.

Since its previous climate change assessment in 2012, California has experienced several of the most extreme natural events in its recorded history: a severe drought from 2012–2016, an almost non-existent Sierra Nevada winter snowpack in 2014-2015, increasingly large and severe wildfires, and back-to-back years of the warmest average temperatures (OPR et al. 2019:56). According to the California Natural Resources Agency's (CNRA's) *Safeguarding California Plan: 2018 Update*, California experienced the driest 4-year statewide precipitation on record from 2012

through 2015; the warmest years on average in 2014, 2015, and 2016; and the smallest and second smallest Sierra snowpack on record in 2015 and 2014 (CNRA 2018:55). In contrast, the northern Sierra Nevada experienced its wettest year on record during the 2016–2017 water year (CNRA 2018:64). The changes in precipitation exacerbate wildfires throughout California through a cycle of high vegetative growth coupled with dry, hot periods which lowers the moisture content of fuel loads. As a result, the frequency, size, and devastation of forest fires increases. In November 2018, the Camp Fire completely destroyed the town of Paradise in Butte County and caused 85 fatalities, becoming the state's deadliest fire in recorded history. Moreover, changes in the intensity of precipitation events following wildfires can also result in devastating landslides. In January 2018 following the Thomas Fire, 0.5 inches of rain fell over just 5 minutes in Santa Barbara causing destructive mudslides formed from the debris and loose soil left behind by the fire. These mudslides resulted in 21 deaths.

As temperatures increase, the amount of precipitation falling as rain rather than snow also increases, which could lead to increased flooding because water that would normally be held in the snowpack of the Sierra Nevada and Cascade Range until spring would flow into the Central Valley during winter rainstorm events. This scenario would place more pressure on California's levee/flood control system (CNRA 2018:190–192).

Temperature increases and changes to historical precipitation patterns will likely affect ecologically productivity. Existing habitats may migrate from climatic changes where possible, and those that lack the ability to retreat will be severely threatened. Altered climatic conditions dramatically endangers the survival of arthropods which could have cascading effects throughout ecosystems (Lister and Garcia 2018). Conversely, a warming climate may support the populations of other insects such as ticks and mosquitos, which transmit diseases harmful to human health such as the Zika virus, West Nile virus, and Lyme disease (European Commission Joint Research Centre 2018).

Changes in temperature, precipitation patterns, extreme weather events, wildfires, and sea-level rise have the potential to threaten transportation and energy infrastructure, crop production, forests and rangelands, and public health (CNRA 2018:64, 116–117, 127; OPR 2019:63). The effects of climate change will also have an indirect adverse impact on the economy as more severe natural disasters cause expensive, physical damage to communities and the state.

Additionally, adjusting to the physical changes associated with climate change can produce mental health impacts such as depression and anxiety.

Cal-Adapt is a climate change scenario planning tool developed by the California Energy Commission (CEC) that downscales global climate model data to local and regional resolution under two emissions scenarios. The Representative Concentration Pathway (RCP) 8.5 scenario represents a business-as-usual future emissions scenario, and the RCP 4.5 scenario represents a future with reduced GHG emissions.

The project area experienced an annual average high temperature of 74.8°F between 1961 and 1990. Under the RCP 4.5 scenario, the project area's annual average high temperature is projected to increase by 5.3°F to 80.1°F by 2050 and increase an additional 0.3°F to 80.4°F by 2099 (Cal-Adapt 2019). Under the RCP 8.5 scenario, the project area's annual average high temperature is similarly projected to increase by 5.3°F to 80.1°F by 2050 and increase an additional 5.0°F to 85.1°F by 2099 (Cal-Adapt 2019). Average annual minimum temperatures are expected to rise within a similar range.

The project area experienced an average precipitation of 17.7 inches per year between 1961 and 1990. Under the RCP 4.5 scenario, the county is projected to experience an increase of 11.3 inches to 29.0 inches per year by 2050 and decrease to 21.2 inches per year by 2099 (Cal-Adapt 2019). Under the RCP 8.5 scenario, the project area is projected to experience an increase of 10.9 inches to 28.6 inches per year by 2050 and decrease to 27.3 inches per year by 2099 (Cal-Adapt 2019).

4.7.3 Environmental Impacts and Mitigation Measures

METHODOLOGY

The evaluation of project-related GHG emissions is based on information provide as part of an Air Quality Impact Assessment prepared by SCS Engineers (SCS Engineers 2019) and supplemental calculations. The Air Quality Impact Assessment is provided in Appendix D. The supplemental emissions calculations are provided in Appendix E.

Construction-related emissions of GHGs were calculated using the California Emissions Estimator Model (CalEEMod) Version 2016.3.2 computer program (CAPCOA 2016). CalEEMod was used to calculate emissions generated during the construction phase of the project. Modeling was based on project-specific information (e.g., schedule, area of disturbance), where available, and default values in CalEEMod that are based on the project's location, land use type, and type of construction activity. Specific CalEEMod modeling inputs and assumptions can be found in the Air Quality Impact Assessment in Appendix D.

GHG emissions associated with the storage and decomposition of solid waste at the Recology Hay Road (RHR) Landfill were estimated using the Landfill Gas Emissions Model (LandGEM), developed and maintained by the EPA (EPA 2005). Emissions generated by the additional solid waste decomposition were calculated by comparing the estimated emissions generated by existing operations to the estimated emissions generated by the existing landfill plus additional waste accepted as a result of the project. The modeling inputs are provided in Appendices C and D of the Air Quality Impact Assessment (SCS Engineers 2019), which is provided in Appendix D of this Draft SEIR.

Operational mobile-source GHG emissions were estimated using project-specific information, where available, and default values in CARB's Emission Factor Web Database, version 1.0.2 (EMFAC2017) (CARB 2017d) based on the project's location and land use characteristics. Mobile-source emissions were estimated using the number of project-generated vehicle trips provided by the traffic analysis used to support Section 4.11, "Transportation and Circulation" (KD Anderson 2018:14), which is provided in Appendix G. Operational emissions from all sources were estimated, and detailed model assumptions and inputs for these calculations can be found in Appendix E.

The project's consistency with adopted plans, and policies aimed at reducing GHG emissions, including CARB's 2017 Scoping Plan, is assessed qualitatively based on applicable regulations.

THRESHOLDS OF SIGNIFICANCE

Because the issue of global climate change is inherently a cumulative issue, the contribution of project-related GHG emissions to climate change is addressed as a cumulative impact.

State CEQA Guidelines Section 15064 and Appendix G recommend that a lead agency consider a project's consistency with relevant, adopted plans, and discuss any inconsistencies with applicable regional plans, including plans to reduce GHG emissions. Under Appendix G of the State CEQA Guidelines, implementation of a project would result in a cumulatively considerable contribution to climate change if it would:

- generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, or
- conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.

In California, some counties, cities, and air districts have developed guidance and thresholds for determining the significance of GHG emissions that occur within their jurisdiction. Solano County is the CEQA lead agency for the project and is, therefore, responsible for determining whether project-related GHG emissions would be a cumulatively considerable contribution to climate change.

At the time of writing this SEIR, Solano County and YSAQMD do not have recommended thresholds or approaches for evaluating a project's GHG emissions. CARB has suggested that "[l]ead agencies have the discretion to develop evidence-based numeric thresholds consistent with the 2017 Scoping Plan, the State's long-term GHG goals, and

climate change science." Solano County has developed a Climate Action Plan which sets GHG reduction targets consistent with state GHG reduction policies for the year 2020. However, the County has not established quantitative thresholds applicable to a project-specific analysis. The County's Climate Action Plan includes numerous measures and actions that would help reduce countywide emissions to meet the identified 2020 target, which is aligned with the statewide target mandated by AB 32 of 2006 (i.e., reduce statewide emissions to 1990 levels by 2020). However, the County's Climate Action Plan has not been updated to establish a countywide target that is aligned with the statewide target mandated by SB 32 of 2016 (i.e., 40 percent below 1990 levels by 2030). For this reason, this analysis examines whether the project would conflict with CARB's 2017 Scoping Plan.

PROJECT IMPACTS AND MITIGATION MEASURES

Impact 4.7-1: Generation of Greenhouse Gas Emissions and Consistency with GHG Reduction Targets/Plan

The project would result in increased GHG emissions contained in landfill gas and increased GHG emissions generated by truck hauling. All the GHG-emitting activities that would operate with the project are subject to regulations developed for the purpose of reducing GHG emissions and/or are consistent with GHG reduction policies identified in CARB's 2017 Scoping Plan to help California meet its statewide GHG emission targets. Therefore, the project would not conflict with any applicable plan, policy or regulation adopted for the purpose of reducing GHG emissions. Because the RHR Landfill is both infrastructure and an accessory land use that receives waste generated by residential and commercial land uses throughout the Bay Area and Sacramento Region, thereby supporting a large population and a large quantity of economic activity, its emissions of GHGs would not be substantial. For these reasons, project-related GHG emissions would not result in a cumulatively considerable contribution to climate change and this impact would be **less than significant**.

Because the County and YSAQMD have not developed guidance or a threshold for quantifying a project's GHG emissions, and because, at the time of writing this SEIR, none of the air districts in California have developed a quantitative threshold that is aligned with the statewide GHG target mandated by SB 32 of 2016, this analysis presents the estimate of project-related GHG emission and qualitatively assesses whether the project would be aligned with CARB's 2017 Scoping Plan. GHG emissions would be generated during project construction, from the landfill after the project becomes operational, and from the increase in trucks hauling solid waste to the landfill. These sources of emissions are discussed separately below.

Construction-Related Emissions

Project-related construction activities would generate GHG emissions. Off-road construction equipment, materials transport, and worker commutes during construction of the project would result in tailpipe emissions of GHGs from fuel combustion. Refer to Appendix A of the Air Quality Impact Assessment in Appendix D to this SEIR for detailed modeling inputs (e.g., duration, equipment types, equipment quantities). Based on modeling conducted for the project, it is estimated that construction would generate approximately 957 $MTCO_2e$ over the duration of the construction period. Based on previously accepted thresholds for construction-related GHG emissions by YSAQMD and BAAQMD (i.e., 1,100 $MTCO_2e$) (Jones, pers. comm., 2015), this level of emissions is not considered substantial. Further, onsite construction would likely be completed by onsite construction equipment that would otherwise be operating elsewhere within the RHR Landfill, and as a result, construction-related emissions are considered nominal.

Landfill-Generated Methane Emissions

General operations of the landfill would not change except that the allowable solid waste received by the landfill would increase, as described in Chapter 3, "Project Description," of this SEIR. All operational emissions from stationary sources would be regulated and monitored through YSAQMD permitting process. Landfilling of organic materials generates GHG emissions through the anaerobic breakdown of these materials. Methane is the primary GHG emission generated by landfilled material. As explained in CARB's 2017 Scoping Plan, landfill emissions are driven by the total waste-in-place, rather than year-to-year fluctuation in annual deposition of solid waste, as the rate and

volume of gas produced during decomposition depends on the characteristics of the waste and a number of environmental factors. As a result, waste disposed in a given year contributes to emissions that year and in subsequent years (CARB 2017a:88). The level of methane emissions associated with the storage and decomposition of solid waste in the landfill due to the project was estimated using the Landfill Gas Emissions Model (LandGEM) (EPA 2005) and is summarized in Table 4.7-2. The modeling inputs are provided in Appendices C and D of the Air Quality Impact Assessment (SCS Engineers 2019), which is provided in Appendix D to this SEIR. As shown in Table 4.7-2, the level of GHG emissions associated with project operations would be approximately 80,288 MT CO_2e/year.

Operation of the expanded landfill would be considered consistent with the 2017 Scoping Plan because the project would include the use of landfill gas capture and control systems that meet all applicable requirements of CARB's Short-Lived Climate Pollutant Reduction Strategy, the California State Plan for Municipal Solid Waste Landfills, and the landfill methane control measures and reporting requirements approved by CARB. In addition, the methane-containing landfill gas captured from the landfill would continue to be used to produce electricity, an operation that will help meet the state-wide renewable electricity targets that are a key component to achieving the statewide GHG emission targets. Moreover, the project would be consistent with Measure W-4 of the Solano County Climate Action Plan, which states that the County shall facilitate CalRecycle and CARB's implementation of the Landfill Methane Capture Strategy by requiring landfills to capture methane to the greatest extent feasible.

Table 4.7-2 Operational Greenhouse Gas Emissions

Vehicle Type	GHG Emissions (MTCO2e/year)
Stationary Sources	
Landfill Gas[1]	79,200
Flare	207
Diesel Generator	881
Subtotal	80,288
Mobile Sources	
Self-Haul Trucks	193
Packer Trucks	788
Transfer Trucks	5,890
Subtotal	6,870
Total	**87,158**

Notes: Totals may not add due to rounding. GHG = greenhouse gas; $MTCO_2e$/year = metric tons of carbon dioxide–equivalent per year

[1] The level of landfill gas GHG emissions represents the peak annual level of GHG emissions associated with the project. Landfill emissions are driven by the total waste-in-place, rather than year-to-year fluctuation in annual deposition of solid waste.

For detailed input parameters and modeling results for the stationary-sour emissions see Appendices C and D of the Air Quality Impact Assessment (SCS Engineers 2019), which is provided in Appendix D to this SEIR

See Appendix E for detailed calculations of mobile-source emissions.

Source: SCS Engineers (stationary source) and Ascent Environmental 2019 (mobile source)

Mobile-Source Emissions

The increase in average daily throughput associated with the project would result in approximately 195 additional round trips per day by haul trucks relative to existing conditions, as explained in the traffic impact analysis prepared for the project (KD Anderson 2018:13). Table 4.7-2 also summarizes the GHG emissions that would be generated by this increase in truck travel in 2020, which is the earliest year in which the project could become fully operational, although the increase in throughput would likely occur gradually over a much longer period of time. Emissions were calculated using EMFAC2017 and detailed modeling parameter are included in Appendix E. As shown in Table 4.7-2, the increase in truck travel associated with the project would generate approximately 6,870 MT CO_2e/year.

One of the factors that contributes to this level of project-related mobile-source emissions is the fact that the transfer trucks that would haul waste to the landfill would be coming from distant locations in the Bay Area and Sacramento Region. It is estimated that the project would generate approximately 91 additional daily round trips by transfer trucks (DKD Anderson 2019:13) with an average round-trip distance of approximately 120 miles (SCS Engineers 2019:41). This amounts to transfer trucks traveling approximately 10,920 miles per day. One of the reasons the level of vehicle travel associated with landfill operations is high is the constraints of siting landfills. In California, the siting of landfills is strictly regulated by CalRecycle, and landfill operations must be remote enough from homes, schools, airports, and other sensitive human activities to prevent the exposure of people to adverse health effects and offensive odors (CalRecycle 2018c). Also, multiple air districts recommend that residential land uses and other sensitive receptors not be located within 1–2 miles of a landfill to prevent exposure of people to offensive odors (YSAQMD 2007:14; BAAQMD 2017:3-4; SMAQMD 2018:7-1).

Though the Scoping Plan does not include any measures that specifically address the GHG emissions associated with the hauling of solid waste to landfills by truck, GHG emissions from truck hauling are being addressed in multiple ways at the regulatory level to help California achieve its mandated statewide GHG emission targets. For instance, the packer trucks and transfer trucks would be subject to California's special Phase 2 standards of the federal GHG and fuel efficiency standards for medium- and heavy-duty engines, a set of standards that is recognized in CARB's 2017 Scoping Plan as important to helping achieve the statewide GHG emission targets (CARB 2017a:25). Moreover, based on CARB's Emission Factor Web Database, version 1.0.2 (EMFAC2017), CO_2 emission rates for Solid Waste Collection Vehicles are projected to decrease by approximately 34 percent between 2020 and 2050 (CARB 2017d). Related calculations are included in Appendix E.

In addition, any truck activity associated with the project would rely on fuels that are subject to the state's low carbon fuels standard, which addresses the carbon intensity of automotive fuels used in California and is also recognized as a key GHG reduction measure in CARB's 2017 Scoping Plan (CARB 2017a:ES7, 25). Also, the project would not alter the system of collecting solid waste from local land uses with packer trucks, sorting and consolidating the collected material at transfer station/material recovery facilities, and then hauling only non-organic, non-recyclable waste to a landfill in higher-capacity transfer trucks—a system considered to be consistent with the goal of improving freight system efficiency outlined in the California Sustainable Freight Action Plan (California Department of Transportation et al. 2016:5-6). The presence of transfer stations/material recovery facilities reduces the amount of waste hauled to landfills and reduces the number of trips traveling to and from landfills by combining the loads of several individual packer collection trucks into a single, larger load (EPA 2018b).

In summary, because project-related truck activity would be subject to stringent engine emission standards and low carbon fuel standards, and be consistent with GHG-efficient freight hauling practices—all of which are recognized in CARB's 2017 Scoping Plan as measures to help achieve statewide GHG emission targets—the project's trucking activity would not conflict with California's ability to achieve statewide GHG emission targets.

All the GHG-emitting activities that would operate with the project are subject to regulations developed for the purpose of reducing GHG emissions and/or consistent with GHG reduction policies identified in CARB's 2017 Scoping Plan to help California meet its statewide GHG emission targets. Therefore, the project would not conflict with any applicable plan, policy or regulation adopted for the purpose of reducing GHG emissions.

As cities and counties served by this landfill continue to implement waste reduction actions to meet solid waste diversion requirements, less solid waste would be generated and subsequently transported to the landfill where it would generate methane emissions. The project would not result in more solid waste being generated and, therefore, would not conflict with the state's solid waste diversion regulations. Furthermore, the project includes an upgrade to the existing system for sorting, separating, and processing construction and demolition (C&D) materials. While the RHR Landfill is currently permitted to receive C&D waste stream, the CUP modification would authorize the further sorting of this waste stream, which would allow for greater recovery of recyclable materials and greater diversion of materials from landfill disposal. This component of the project would support attainment of statewide solid waste diversion targets and CalRycycle's *75 Percent Strategy*.

The RHR Landfill is both an infrastructure and an accessory land use that serves the broader region. It receives waste generated by residential and commercial land uses throughout the Bay Area and Sacramento Region, thereby supporting a large population and a large quantity of economic activity. Landfills play a vital role in California's waste management system and are necessary for the safe and regulated disposal of wastes that cannot be reduced, reused, or recycled. Thus, in this regional context, the level of GHG emissions associated with the project would not be substantial. For these reasons, project-related GHG emissions would not be a cumulatively considerable contribution to climate change, and this impact would be **less than significant**.

Moreover, the GHG emissions associated with the decomposition of solid waste generated by new land use development projects are accounted for when new development undergoes planning review and CEQA review. The California Emissions Estimator Model (CalEEMod), for instance, which is used to estimate the GHG emissions associated with new land use development projects in support of CEQA review, includes a module that estimates the levels of GHG emissions associated with the amount of landfilled solid waste that would be generated by the new land uses (CAPCOA 2016). If these emissions were also accounted for in projects that involve the development or expansion of a landfill, then they would be double counted.

Mitigation Measures

No mitigation is required.

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File Contents

4.7 Greenhouse Gas Emissions and Climate Change 4.7-1

Appendices

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Appendix G

Figures

No table of contents entries found.

Tables

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Table 4.7-2 Operational Greenhouse Gas Emissions 4.7-11

Acronyms/Abbreviations

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Citations

Yellow = confusing (sequential lettering doesn't match, years don't match, misspellings, etc.)
Green = matched reference
Aqua = missing full reference
Pink = no citation in text

Baughman, pers. comm., 2019
Black et al. 2017
CARB 2016a
CARB 2016b
CARB 2017
CARB 2018a
CARB 2018b
CARB 2018c
CEC 2018
CEC 2019
CNRA 2018
El Dorado County 2004
El Dorado County 2008
EPA 2018a
EPA 2018b
EPA 2019
European Commission Joint Research Centre 2018
IPCC 2013

IPCC 2014
Lister and Garcia 2018
McKibben 2018
OPR 2017a
OPR 2017b
OPR 2019
SACOG 2016
SMAQMD 2018
SMAQMD 2019
United Nations 2015
Wade, pers. comm., 2017

References

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