3.8 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

This section discusses greenhouse gas (GHG) emissions caused by proposed development of the 2018 LRDP. Emissions of GHGs have the potential to adversely affect the environment because they contribute to global climate change. Although no single project produces enough GHG to alter climate change effects, each project has the potential to contribute GHGs that ultimately concentrate in the globe's atmosphere and, from a global perspective, contribute to this growing crisis. Unlike criteria air pollutants and toxic air contaminants (TACs) that are pollutants of localized or regional concern, the location where GHG emissions are generated is less of a concern.

Public comments of the NOP included concerns regarding the GHG impacts associated with growth planned under the 2018 LRDP, construction, and consistency with regional growth plans and UC Davis's GHG reduction efforts. Concerns were also raised related to growth focused on the potential for the 2018 LRDP to result in increased students and staff vehicles emissions due to limited housing availability on-campus and within the City of Davis (City).

3.8.1 Regulatory Setting

FEDERAL

Supreme Court Ruling

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for implementing the federal Clean Air Act (CAA) and its amendments. The Supreme Court of the United States ruled on April 2, 2007, that carbon dioxide (CO_2) is an air pollutant as defined under the CAA, and that EPA has the authority to regulate emissions of GHGs. The ruling in this case resulted in EPA taking steps to regulate GHG emissions and lent support for state and local agencies' efforts to reduce GHG emissions.

Greenhouse Gas Permitting Requirements

EPA's New Source Review permitting program, including its Prevention of Significant Deterioration (PSD) requirements, applies to new major sources of criteria air pollutants and precursors. Title V of the federal Clean Air Act requires "major sources" of air pollutants to obtain and operate in compliance with an operating permit (EPA 2017b). Operating permits are legally-enforceable documents designed to improve compliance by clarifying what sources must do to control air pollution. A source is considered a major source if it would emit emissions of criteria air pollutants (or precursors) or hazardous air pollutants that exceed certain mass emission level criteria (e.g., 100 tons per year) depending on the ambient air quality conditions where the source is located. The PSD program is designed to make sure that a source's emissions would not cause or contribute to any applicable National Ambient Air Quality Standard. National Ambient Air Quality Standards are explained in more detail in Section 3.3, "Air Quality."

In 2010, EPA issued the Prevention of Significant Deterioration and Title V Greenhouse Gas Tailor Rule (EPA 2011). This rule set mass emission-based permitting criteria specifically for carbon dioxide-equivalent (CO_2e) emissions that define when permits under the New Source Review PSD and Title V Operating Permit programs are required for new and existing industrial facilities. This is known as Steps 1 and 2 of the Tailoring Rule for PSD and Title V permitting based on CO_2e emissions.

A new part of the GHG Tailoring Rule, known as Step 3, was issued by EPA in 2012. This step, known as Step 3, revised the regulations to require a source that emits or has the potential to emit levels of CO_2e that exceed established mass emission criteria (i.e., 100,000 tons per year [90,718 metric tons (MT) per year]) of CO_2e, but that has minor source emissions of all other regulated pollutants, to apply for an operating permit. However, in 2014, the U.S. Supreme Court issued its decision in *Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427 (2014). The Court held that EPA may not treat GHGs as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or title V permit. The Court also held that PSD permits that are otherwise required (based on emissions of other, non-GHG pollutants) may continue to require limitations on GHG emissions. In response to the Supreme Court decision and the D.C. Circuit's amended judgment, EPA is undertaking various actions to explain the next steps in GHG permitting (EPA 2017c). This program is also currently under review by EPA, but at the time of publication of this Draft EIR had not been changed.

Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks and Corporate Average Fuel Economy Standards

In October 2012, EPA and the National Highway Traffic Safety Administration (NHSTA), on behalf of the 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 FR 62624). NHSTA's CAFE standards have been enacted under the Energy Policy and Conservation Act since 1978. This national program requires automobile manufacturers to build a single light-duty national fleet that meets all requirements under both federal programs and the standards of California and other states. This program would increase fuel economy to the equivalent of 54.5 miles per gallon (mpg) 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).

In January 2017, EPA Administrator Gina McCarthy signed a Final Determination to maintain the current GHG emissions standards for model year 2022-2025 vehicles. However, on March 15, 2017, EPA Administrator Scott Pruitt, and Department of Transportation Secretary Elaine Chao announced that EPA intends to reconsider the Final Determination. On April 2, 2018, EPA Administrator Scott Pruitt officially withdrew the January 2017 Final Determination, citing information that suggests that these current standards may be too stringent due to changes in key assumptions since the January 2017 Determination. According to the EPA, these key assumptions include gasoline prices and overly optimistic consumer acceptance of advanced technology vehicles. The April 2nd notice is not EPA's final agency action. The EPA intends to initiate rulemaking to adopt new standards. Until that rulemaking has been completed, the current standards remain in effect. (EPA 2017a, EPA 2018a).

Clean Power Plan

The Clean Power Plan was unveiled by President Obama on August 3, 2015. The plan aims to reduce carbon dioxide emissions from electrical power generation by 32 percent within twenty-five years relative to 2005 levels. President Donald Trump signed an executive order on March 28, 2017 mandating the EPA to review the plan. EPA is proposing to repeal the Clean Power Plan based on a change to the legal interpretation of section 11(d) of the CAA, on which the Clean Power Plan was based. EPA is accepting public comments on the proposal until April 26, 2018. (EPA 2018b).

STATE

The California Air Resources Board (CARB) is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act, which was adopted in 1988. Various initiatives to reduce the state's contribution to GHG emissions are underway.

California Building Efficiency Standards (Title 24, Part 6)

The California Building Standards Code or Title 24 of the California Code of Regulations contains the regulations that govern the construction of buildings in California. Within the Building Standards Code, two parts pertain to the incorporation of both energy efficient and green building elements into land use development. Part 6 is California's Energy Efficiency Standards for Residential and Non-Residential Buildings and Part 11 is the California Green Building Standards, also known as CALGreen. These standards were first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption and are updated on an approximately 3-year cycle to allow consideration and possible incorporation of new energy efficient technologies and methods. All buildings for which an application for a building permit is submitted on or after January 1, 2017 must follow the 2016 standards (CEC 2015). The next set of standards is anticipated in 2019. Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases GHG emissions.

California Integrated Waste Management Act

To minimize the amount of solid waste that must be disposed of in landfills, the State Legislature passed the California Integrated Waste Management Act of 1989 (AB 939), effective January 1990. According to AB 939, all cities and counties were required to divert 25 percent of all solid waste from landfill facilities by January 1, 1995, and 50 percent by January 1, 2000. Through other statutes and regulations, this 50 percent diversion rate also applies to State agencies. In order of priority, waste reduction efforts must promote source reduction, recycling and composting, and environmentally-safe transformation and land disposal.

In 2011, AB 341 modified the California Integrated Waste Management Act and directed CalRecycle to develop and adopt regulations for mandatory commercial recycling. The resulting Mandatory Commercial Recycling Regulation (2012) requires that on and after July 1, 2012, certain businesses that generate four cubic yards or more of commercial solid waste per week shall arrange recycling services. To comply with this requirement, businesses may either separate recyclables and self-haul them or subscribe to a recycling service that includes mixed waste processing. AB 341 also established a statewide recycling goal of 75 percent; the 50 percent disposal reduction mandate still applies for cities and counties under AB 939, the Integrated Waste Management Act.

In April 2016, AB 1826 further modified the California Integrated Waste Management Act, requiring businesses that generate a specified amount of organic waste per week to arrange for recycling services for that organic waste in a specified manner. The bill decreases organic waste disposal rate criteria under which a business would be subject to these requirements, from 4 cubic yards per week starting on January 1, 2017 gradually down to 2 cubic yards per week starting on January 1, 2020. Diverting organic waste from landfills reduces emissions of methane (CH_4), considered a GHG, be reducing anaerobic decomposition of organic waste that are more likely to occur in landfills were organic waste is often buried with other inorganic waste.

Executive Order S-3-05

Executive Order (EO) S-3-05, signed by Governor Arnold Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra Nevada snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the executive order established total GHG emission targets for the state. Specifically, statewide emissions are to be reduced to 2000 levels by 2010, 1990 levels by 2020, and to 80 percent below 1990 levels by 2050.

This executive order was the subject of a California Appellate Court decision, *Cleveland National Forest Foundation v. San Diego Association of Governments* (SANDAG) (November 24, 2014) 231 Cal.App.4th 1056, which was reviewed by the California Supreme Court in January 2017. The case addressed the adequacy of the GHG analysis in the EIR SANDAG prepared for its 2011 Regional Transportation Plan. The Supreme Court decided a singular question in the case, which was released on July 13, 2017. The California Supreme Court ruled that SANDAG did not abuse its discretion by declining "to adopt the 2050 goal as a measure of significance in light of the fact that the Executive Order does not specify any plan or implementation measures to achieve its goal."

In addition to concluding that an EIR need not use this executive order's goal for determining significance, the Court described several principles relevant to CEQA review of GHG impacts, including: (1) EIRs should "reasonably evaluate" the "long-range GHG emission impacts for the year 2050;" (2) the 2050 target is "grounded in sound science" in that it is "based on the scientifically supported level of emissions reduction needed to avoid significant disruption of the climate;" (3) in the case of the SANDAG plan, the increase in long-range GHG emissions by 2050, which would be substantially greater than 2010 levels, was appropriately determined to be significant and unavoidable; (4) the reasoning that a project's role in achieving a long-range emission reduction target is "likely small" is not valid for rejecting a target; and (5) "as more and better data become available," analysis of proposed plan impacts will likely improve, such that "CEQA analysis stays in step with evolving scientific knowledge and state regulatory schemes." The Court also ruled that "an EIR's designation of a particular adverse environmental effect as 'significant' does not excuse the EIR's failure to reasonably describe the nature and magnitude of the adverse effect." The Court also recognized that the 40 percent reduction in 1990 GHG levels by 2030 is "widely acknowledged" as a "necessary interim target to ensure that California meets its longer-range goal of reducing greenhouse gas emission 80 percent below 1990 levels by the year 2050." Senate Bill (SB) 32 has since defined the 2030 goal in statute (discussed below).

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

In September 2006, Governor Schwarzenegger signed the California Global Warming Solutions Act of 2006, Assembly Bill (AB) 32. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. AB 32 also requires that (a) the statewide greenhouse gas emissions limit shall remain in effect unless otherwise amended or repealed; (b) It is the intent of the Legislature that the statewide greenhouse gas emissions limit continues in existence and be used to maintain and continue reductions in emissions of greenhouse gases beyond 2020; (c) The [California Air Resources Board (CARB)] shall make recommendations to the Governor and the Legislature on how to continue reductions of greenhouse gas emissions beyond 2020" [California Health and Safety Code, Division 25.5, Part 3, Section 38551].

Low Carbon Fuel Standard

In January 2007, Executive Order S-01-07 established a Low Carbon Fuel Standard (LCFS). The Order 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 LCFS 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 a full fuels cycle basis and may be met through market-based methods by which 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 Section38560.5, 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.

In response to certain court rulings, CARB re-adopted the LCFS regulation in September 2015, and the LCFS went into effect on January 1, 2016.

Senate Bill 375 of 2008

Senate Bill (SB) 375, signed by Governor Schwarzenegger in September 2008, aligns regional transportation planning efforts, regional GHG emission reduction targets, and land use and housing allocation. SB 375 requires metropolitan planning organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy, showing prescribed land use allocation in each MPO's Regional Transportation Plan. CARB, in consultation with the MPOs, is to provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in their respective regions for 2020 and 2035.

The Sacramento Area Council of Governments (SACOG) serves as the MPO for Sacramento, Placer, El Dorado, Yuba, Sutter, and Yolo Counties, excluding those lands located in the Lake Tahoe Basin. Most of the urban land uses associated with UC Davis are in Yolo County. SACOG adopted its 2035 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) (2035 MTP/SCS) in 2012, and completed an update adopted on February 18, 2016 (SACOG 2016). SACOG was tasked by CARB to achieve a 7 percent per-capita reduction compared to 2012 emissions by 2020 and a 16 percent per-capita reduction by 2035, which CARB confirmed the region would achieve by implementing its SCS (CARB 2013). CARB's subsequent evaluation confirmed that, if the MTP/SCS were implemented, the SACOG region would achieve the per-capita reduction targets prescribed by CARB (CARB 2016a:3).

In June 2017, CARB released the proposed Target Update for the SB 375 targets tasking SACOG to achieve a 7 percent and a 19 percent per-capita reduction by 2020 and 2035, respectively (CARB 2017a). On March 22, 2018, CARB approved the proposed Target Update for SB 375 without modifications. The next step in the process will be for SACOG to release notice of efforts to revise the 2035 MTP/SCS, following the announcement of this approval.

Climate Change Scoping Plan

In December 2008, CARB adopted its first version of its *Climate Change Scoping Plan*, which contained the main strategies California will implement to achieve the mandate of AB 32 (2006) to reduce statewide GHG emissions to 1990 levels by 2020. In May 2014, CARB released and subsequently adopted the *First Update to the Climate Change Scoping Plan* to identify the next steps in reaching the goals of AB 32 (2006) and evaluate the progress made between 2000 and 2012 (CARB 2014). After releasing multiple versions of proposed updates in 2017 CARB adopted the next version titled *California's 2017 Climate Change Scoping Plan* (2017 Scoping Plan) in December of that same year (CARB 2017a). The 2017 Scoping Plan indicates that California is on track to achieve the 2020 statewide GHG target mandated by AB 32 of 2006 (CARB 2017a:9). It also lays out the framework for achieving the mandate of SB 32 of 2016 to reduce statewide GHG emissions to at least 40 percent below 1990 levels by the end of 2030 (CARB 2017a).

The 2017 Scoping Plan recommends that local plan-level GHG emission reduction goals should be consistent with state goals of reducing emissions to 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050. For local plans, CARB recommends statewide targets of no more than 6 metric tons of CO_2e per capita by 2030 and 2 $MTCO_2e$ per capita by 2050, which were developed by applying the percent reduction goals to the State's 1990 emissions. Because these per-capita targets include emissions from all sectors in the State, CARB states that it is appropriate for local jurisdictions to develop evidence-based per-capita targets that are consistent with the framework used to develop statewide per-capita targets. The resulting emissions should be consistent with the downward trends of the statewide objectives (CARB 2017a: 99-100).

Additionally, the 2017 Scoping Plan includes some guidance for project-level thresholds for consideration. Where adequate geographically-specific GHG reduction plans, as defined in the 2017 Scoping Plan, are not available, CARB recommends that projects incorporate design features and GHG reduction measures, as feasible, to minimize GHG emissions. CARB considers a project-level threshold of no net additional increase in GHG emissions to be appropriate as an overall objective for new development. (CARB 2017a: 101.)

Cap-and-Trade Program

In 2011, CARB adopted the cap-and-trade regulation and created the cap-and-trade program. The program covers sources of GHG emissions that emit more than 25,000 MT CO_2e per year in the State such as refineries, power plants, industrial facilities, and transportation fuels. The cap-and-trade program includes an enforceable state-wide emissions cap that declines approximately three percent annually. CARB distributes allowances, which are tradable permits, equal to the emissions allowed under the cap. Sources that reduce emissions more than their limits can auction carbon allowances to other covered entities through the cap-and-trade market. Sources subject to the cap are required to surrender allowances and offsets equal to their emissions at the end of each compliance period (CARB 2012). The cap-and-trade program took effect in early 2012 with the enforceable compliance obligation beginning January 1, 2013. The cap-and-trade program was initially slated to sunset in 2020 but the passage of SB 398 in 2017 extended the program through 2030.

The Davis campus is subject to cap-and-trade and participates in the program. Through an agreement with CARB, all subject UC campuses, including the Davis campus, receive allowances in exchange for a financial commitment to university actions to combat climate change. The campus acquires California Carbon Offsets to offset eight percent (the maximum allowed in the cap-and-trade program) of cap-and-trade subject emissions.

Senate Bill X1-2, the California Renewable Energy Resources Act of 2011 and Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015

SB X1-2 of 2011 requires all California utilities to generate 33 percent of their electricity from renewables by 2020. SB X1-2 sets a three-stage compliance period requiring all California utilities, including independently-owned utilities, energy service providers, and community choice aggregators, to generate 20 percent of their electricity from renewables by December 31, 2013; 25 percent by December 31, 2016; and 33 percent by December 31, 2020. SB X1-2 also requires the renewable electricity standard to be met increasingly with renewable energy that is supplied to the California grid from sources within, or directly proximate to, California. SB X1-2 mandates that renewables from these sources make up at least 50 percent of the total renewable energy for the 2011-2013 compliance period, at least 65 percent for the 2014-2016 compliance period, and at least 75 percent for 2016 and beyond. In October 2015, SB 350 was signed by Governor Brown, which requires retail sellers and publicly-owned utilities to procure 50 percent of their electricity from renewable resources by 2030.

Advanced Clean Cars Program

In January 2012, CARB approved the Advanced Clean Cars program which combines the control of GHG emissions and criteria air pollutants, as well as requirements for greater numbers of zero-emission vehicles, into a single package of regulatory standards for vehicle model years 2017 through 2025. The new regulations strengthen the GHG standard for 2017 models and beyond. This will be achieved through existing technologies, the use of stronger and lighter materials, and more efficient drivetrains and engines. The program's zero-emission vehicle regulation requires battery, fuel cell, and/or plug-in hybrid electric vehicles to account for up to 15 percent of California's new vehicle sales by 2025. The program also includes a clean fuels outlet regulation designed to support the commercialization of zero-emission hydrogen fuel cell vehicles planned by vehicle manufacturers by 2015 by requiring increased numbers of hydrogen fueling stations throughout the state. The number of stations will grow as vehicle manufacturers sell more fuel cell vehicles. By 2025, when the rules will be fully implemented, the statewide fleet of new cars and light trucks will emit 34 percent fewer GHGs and 75 percent fewer smog-forming emissions than the statewide fleet in 2016 (CARB 2016b).

Executive Order B-18-12

In April 2012, Governor Brown signed Executive Order B-18-12 requiring State agencies, departments, and other entities under the Governor's direct executive authority to implement green building practices to improve energy, water and materials efficiency, improve air quality and working conditions for State employees, reduce costs to the State and reduce environmental impacts from State operations. Among other actions, EO B-18-12 requires State agencies to reduce agency-wide water use by 10 percent by 2015 and 20 percent by 2020, as measured against a 2010 baseline. The Executive Order directs that new State buildings larger than 10,000 square feet use clean, on-site power generation and obtain the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver certification. Further, EO B-18-12 states that all new State buildings beginning design after 2025 be constructed as Zero Net Energy (ZNE) facilities, with an interim target of 50 percent of new facilities beginning design after 2020 to be ZNE. The Executive Order also calls for State agencies to identify and pursue opportunities to provide electric vehicle charging stations at employee parking facilities in new buildings. As a state entity not under the direct executive authority of the Governor, the UC is not subject to the EO B-18-12; however, the green building practices required by the Executive Order are largely implemented through the UC Sustainable Practices Policy, discussed further below.

Executive Order B-30-15

On April 20, 2015 Governor Brown signed EO B-30-15 to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The Governor's EO aligns California's GHG reduction targets with those of leading international governments such as the 28-nation European Union, which adopted the same target in October 2014. California is on track to meet or exceed the target of reducing GHG emissions to 1990 levels by 2020, as established in the California Global Warming Solutions Act of 2006 (Assembly Bill 32, discussed above). California's new emission reduction target of 40 percent below 1990 levels by 2030 sets the next interim step in the State's continuing efforts to pursue the long-term target expressed under Executive Order S-3-05 to reach the goal of reducing emissions 80 percent below 1990 levels by 2050. This is in line with the scientifically established levels needed in the U.S. to limit global warming below 2 degrees Celsius, the warming threshold at which major climate disruptions are projected, such as super droughts and rising sea levels.

Senate Bill 32 and Assembly Bill 197 of 2016

In August 2016, Governor Brown signed SB 32 and AB 197, which serve to extend California's GHG reduction programs beyond 2020. SB 32 amended the Health and Safety Code to include Section 38566, which contains language to authorize CARB to achieve a statewide GHG emission reduction

of at least 40 percent below 1990 levels by no later than December 31, 2030. SB 32 codified the targets established by EO B-30-15 for 2030, which set the next interim step in the State's continuing efforts to pursue the long-term target expressed in EOs S-3-05 and B-30-15 of 80 percent below 1990 emissions levels by 2050. AB 197 requires CARB to prioritize direct emission reductions and consider social costs when adopting regulations to reduce greenhouse gas emissions as a means to protect what are perceived as impacted and disadvantaged communities. The legislation requires CARB to prioritize those rules and regulations that would result in direct emissions reductions at large stationary and mobile sources.

Senate Bill 1383 of 2016

In supporting the goals of AB 32, Governor Brown approved SB 1383 in September 2016, which requires CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants (SLCPs), such as CH_4, hydrofluorocarbons, and anthropogenic black carbon (soot) emissions. SLCPs are GHGs that degrade in the atmosphere at a faster rate than carbon dioxide (CO_2) and are considered to be responsible for 40 percent of current net climate forcing. The strategy includes a target to reduce CH_4 emissions by 40 percent below 2013 levels by 2030, including those from livestock management operations. This bill also requires CalRecycle and CARB to adopt regulations that achieve specific targets to reduce organic waste in landfills. The SLCP Reduction Strategy was approved by CARB in March 2017 and includes recommendations to reduce CH_4 emissions from livestock operations, landfills, and wastewater treatment facilities. (CARB 2017b).

Executive Order B-48-18

In January 2018, Governor Brown signed Executive Order B-48-18 requiring all State entities to work with the private sector to have at least 5 million zero-emission vehicles (ZEVs) on the road by 2030, as well as install 200 hydrogen fueling stations and 250,000 electric vehicle charging stations by 2025. It specifies that 10,000 of the electric vehicle charging stations should be direct current fast chargers. This order also requires all State entities to continue to partner with local and regional governments to streamline the installation of ZEV infrastructure. The Governor's Office of Business and Economic Development is required to publish a *Plug-in Charging Station Design Guidebook* and update the *2015 Hydrogen Station Permitting Guidebook* (Eckerle and Jones 2015) to aid in these efforts. All State entities are required to participate in the updating the *2016 Zero-Emissions Vehicle Action Plan* (Governor's Interagency Working Group on Zero-Emission Vehicles 2016) to help expand private investment in ZEV infrastructure with a focus on serving low-income and disadvantaged communities. Additionally, all State entities are to support and recommend policies and actions to expand ZEV infrastructure at residential land uses, through the Low Carbon Fuel Standard Program, and recommend how to ensure affordability and accessibility for all drivers.

UNIVERSITY OF CALIFORNIA

University of California Carbon Neutrality Initiative

In November 2013, UC President Janet Napolitano introduced the Carbon Neutrality Initiative, which commits UC campuses (buildings and vehicle fleets) to emitting net zero GHG emissions by 2025. In line with this initiative, UC Davis and other UC campuses also planned to achieve net zero GHG emissions from commuting and business air travel by 2050. These goals require the UC system, including UC Davis, to aggressively improve energy efficiency in buildings, reduce emissions from campus fleet and other sources, and increase utilization of renewable energy sources. (University of California Office of the President [UCOP] 2018; UC Davis 2015). The UC defines carbon neutrality as where:

> *… the University will have net zero climate impacts from [GHG] emissions attributed to Scope 1 direct emission sources and Scope 2 indirect emission sources as defined by The*

> *Climate Registry, and specific Scope 3 emissions as defined by the American College and University Presidents' Climate Commitment (ACUPCC). This neutrality will be achieved by minimizing GHG emissions from these sources as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions.* [UCOP 2016]

What constitutes a Scope 1, 2, or 3 emission is defined in greater detail below in the discussion of UC Davis emissions. The UC has incorporated the Carbon Neutrality Initiative into the UC Sustainable Practices Policy, and specifies the reduction targets in the Climate Action section.

University of California Sustainable Practices Policy

At the direction of The Regents of the University of California, UCOP developed a Sustainable Practices Policy which establishes sustainability goals to be achieved by all campuses, medical centers, and the Lawrence Berkeley National Laboratory within the UC system. The policy is regularly updated, with the most recent update occurring in January 2018. The policy goals encompass nine areas of sustainable practices: green building, clean energy, transportation, climate protection, sustainable operations, waste reduction and recycling, environmentally preferable purchasing, sustainable foodservice, sustainable water systems. Examples of policies include the following:

- Green Building Design
  - All new buildings projects, other than acute care facilities, shall be designed, construction, and commissioned to outperform the California Building Code (Title 24 portion of the California Code of Regulations) energy efficiency standards by at least 20 percent or achieve energy performance targets shown in Table 1 of Section V.A.3 of the policy. The Sustainable Practices Policy does not prohibit campuses from setting more rigorous goals, and the Davis campus has a campus-level policy to achieve at least 25 percent below Title 24 standards.
  - All new building will strive to achieve certification of U.S. Green Building Council's LEED "Gold" and achieve a minimum of LEED "Silver" certification, whenever possible within the constraints of program needs and standard budget parameters.
- Climate Protection Each campus and the UC Office of the President will develop strategies for meeting the following UC goals:
  - Reduction of Scope 1, 2, and 3 sources of GHG emissions to 1990 levels by 2020. (An earlier interim goal was to achieve year 2000 levels of emissions by 2014.)
  - Climate neutrality from Scope 1 and 2 sources, such as on-site natural gas combustion and off-site electricity generation, by 2025.
  - Climate neutrality from specific Scope 3 sources (as defined by the American College and University Presidents' Climate Commitment (ACUPCC)) by 2050 or sooner. Scope 3 sources include emissions from vehicle commute trips and manufacturing of consumed products.
- Sustainable Transportation
  - Develop a Fleet Sustainability Implementation plan by January 1, 2018 to document the infrastructure and financial needs to implement a low-carbon fleet program and lower campus fleet carbon emissions through 2025.
  - To amplify the impact of campus programs, each location is encouraged to partner with local agencies on opportunities to improve sustainable transportation access to and around university facilities in addition to developing its own transportation programs.
  - This policy shall be consulted for all new campus development – including acquisitions and leases – to evaluate how the development or acquisition would meet the transportation policies and goals of the campus and University.

- Sustainable Building Operations for Campuses
  - The University will incorporate the Sustainable Building Operations policy requirements into existing facilities-related training programs, with the aim of promoting and maintaining the goals of the Policy.
- Recycling and Waste Management
  - The University will reduce per capita total municipal solid waste generation at all locations other than medical centers as follows:
    - reduce waste generation per capita to FY2015/16 levels by 2020,
    - reduce waste generation by 25 percent per capita from FY2015/16 levels by 2025, and
    - reduce waste generation by 50 percent per capita from FY2015/16 levels by 2030.
  - The University will achieve zero waste by 2020 at all locations other than medical centers. Minimum compliance for zero waste is 90 percent diversion of municipal solid waste from landfills.
  - By 2020, the University will prohibit the sale, procurement or distribution of Expanded Polystyrene (EPS) other than that utilized for laboratory supply or medical packaging and products.
  - By 2018, no EPS shall be used in foodservice facilities for takeaway containers.

As a member of the UC, the goal of carbon neutrality under the Climate Protection policy shown above applies to UC Davis. By 2025, UC Davis and its projects must demonstrate zero net emissions from campus buildings and fleet (Scope 1 and 2 emissions) to comply with the UC's climate change commitments. As part of the goals set in the 2018 LRDP, UC Davis is also committed to achieving net zero Scope 3 emissions by 2050 (UC Davis 2015).

UC Davis Climate Action Plan

The Climate Protection section of the UC Sustainable Practices Policy, prior to the 2016 update, targeted three goals: reduction of GHG emissions to 2000 levels by 2014, to 1990 levels by 2020, and ultimately climate neutrality as soon as feasible. These goals were the foundation of the development of the UC Davis 2009-2010 Climate Action Plan (CAP).

UC Davis' CAP, written prior to SB 32's 2030 goals (GHG emissions that are 40 percent 1990 levels by 2030), includes emissions from both the Davis and Sacramento campuses, as well as outlying facilities. The CAP describes and addresses policy and regulatory requirements of (1) the UC Sustainable Practices Policy, (2) AB 32, including CARB's GHG Mandatory Reporting Program (3) the American College and University Presidents Climate Commitment, (4) CEQA, and (5) EPA reporting requirements. The CAP provides documentation of how campus GHG emissions are calculated from 1990 to 2008 calendar year inventories. The CAP also projects future emissions, presents UC Davis' GHG emission reduction goals, and proposes additional actions to further reduction GHG emissions. These actions mainly consist of proposals for further study to improve overall campus energy efficiency.

The 2009-2010 CAP was written before the UC Carbon Neutrality Initiative was announced and written into the UC Sustainable Practices Policy. As such, the CAP focuses on the 2014 and 2020 targets, with an understanding that climate neutrality will require fundamental shifts in global and national energy policy, energy production, and technologies currently using fossil fuels. The CAP mainly focuses on emissions related to campus operations, rather than commuting and business air travel, because the share of operations-related emissions is much larger (3 to 4 times greater) than the share attributable to commuting and air travel or commuting alone, respectively. The CAP provides analysis of commuting and air travel reduction options, but does not quantify emissions reductions for those options (UC Davis 2010). UC Davis is currently in the process of updating its CAP.

To reduce UC Davis' emissions, the CAP provides recommendations and actions on how the University can reduce emissions. Actions include including proposing projects that reduce electricity and natural gas use through the Strategic Energy Partnership Program, studying and implementing programs, as appropriate, for removing 100,000 sf per year of old, inefficient building space, and conducting a detailed feasibility study on additional on-site electricity generation and purchase costs for "green" power (UC Davis 2010:44). UC Davis is also conducting a transportation demand management planning study to determine options for additional GHG reduction related to commuting.

The past five years of inventories of emissions have shown that the Davis campus contributes about 65 percent of the emissions total, the Sacramento campus contributes about 34 percent of the total, and the outlying facilities contribute about 1 percent of the total. The most recent year of inventory completed, 2016, shows a trend shift, which will continue due to solar PV procurement, of the Davis campus contributing 61 percent of emissions, the Sacramento campus contributing 37 percent, and the outlying facilities contributing almost 2 percent.

The existing UC Davis CAP has not undergone environmental review and, therefore, is not considered a "qualified" Greenhouse Gas Reduction Strategy under CEQA. UC Davis is currently in the process of updating its CAP considering updates to the UC Sustainable Practices Policy in 2016. The campus has identified a round of solutions and is running feasibility analysis on those identified solutions, as well as considering additional solutions. The proposed solutions and potential GHG reductions are listed below.

UC Davis Conservation Programs

The UC Davis Office of Sustainability and the Energy Conservation Office offer various behavior-based programs to encourage individuals to reduce their energy consumption on campus and report energy waste. The Office of Sustainability offers the Green Workplace program, which includes office and lab programs for groups and individuals, and the Aggie Green Pledge program, which is aimed at individual actions. These programs address a wide variety of sustainable/green actions, covering more than energy. The Energy Conservation Office offers energy-specific programs, including thermal comfort reporting (TherMOOstat), an energy education campaign (Trim the Waste), and building energy education (Campus Energy Education Dashboard).

UC Davis Energy Efficiency Programs

The Energy Conservation Office has formed an Energy & Controls Engineering team, to take on campus-wide energy efficiency projects and develop tools for expanding and sustaining the savings achieved through the Statewide Energy Partnership program. In 2017, the Energy Conservation Office completed the first year of savings from an in-house ongoing operational commissioning program called Active Commissioning Enterprise (ACE), and implemented a sliding "comfort band" for classroom temperature set-points based on outside air temperature. The ACE program is designed to tune selected buildings' HVAC systems, including their temperature settings and schedules; integrate the systems into occupancy sensors; and maintain that improved energy efficiency performance. The Energy Conservation Office also installed thermal feedback-controlled ceiling fans in a classroom to test comfort & energy optimization potential. UC Davis is also preparing a phased plan for conversion of steam heating to heating hot water using electricity. Over time, this conversion would result in further reductions in campus natural gas use.

UC Davis Smart Lighting Initiative

In 2010, UC Davis established the Smart Lighting Initiative, with a goal to reduce electricity used on indoor and outdoor lighting by 30 million kilowatt-hours, which is 60 percent of 2007 levels used (calculated at 50,400,000 kilowatt hours [kWh] per year), and is in process towards meeting that goal. Campus design standards for all new construction projects require interior light-emitting diode

(LED) lights. To date, two phases of the project have been completed, and annual savings are totaling about 12,488,400 kWh/year. The work includes retrofits of lighting in parking structures, parking lots, pathways and roadways (the majority of which have been LED), wallpacks, and retrofit of 43 buildings, representing 2.5 million square feet, with highly efficient lamp and ballast replacements, LED fixture retrofits, and advanced lighting controls. The campus is planning the next phases of the SLI, which will include retrofit of selected additional exterior lighting and buildings.

LOCAL

As noted in Section 3.0.2, "University of California Autonomy," UC Davis, a constitutionally created State entity, is not subject to municipal regulations of surrounding local governments for uses on property owned or controlled by UC Davis that are in furtherance of the university's education purposes. However, UC Davis may consider, for coordination purposes, aspects of local plans and policies for the communities surrounding the campus when it is appropriate and feasible, but it is not bound by those plans and policies in its planning efforts.

Yolo-Solano Air Quality Management District

The Yolo-Solano Air Quality Management District's (YSAQMD) CEQA handbook and website currently recommends that GHG emissions and impacts to climate change be evaluated for every CEQA project (YSAQMD 2007; 24-25, 2018). YSAQMD's website recommends resources from the California Air Pollution Control Officers Association (CAPCOA) to evaluation project-level GHG emissions. YSAQMD has not, as of the writing of this EIR, adopted project- or plan-level thresholds to be used for CEQA evaluations.

3.8.2 Environmental Setting

THE PHYSICAL SCIENTIFIC BASIS OF GREENHOUSE GAS EMISSIONS 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 earth's atmosphere from space. A portion of the radiation is absorbed by the earth's surface and a smaller portion of this radiation is reflected toward space. This 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 CO_2, CH_4, nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Human-caused emissions of these GHGs more than 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. 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 anthropogenic increase in GHG concentrations and other anthropogenic forcing (International Panel on Climate Change [IPCC] 2014).

GHGs have varying potential to trap heat in the atmosphere, known as global warming potential (GWP), and atmospheric lifetimes. GWP reflects how long GHGs remain in the atmosphere, on

average, and how intensely they absorb energy. Gases with a higher GWP absorb more energy per pound than gases with a lower GWP, and thus contribute more to warming Earth. GWP is alternatively described as "carbon dioxide equivalents," or CO_2e. The parameter "atmospheric lifetime" describes how long the molecules will remain in the atmosphere. Atmospheric lifetimes of GHGs range from tens to thousands of years. These gases remain in the atmosphere long enough to become well mixed. The amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

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 (about one day), GHGs have long atmospheric lifetimes (one to several thousand years). GHGs persist in the atmosphere for long enough time periods to be dispersed around the globe. Although the lifetime of any GHG molecule is dependent on multiple variables and cannot be determined with any 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 is 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 remains stored in the atmosphere (IPCC 2013:467).

The quantity of GHGs in the atmosphere that ultimately result in climate change is not precisely known, but is enormous; no single project alone would measurably contribute to an incremental change in the global average temperature, or to global, local, or micro climates. From the standpoint of CEQA, GHG impacts relative to global climate change are inherently cumulative.

GREENHOUSE GAS EMISSION SOURCES

GHG emissions contributing to global climate change are attributable in large part to human activities associated with the electricity, transportation, industrial, commercial, residential, and agricultural/forestry sectors. Emissions of CO_2 are mainly byproducts of fossil fuel combustion. CH_4, 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 and landfills. N_2O is also 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, two of the most common processes for removing CO_2 from the atmosphere.

STATEWIDE SOURCES

California produces about 1 percent of the entire world's GHG emissions and 7 percent of the nation's GHG emissions, with major emitting sources including fossil fuel consumption from transportation (39 percent), electricity production (19 percent), industry (23 percent), agricultural and forestry (8 percent), residential (6 percent), and commercial (5 percent) (CARB 2017c, Boden et al. 2016). California produced 440 gross million metric tons (MMT) of CO_2 equivalent (CO_2e) in 2015 (CARB 2017c). California government is putting in place programs and legislation to reduce GHG emissions with the hope of delaying, mitigating, or preventing at least some of the anticipated impacts of global climate change on California communities.

Combustion of fossil fuel in the statewide transportation sector was the single largest source of California's GHG emissions in 2015, accounting for 39 percent of total GHG emissions in the state (CARB 2017c). This sector was followed by the electric power sector (including both in-state and out-

of-state sources) (19 percent) and the industrial sector (23 percent) (CARB 2017c). See Table 3.8-1 and Exhibit 3.8-1 below.

Table 3.8-1 California Greenhouse Gas Emissions Inventory

Emissions Sector	MMT CO_2e/yr				
	1990	2000	2005	2010	2015
Transportation	150.6	179.5	188.9	168.1	169.4
Electricity Generation[1]	110.5	105.3	108.2	90.6	84.1
Industrial[2]	105.3	104.6	104.6	101.1	103.0
Agriculture & Forestry	18.9	32.0	34.5	34.6	34.6
Residential	29.7	31.2	29.5	31.3	26.9
Commercial	14.4	14.3	15.8	20.1	22.2
Not Specified[3]	1.3	0.4	0.3	0.3	0.2
Total Emissions[4]	430.7	467.2	481.7	446.1	440.4

Notes: GWP = global warming potential; MMT CO_2e/yr = million metric tons of carbon dioxide equivalent per year

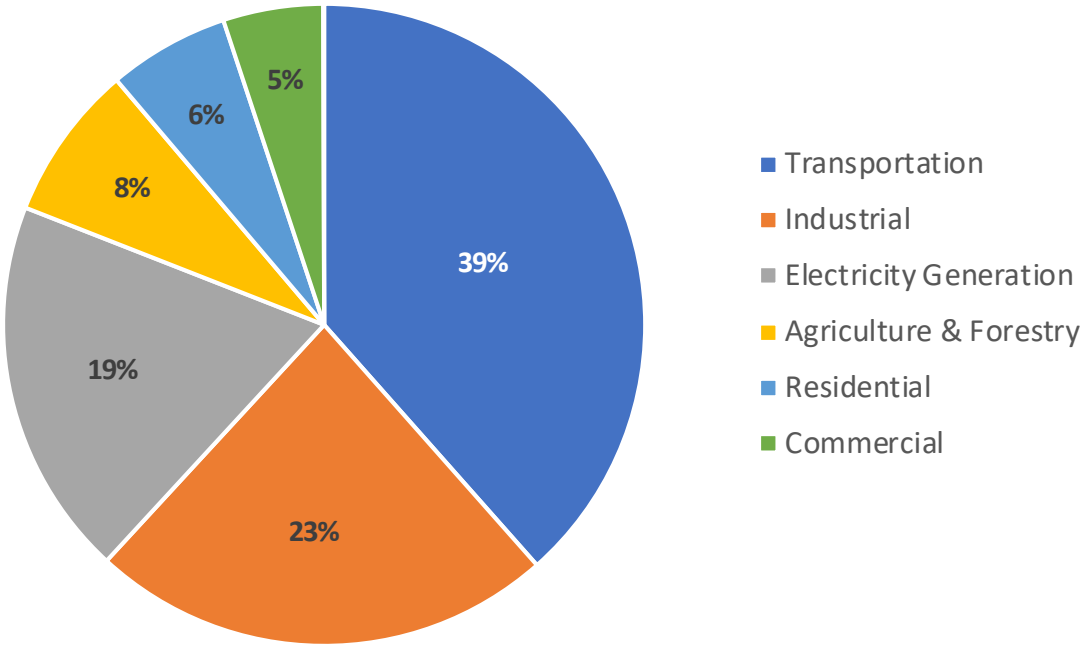
1 Includes in-state-generated and imported electricity production.

2 Waste emissions are contained within Industrial Sector emissions.

3 Includes solvent and chemical emissions

4 Totals may not sum exactly due to rounding

Source: CARB 2017c



Source: CARB 2017c. "Not Specified" emissions category not shown.

Exhibit 3.8-1 California's Greenhouse Gas Emissions by Economic Sector (2015 Average)

UC DAVIS EMISSIONS

Greenhouse Gas Emission Scopes

To separately account for direct and indirect emissions, to increase transparency, and to provide usefulness for different types of climate policies and goals, the World Resources Institute and the World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol Corporate Standard categorizes direct and indirect emissions into "scopes" as follows, assuming the use of the operational control approach to the organizational boundary (Note: examples of the various emission per scope type are provided below in Table 3.8-2):

- **Scope 1:** All direct GHG emissions (except for direct CO_2 emissions from biogenic sources) from sources controlled by the reporting entity;
- **Scope 2:** Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling, at facilities controlled by the reporting entity;
- **Scope 3:** All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities, waste disposal, and other activities.

Table 3.8-2 UC Davis Greenhouse Gas Emissions Sources by Scope in Verified Inventories Registered with The Climate Registry[1]

Scope	Types of GHG Emissions
1	◢ **Mobile combustion**, including Fleet Services vehicles, Unitrans buses, Davis-Sacramento shuttle, and off-road agricultural and grounds maintenance equipment. ◢ **Stationary combustion**, including natural gas combustion in boilers, cogeneration plant, propane, kerosene and diesel combustion in various heaters, equipment, and generators. ◢ **Process emissions** from the Davis campus wastewater treatment plant. ◢ **Fugitive emissions** include refrigerant usage in chillers, HVAC systems, vehicles, and research gases, fume hood testing, electrical switches, fire extinguishers, landfill gases, and distribution losses in natural gas lines.
2	◢ **Purchased electricity** is the main indirect emission for UC Davis, and includes purchases from many different suppliers. UC Davis purchases some natural gas for leased spaces, which is reported under Scope 2 per revision to the General Reporting Protocol.
3	◢ **Business, research, athletics, study abroad related travel and commuting**, such as passenger vehicle trips, truck trips, air travel, and non-Unitrans transit trips.
Non-Scope[2]	◢ **Biogenic emissions** from the on-site landfill gas collection system, and, historically, biodiesel (as of 2017, the campus began using renewable diesel instead of B20 fuel blend)

Notes: GHG = greenhouse gas; HVAC = heating ventilation air conditioning, B20 = diesel fuel blend with 20 percent biodiesel and 80 percent non-renewable diesel.

1 UC Davis GHG emissions provided in the campus-generated inventories exclude emissions from on-campus developments operated under a public-private partnership. This EIR, however, does evaluate the potential emissions associated with those developments.

2 These emissions are not categorized in any of the three scopes, per guidance under the Local Government Operations Protocol (CARB 2010:22). See discussion below under Analysis Methodology for further explanation of why estimation of biogenic emissions for the purposes of impact determinations is not included.

Source: UC Davis 2010

GHG accounting programs recognize that the Scope 2 emissions reported by one entity may also be reported as Scope 1 emissions by another entity. For example, the Scope 2 emissions from electricity use reported by a local government may also be reported as Scope 1 emissions by the regionally-serving utility that produced the electricity. This dual reporting does not constitute double counting of emissions as the entities report the emissions associated with the electricity production and use in different scopes (Scope 1 for the regionally-serving utility and Scope 2 for the local government). Emissions can only be aggregated meaningfully within a scope, not across scopes. Scope 2 emissions will always be accounted for by another entity as Scope 1 emissions. Therefore, Scope 1 and Scope 2 emissions must be accounted for separately. The appropriate scopes for each inventory sector are identified as follows.

This also applies to Scope 3 emissions, as one entity's Scope 3 emissions are also another entity's Scope 1 or Scope 2 emissions. Thus, all scopes should be accounted for separately. Reporting both Scope 1 and Scope 2 emissions helps ensure that local governments create a comprehensive emissions profile that reflects the decisions and activities of their operations. Reporting of Scope 3 emissions is encouraged but considered optional by the WRI/WBCSD. Some Scope 3 emissions are associated with life-cycle processes, which can be speculative and difficult to quantify.

UC Davis' CAP divides the University's GHG emissions into the three scopes/categories developed by WRI/WBCSD. Table 3.8-2 provides a detailed breakdown of the types of GHG emissions estimated by UC Davis as part of their GHG reporting.

A summary of UC Davis's GHG inventories for the Davis campus by scope between 1990 and 2016 is included below in Table 3.8-3. These values combine emissions reported in the CAP, which report emissions through 2005, and more recent emissions reported provided by UC Davis and through the traffic study conducted for this EIR. Some types of Scope 3 emissions under WRI/WBCSD protocol are not required to be included under CEQA because those emissions are the responsibility of other agencies (e.g., manufacturing, material extraction). Therefore, they are not included in this analysis. It is also important to note that UC Davis reports under operational control, per General Reporting Protocol guidance. and as such, does not report on emissions from things on UC Davis land that are not under UC Davis' operational control, such as West Village residences, Los Rios Community College, Solano Park residences, Hyatt Place, or other third-party-controlled and operated emissions sources.

Table 3.8-3 UC Davis GHG Emissions between 1990 and 2016 for the Davis Campus ($MTCO_2e$)

Emissions Source	1990[1]	2000	2005	2008	2012	2014	2016
Scopes 1							
Mobile Combustion – Fleet & Unitrans	4,932	5,567	6,101	6,045	4,757	5,806	5,156
Mobile Combustion - Other	NA	NA	NA	800	766	831	816
Stationary Combustion	59,352	98,359	84,387	66,255	61,798	56,584	57,976
Process	8,199	8,574	9,923	9,213	308	302	279
Fugitives[2]	NA	NA	NA	7,220	8,651	9,901	9,060
Purchased Offsets	0	0	0	0	0	-5,465	-5,561
Total Scope 1 Emissions	72,483	112,500	100,411	89,533	76,280	67,959	67,726
Scopes 2							
Purchased Electricity	48,509	43,903	78,827	75,396	59,875	55,718	41,410
Leased Space Off-Campus	NA	NA	NA	2,060	431	923	844
Total Scope 2 Emissions	48,509	43,903	78,827	77,456	60,306	56,641	42,254

Table 3.8-3 UC Davis GHG Emissions between 1990 and 2016 for the Davis Campus ($MTCO_2e$)

Emissions Source	1990[1]	2000	2005	2008	2012	2014	2016
Total Scope 1 and 2 Emissions	**120,991**	**156,403**	**179,238**	**166,989**	**136,586**	**124,600**	**109,980**
Scope 3							
Air Travel[3]	**7,832**	**9,576**	**11,592**	**12,603**	**13,558**	**14,158**	**13,754**
On-Road Vehicle Travel, excluding UC Davis vehicles [4]	88,901	93,700	96,099	97,538	99,458	100,418	101,377
Total Scope 3 Emissions	97,476	104,099	108,634	111,058	114,077	*115,586*	117,095
Total Emissions from all Scopes	**217,724**	**259,679**	**286,929**	**277,131**	**249,602**	**239,176**	**225,111**
Percent Change from 1990 levels	**0%**	**19%**	**32%**	**27%**	**15%**	**10%**	**3%**

Notes: Emissions shown based on global warming potential factors from IPCC's Third Assessment Report. Totals may not match those reported in the UC Davis 2009-2010 Climate Action Plan (CAP) due to differences in methodologies used to estimate commuting emissions.

$MTCO_2e$ = metric tons of carbon dioxide equivalents; NA = not available,

1 The UC Davis 2009-2010 CAP does not break down Scope 1 and 2 emissions from the Davis campus.

2 Includes landfill gas, refrigerant use, natural gas distribution, fume hood tests, and research gases.

3 Includes air travel by UC Davis staff only. Estimates from 1990 – 2007 and 2009-2016 are extrapolated from trends based on sampled air travel data taken in 2008 and 2009 scaled to UC Davis campus based on historical employee population at Davis and Sacramento campuses (UC Davis 2017).

4 2016 values estimated by Ascent Environmental in 2018 based on vehicle miles travelled estimates provided by Fehr and Peers. 1990 values scaled from 2016 estimates, changes in the Davis campus population (UCOP 2017), and 1990 vehicle emission factors reported in EMFAC 2011 and EMFAC 2017. Estimates from 2000 to 2012 were interpolated between 1990 and 2016 values. Excludes on-road vehicles owned and operated by UC Davis.

Source: UC Davis 2010; data compiled by Ascent Environmental in 2018.

Table 3.8-3 shows that UC Davis has been reducing emissions generated by the Davis campus since 2005. Although emissions in 2016 are still 4 percent higher than they were in 1990, the campus exceeded its CAP target of meeting 2000 emission levels by 2014 and is on the downward trajectory to meeting 1990 emission levels by 2020. These emissions comprise the voluntary inventory; the campus also prepares a mandatory inventory of emissions for CARB and USEPA, and the reportable emissions for the mandatory inventories are a subset of the voluntary emissions due to mandated reporting requirements.

EFFECTS OF CLIMATE CHANGE ON THE ENVIRONMENT

The IPCC was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide the world with a scientific view on climate change and its potential effects. According to the IPCC global average temperature is expected to increase relative to the 1986-2005 period by 0.3–4.8°C (0.5-8.6 °F) by the end of the 21st century (2081-2100), depending on future GHG emission scenarios (IPCC 2014:SPM-8). This temperature range represents the lower and higher bounds of five mitigation scenarios analyzed by the IPCC – two stringent scenarios, two intermediate scenarios, and a worst-case scenario. Temperatures in California are projected to increase 2.7°F above 2000 averages by 2050 and, depending on global emission levels, 4.1–8.6°F by 2100 (CNRA 2012:2).

Other environmental resources could be indirectly affected by the accumulation of GHG emissions and resulting rise in global average temperature. In recent years, California has been marked by extreme weather and its effects. According to CNRA's report, *Safeguarding California Plan: 2018 Update* (CNRA 2018), California experienced the driest four-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). In

contrast, the northern Sierra Nevada range experienced its wettest year on record in the 2016-2017 water year (CNRA 2018). The changes in precipitation exacerbate wildfires throughout California with increasing frequency, size, and devastation. As temperatures increase, the increase in precipitation falling as rain rather than snow also could lead to increased potential for floods because water that would normally be held in the snowpack of the Sierra Nevada and Cascade mountains until spring would flow into the Central Valley concurrently with winter rainstorm events. This scenario would place more pressure on California's levee/flood control system (CNRA 2018).

Changes in temperature, precipitation patterns, extreme weather events, and sea-level rise have the potential to effect and decrease the efficiency of thermal power plants and substations, decrease the capacity of transmission lines, disrupt electrical demand, and threaten energy infrastructure with the increased risk of flooding (CNRA 2018). Increased temperatures would also lead to increase electricity demand for cooling needs in buildings and facilities.

Water availability and changing temperatures, which effects prevalence of pests, disease, and species, directly impact crop development and livestock production. Other environmental concerns include decline in water quality, groundwater security, and soil health (CNRA 2018). Vulnerabilities of water resources also include risks to degradation of watersheds, alteration of ecosystems and loss of habitat, impacts to coastal areas, and ocean acidification (CNRA 2018). The ocean absorbs approximately a third of the CO_2 released into the atmosphere every year from industrial and agricultural activities, changing the chemistry of the ocean by decreasing the pH of seawater (CNRA 2018).

In comparison with historical annual means (between 1961 and 1990), Yolo County annual mean rainfall is expected to increase by 3 to 6 inches and annual maximum temperatures are project to rise 5 to 8°F by the 2070-2099 period, according to the RCP 4.5 scenario under CEC's Cal-Adapt climate change scenario planning tool. Cal-Adapt downscales global climate model data to local and regional resolution under two emissions scenarios: the RCP 4.5 scenario represents a forecast where emissions peak in 2040 then decline, and the RCP 8.5 scenario a forecast where emissions continue to rise strongly through 2050 then plateau around 2100. RCP 4.5 represents a low-emissions scenario in which global emissions are lower in the long term compared to RCP 8.5. (Cal-Adapt 2018).

3.8.3 Environmental Impacts and Mitigation Measures

SIGNIFICANCE CRITERIA

GHG emissions resulting from implementation of the 2018 LRDP would be significant if they would exceed either of the following significance criteria, in accordance with Appendix G of the *State CEQA Guidelines*:

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

The 2018 LRDP is considered to have a cumulatively considerable contribution to global climate change if the 2018 LRDP would:

- generate GHG emissions that would conflict with the GHG emission reduction efforts of the State of California. With respect to statewide planning efforts to reduce GHG emissions, the 2018 LRDP

would have a less-than-significant impact if it would help achieve a reduction that meets 1990 emission levels by 2020 and a 40 percent reduction below 1990 emission levels by 2030; or

- conflict with the following plans for the reduction of GHG emissions: (1) the UC Sustainable Practices Policies (UCOP 2011), (2) the GHG reduction goals of the SACOG RTP/SCS; or (3) the potential attainment of the State uncodified GHG reduction goals for 2050

As stated in the 2017 Scoping Plan, "… the State's (2020 and) 2030 targets have not been set in isolation. They represent benchmarks, consistent with prevailing climate science, charting an appropriate trajectory forward that is in line with California's role in stabilizing global warming below dangerous thresholds." (CARB 2017a:ES3). Per the Scoping Plan, achieving the 2020 and 2030 GHG reduction targets will place California on a path toward and provide the momentum to attain a 2050 goal of 80 percent reduction in GHG emissions below 1990 levels.

These thresholds were developed based on science-based goals of the world-wide reductions in GHG emissions would be needed to be in order to avoid dangerous climate change effects, as discussed in both the regulatory and environmental setting discussions above; these goals represent what can be described as California's—and by parallel consideration, UC Davis'—proportional reduction in GHG emissions to avoid dangerous climate change. Also, in addition to reflecting both the State's and UC Davis' GHG reduction goals, these thresholds are consistent with CARB's recommendations for assessing plan-level direct and indirect impacts to global climate change in the 2017 Scoping Plan. These thresholds meet or exceed other GHG emissions reductions proposed by the State of California and to represent ambitious efforts to shift from carbon-based fuels to other options for energy needs of UC Davis.

ANALYSIS METHODOLOGY

The California Office of Planning and Research's recommends that lead agencies under CEQA make a good-faith effort, based on available information, to estimate the quantity of GHG emissions that would be generated by a proposed project, including the emissions associated with construction activities and operational emissions (stationary sources, vehicular traffic, and energy consumption), and to determine whether the impacts have the potential to result in a project or cumulative impact and to mitigate the impacts where feasible mitigation is available (CEQA Guidelines Section 15064.4).

Of note, biogenic GHG emissions are included in UC Davis' GHG verified inventory, but are excluded from the analysis of GHG impacts herein. EPA has defined biogenic emissions as CO_2 emissions related to the natural carbon cycle, such as the decomposition, combustion, and digestion of organic matter (EPA 2017d). Conversion of un-fossilized organic matter into CO_2 emissions releases CO_2 converted into organic matter through photosynthesis in plants back into the atmosphere, whether directly or indirectly through consumption. Biogenic emissions exclude anthropomorphic CO_2 emissions, such as premature removal of vegetation leading to increased CO_2 emissions from the accelerated release of the carbon stored in vegetation. According to the Local Government Operations Protocol, biogenic emissions may be reported, but should be quantified separately from anthropomorphic emissions because biogenic emissions do not contribute to a net increase of GHGs in the atmosphere (CARB 2010:24). Excluding biogenic emissions also allows for the recognition of the lower carbon intensities of biofuels relative to their fossil fuel equivalents. This analysis considers planned tree plantings as having an anthropomorphic effect on emission levels in the atmosphere, such that the carbon sequestration potential from new tree plantings may be counted against new emissions.

The following section describes the analysis methodology for projection construction emissions and operational emissions.

Construction

Construction-related emissions of criteria air pollutants and precursors were calculated using the California Emissions Estimator Model (CalEEMod) Version 2016.3.2 computer program (SCAQMD 2017), as recommended by YSAQMD (YSAQMD 2016). Modeling was based on project-specific information (e.g., land use types, traffic modelling, building sizes), where available, reasonable assumptions based on typical construction activities, and default values in CalEEMod that are based on location and land use type. CalEEMod accounts for a variety of state, federal, and local programs and policies that affect construction-related emissions, such as local air district rules on architectural coatings and federal emission standards for off-road equipment, but these regulations primarily affect criteria pollutants. For a detailed description of model input and output parameters, and assumptions, refer to Appendix C.

Due to the programmatic nature of this analysis, the timing of construction activities for all projects anticipated during implementation of the 2018 LRDP is not possible, other than for the construction of the proposed West Village Expansion and Orchard Park components of the 2018 LRDP, analyzed in Volumes 2 and 3. The construction of the West Village Expansion and Orchard Park Redevelopment components are assumed to occur simultaneously starting in September 2018 and lasting through fall of 2020. Construction of additional academic space under the 2018 LRDP could begin as soon as 2019. It is conservatively assumed that an average of 200,000 sf of academic space would be construction per year through the end of the 2018 LRDP period. Other components of the 2018 LRDP, such as recreational space and infrastructure, would be constructed starting in 2021 after the completion of the West Village Expansion and Orchard Park Redevelopment components. See Table 3.8-4 for a general summary of the construction schedule that would occur under the 2018 LRDP.

Table 3.8-4 2018 LRDP General Construction Schedule

Project Component	2018[a]	2019-2020	2021-2031
West Village Expansion	X	X	
Orchard Park Redevelopment	X	X	
Academic and Administrative Designated Land Use (200,000 sf/year)		X	X
Campus Recreation & Intercollegiate Athletics			X
Other Residential Land Use Designations			X
Infrastructure		X	X

Notes: "X" indicates year or years in which the construction of a project component would occur.

[a] Construction would begin in September

Source: data compiled by Ascent Environmental in 2018

For construction years 2018 through 2019, annual and maximum daily construction emissions are based on the combined results of CalEEMod runs for the construction of West Village Expansion and Orchard Park Redevelopment components, in addition to the model results from construction of 200,000 sf of academic space per year in 2019 and 2020. For construction years 2021 through 2031, the exact construction schedule of the remainder of the 2018 LRDP components (e.g., recreational space) is unknown. To simplify the analysis of construction emissions in these years, the construction activity of the remaining anticipated housing, academic space, recreational space, and infrastructure are amortized over a 30-year lifespan to estimate average annual construction activity, associated annual emissions, and maximum daily emissions that may occur within a year of construction.

Consistent with the assumptions made in the 2010 UC Davis Climate Action Plan, modeling assumes that an average of 100,000 sf of building space would be removed per year (UC Davis 2010:28). However, to present a reasonable conservative assessment of potential construction under the 2018 LRDP, this analysis assumes that up to 200,000 sf of building space could be removed in a given year.

Table 3.8-5 summarizes the project-related activities for which emissions were estimated; the model, protocol, and source of emission factors used; and the key input parameters on which each activity's emissions were determined. Operational emissions include those stationary-source emissions generated by activity under the 2018 LRDP.

Operation

Operation-related emissions of criteria air pollutants and precursors from building energy use, area sources (i.e., landscaping equipment), stationary sources, and mobile sources were calculated using a variety of models and reports. CalEEMod Version 2016.3.2 was used to estimate emissions from building energy use, area sources, combustion-based stationary sources, and changes in vegetation. CalEEMod also accounts for policies that may affect operational emissions factors, such as state and federal vehicle emission standards and building energy efficiency standards, discussed further below. These policies are accounted for in modeling results, unless otherwise noted.

Process-based stationary sources, such as a potential composting facility and modifications to the campus's wastewater treatment plant (WWTP), were based on emission reports from the health risk assessment (HRA) conducted by Yorke Engineering for the 2018 LRDP (Yorke Engineering 2018). Mobile source emissions were based on emission factors from CARB's emission factor model, Emission Factor model (EMFAC 2017) and vehicle activity estimated by Fehr and Peers for this Plan (CARB 2017d; Behrens pers. comm., 2018a). Modeling in all cases was based on Plan-specific information (e.g., land use types, traffic modelling, building sizes), where available, reasonable assumptions were based on typical construction activities, and default model values were based on the 2018 LRDP's location and land use types. For a detailed description of model input and output parameters, and assumptions, refer to Appendix C. Operation of uses identified in the 2018 LRDP is assumed to begin in 2020, the year in which West Village Expansion and Orchard Park Redevelopment components would be completed. West Village Expansion and Orchard Park Redevelopment would be the first developments under the 2018 LRDP and whose first full year of operation would occur in 2021.

With respect to building energy use, electricity and natural gas use would result in indirect and direct GHG emissions, respectively. Buildings anticipated under the 2018 LRDP would require electricity and natural gas usage for lighting, space and water heating, appliances, and landscaping maintenance equipment. Building energy use was mainly estimated using CalEEMod v. 2016.3.2 (SCAQMD 2017), assuming that the land uses within the campus would have energy use factors that are 20 percent more efficient than the 2016 Building Energy Efficiency Standards under Title 24, as required in UC Davis's sustainability goals to be achieved by the 2018 LRDP (UCOP 2016).

Table 3.8-5 Methodologies Used to Estimate Project-Related Construction and Operational Emissions of Criteria Air Pollutants and Precursors

Land use/Source	Model/Protocol/ Source of Emission Factors	Key Input Parameter(s)
Construction Emissions		
West Village Expansion	See Volume 2 for details	See Volume 2 for details
Orchard Park Redevelopment	See Volume 3 for details	See Volume 3 for details
Academic and Administrative Designated Land Use	CalEEMod	Assumes 200,000 sf/year of Research and Development land use type.
Other Land Use Types (recreational, additional housing, infrastructure)	CalEEMod	27,600 sf health club space/year 4.39 acres of city park area/year 49 single family homes/year 204,900 sf general heavy industry/year 145 mid-rise apartments/year
Operational Emissions		
Building Energy – Electricity	CalEEMod NREL PV Watts Calculator	Assumes buildings are 20% more efficient than 2016 Title 24 standards. Assumes solar would be installed on 662,000 sf of rooftop or parking canopy space as part of the West Village Expansion and Orchard Park projects.
Building Energy - Natural Gas	CalEEMod	Assumes buildings are 20% more efficient than 2016 Title 24 standards.
Stationary Source – Diesel Emergency Generators	CalEEMod	22 new 700-hp diesel generators operating 12 hours per year.
Stationary Source – Biomass Boiler	CalEEMod	CalEEMod does not have emission factors for biomass boilers. A 200-kW diesel boiler was modeled in its place as a conservative proxy.
Stationary Source – Composting Facility	CalEEMod	Assumes that all on-campus organic waste is diverted to a potential campus composting facility. Organic waste piles are likely to be aerated static piles that would prevent methane emissions from anaerobic decomposition in piles. Taking a conservative approach, default CalEEMod emissions associated with waste generated by the campus are assigned to the composting facility.
Area Sources	CalEEMod	Default parameters based on land use inputs except for hearths. Assumed no fireplaces or wood-burning stoves.
Mobile Sources	EMFAC 2017 and VMT data modeled by Fehr and Peers	Emission factors from EMFAC 2017 applied to VMT data provided by Fehr and Peers. VMT based on travel demand model and on-site traffic counts. Trips include Unitrans buses and campus-operated fleet.

Notes: asf = assignable square footage; CNG = compressed natural gas; hp = horsepower; kW = kilowatt; NREL = National Renewable Energy Laboratory; PV = photovoltaic; sf = square feet; VMT = vehicle miles travelled

Models: CalEEMod v.2016.3.2, EMFAC 2017, NREL PV Watts Calculator

Source: data compiled by Ascent Environmental in 2018

With respect to emissions from electricity use, UC Davis procures its electricity from the Western Area Power Association (WAPA), a federally-run utilities company that markets and transmits wholesale electricity from multi-use water projects (hydropower). UC Davis contracts with WAPA for both base resource power (hydrogeneration power) and custom product power. WAPA's supply of hydropower is contingent upon atmospheric conditions and precipitation events, and therefore varies widely year to year. Due to the inherent uncertainty of hydropower availability, WAPA procures through the open market on behalf of UC Davis to supplement power requirements contracted by UC Davis. As such, WAPA-specific emissions factors are not available. Therefore, electricity-related operational emissions of GHGs for the existing site and project were calculated using emissions factors generated by the EPA's Emissions and Generation Resource Integrated Database (eGRID) for the WECC California subregion CAMX factor. As recommended by EPA, annual non-baseload output emissions rates were used to calculate the GHG emissions associated with electricity use for the existing and future conditions of the campus (EPA 2014). In addition, increases in the renewable mix of electricity generation sources due to RPS and SB 350 are not assumed to affect the emission factors in future years; therefore, the usage of the WAPA emissions factor is conservative. Total natural gas use during operation was based on defaults for the new land uses planned for the 2018 LRDP.

On-site solar electricity generation is planned for the West Village Expansion and Orchard Park Redevelopment components. Though solar facilities may also be installed elsewhere on campus as part of the 2018 LRDP, the feasibility of additional solar facilities is not yet known, though the campus is including an additional 4 MW solar PV installation in its CAP update scenarios. Therefore, it is conservatively assumed that solar would not be included, as part of the analysis, in any other buildings. Refer to Volumes 2 and 3 for a description of the methodology used to estimate solar electricity generation from the West Village Expansion and Orchard Park Redevelopment sites. According to Volumes 2 and 3, approximately 662,000 sf of roof and parking canopy space would be available for solar installations for these two short-term projects.

Operational area source GHG emissions from landscaping equipment were estimated using CalEEmod based on model defaults for the applied land uses. The analysis assumed that new uses under the 2018 LRDP would not include fireplaces or wood-burning stoves per YSAQMD Rule 2.40.

Plan implementation is expected to result in some loss of vegetation (i.e., trees), but also new tree plantings, with an overall net increase in the number of trees (approximately 2,440 over the 2018 LRDP implementation period). The change in carbon sequestration potential was analyzed using CalEEMod's vegetation module assuming net new plantings of 2,440 trees by the 2018 LRDP buildout. This planting rate is based on a cursory review of the current tree density on campus of approximately 20 trees per acre. This is applied to a total new acreage excluding parking lot acreage and redevelopment areas, approximately 122 acres. Eligible acreage includes non-parking lots areas in the West Village Expansion and Orchard Park Redevelopment projects, 20 acres within the academic and administrative land uses (AALU) (e.g., the new dairy site and the area between the Arboretum and I-80), and 59 acres associated with single family housing acreage under other LRDP land uses. It is assumed that new parking lots would install solar canopies in lieu of trees due to the potential for maximizing solar exposure in surface lots and based on existing practice within West Village.

With respect to combustion-based stationary sources, UC Davis indicated that 22 new diesel emergency generators and one biomass boiler would be operated under the 2018 LRDP in addition to existing sources. CalEEMod was used to estimate emissions from the diesel emergency generators. It was conservatively assumed that each generator would have an average rating of 700 horsepower (hp) and would operate at a maximum of one hour per day and up to 12 hours per year, based on discussions with UC Davis (Pfohl, pers. comm., 2018). No changes were made to model defaults other than specifying the number of generators, fuel type, hours, and horsepower. For the biomass boiler, the biomass boiler would be rated at 200 kilowatts (268 hp). The biomass boiler

would use animal bedding (e.g., wood chips, hay) and manure as fuel and would operate 24 hours per day and 365 days per year (Mitchell, pers. comm., 2017). CalEEMod does not have an option for biomass as a fuel type; therefore, diesel was selected as a proxy for biomass as a conservative approach to estimate GHG emissions from the proposed biomass boiler.

Other stationary sources that may occur with implementation of the 2018 LRDP include a potential campus composting facility and modifications to the existing WWTP, which would emit process-based GHG emissions. For the purposes of this analysis, it is assumed that all on-campus organic waste would be sent to the potential composting facility, which would likely be located adjacent to the existing biodigester. Thus, default CalEEMod emissions associated with solid waste generated by the campus were assigned to the composting facility. For the expanded wastewater treatment plant, CalEEMod estimates GHG emissions associated with water and wastewater treatment, conveyance, and delivery and reports them together as "water" emissions. The "water"-related CH_4 and N_2O emissions estimated by CalEEMod, attributed to the new population under the 2018 LRDP, were assumed to reflect the process-based GHG emissions associated with the expanded wastewater treatment plant. Building energy-related emissions from these two facilities are already included in the building energy use estimated through CalEEMod.

With respect to mobile sources, EMFAC 2017 was used to estimate annual and daily criteria air pollutant emissions from vehicle miles travelled (VMT) generated by implementation of the 2018 LRDP, which was available from Fehr and Peers (refer to Section 3.16, "Transportation, Circulation, and Parking"). These VMT estimates were based on travel demand models and traffic counts within the campus cordon over a three-day mid-week average during fall of 2016. EMFAC2017 is CARB's latest update to the EMFAC model series and considers effects of known policy implementation and economic forecasts, such as the implementation of the CAFE standards and Advanced Clean Cars program. The modeled emission factors reflect the county average vehicle mix and usage rates forecast for Yolo County in 2021, the first full year of operation of West Village Expansion and Orchard Park Redevelopment, and 2030, the 2018 LRDP's approximate build out year. Daily VMT were adjusted to annual VMT using a conversion factor of 287 which accounts for UC Davis' academic schedule, holidays, and enrollment levels during summer and regular academic quarters. See Appendix C for calculation details.

The 1990 baseline emissions estimates were based on a combination of values reported in the CAP and scaled values associated with Scope 3 mobile source emissions. Scope 1 and 2 emissions in 1990 were taken from the CAP, representing emissions from natural gas, area sources, stationary sources, campus fleet, Unitrans, electricity, waste, and water. While the CAP reports Scope 3 emissions in 1990, 1990 Scope 3 emissions were calculated separately to be consistent with the methodology used to estimate mobile source emissions generated by the plan. UC Davis calculated VMT based on parking permit zip code data while Fehr and Peers used a travel demand model approach that included calibrating trips to on-site traffic counts within the Davis campus cordon (Kirk, pers. comm., 2018a, Behrens, pers. comm., 2018b). Scope 3 mobile emissions reported in the CAP do not include visitor trips, vendor trips, and other trips that may not be associated with commuting, but are generated by the campus. For the purposes of only analyzing UC Davis campus emissions affected by the 2018 LRDP, Scope 3 emissions include on-road passenger vehicle commutes and construction activity.

ISSUES NOT EVALUATED FURTHER

no issues related to GHG emissions and climate change have been eliminated from further discussion.

IMPACTS AND MITIGATION MEASURES

Impact 3.8-1: Considerably contribute to climate change through plan-generated greenhouse gas emissions.

While the 2018 LRDP would increase development and population within the campus, the 2018 LRDP would result in UC Davis campus emissions four percent below 1990 levels by 2020 and 59 percent below 1990 levels by 2030, which exceeds the state GHG reduction targets proportionally applied to UC Davis. Therefore, the 2018 LRDP contribution to climate change from GHG emissions would be **less than significant**.

The 2018 LRDP would result in increased GHG emissions caused by increases to sources such as construction activity, on-road VMT, building energy consumption, wastewater, and new stationary sources. These projected increases are shown in Table 3.8-6.

Table 3.8-6 Growth Projection for UC Davis GHG Emissions Increases Caused by the 2018 LRDP without implementation of the UC Sustainable Practices Policy ($MTCO_2e$/year)

Emissions Source	Existing 2016 (Baseline LRDP EIR Emissions)	LRDP EIR Projection 2020 with partial 2018 LRDP Implementation	LRDP EIR Projection 2030 with 2018 LRDP Implementation
Scopes 1 & 2 [1]			
New AALU under 2018 LRDP [2]	0	570	6,843
Other LRDP growth under 2018 LRDP [2, 3]	0	0	6,507
Rest of Davis Campus[4]	101,087	109,878	109,084
Total Scope 1 and 2 Emissions	**101,087**	**110,449**	**122,434**
Scope 3 [5]			
Mobile Source Emissions [6]	101,377	98,094	88,214
2018 LRDP Construction[7]	0	938	938
Changes to on-campus vegetation from existing [8]	0	-595	-1,683
Total Scope 3 Emissions	**101,377**	**98,437**	**87,469**
Total Emissions from Scopes 1, 2, and 3	**211,464**	**208,886**	**209,904**
Non-Scope 1, 2, or 3 Emissions			
Public-private partnership projects before 2017[2]	3,273	3,273	3,273
West Village Expansion (Scopes 1 and 2 only)	0	2,725	2,725
Orchard Park Redevelopment (Scopes 1 and 2 only)	0	648	648
Solar Generation at WVE and OPR	0	-4,145	-4,145
Total Non-Scope 1, 2, or 3 Emissions	**3,273**	**2,500**	**2,500**
Total UC Davis Emissions	**214,737**	**211,386**	**212,404**

Notes: Emissions shown in 2016, 2030, and 2050 were adjusted to use global warming potential factors from IPCC's Third Assessment Report, which is consistent with the factors used in UC Davis' 1990 emissions inventory (UC Davis 2010). See Appendix C for additional details.

$MTCO_2e$ = metric tons of carbon dioxide equivalents; AALU = academic and administrative designated land use; LRDP = Long Range Development Plan, WVE=West Village Expansion, OP = Orchard Park Redevelopment

[1] Includes emissions from electricity and natural gas combustion in buildings, campus fleet, electricity, waste (including those associated with the potential composting facility), and stationary sources.

[2] Estimates modeled using CalEEMod 2016.3.2 based on 2018 LRDP land use inputs.

Table 3.8-6 Growth Projection for UC Davis GHG Emissions Increases Caused by the 2018 LRDP without implementation of the UC Sustainable Practices Policy ($MTCO_2e$/year)

Emissions Source	Existing 2016 (Baseline LRDP EIR Emissions)	LRDP EIR Projection 2020 with partial 2018 LRDP Implementation	LRDP EIR Projection 2030 with 2018 LRDP Implementation

[3] Excludes building energy-related emissions generated by the West Village Expansion and Orchard Park projects. Includes new emergency generators, biomass boiler, and waste emissions.

[4] Include campus fleet, Unitrans, and existing stationary sources. Changes in 2020 and 2030 due to improving vehicle emission factors over time as modeled in EMFAC2017.

[5] Only includes on-road mobile and construction sources for the purposes of the 2018 LRDP.

[6] Includes all on-road mobile emissions, including commuting, vendor trips, and trucks trips, excluding campus fleet and Unitrans operations.

[7] Total construction emissions under the 2018 LRDP amortized over a 30-year building lifespan.

[8] Accounts for the net change in carbon sequestration rates and carbon losses due to removal and new plantings of trees. Net reduction in carbon losses.

Source: UC Davis 2010; data compiled by Ascent Environmental in 2018

With expected emission increases in the years leading to 2025 during 2018 LRDP implementation, UC Davis will be concurrently implementing the UC Sustainable Practices Policy and the UC Davis CAP to meet the requirement of climate neutrality for Scope 1 and 2 emissions by 2025 and climate neutrality for Scope 3 emissions by 2050. Implementation of these policies and initiatives would reduce emissions through improved energy efficiency in new and existing buildings, an increased proportion of renewable energy use, reduced petroleum fuel use in campus fleet, and reduced emissions of research gases. UC Davis has approved and implemented large-scale projects to reduce overall campus emissions, such as on-site (17.1 megawatts [MW]) and off-site solar power (a quarter-share of an 80-MW installation). The campus is considering approval of additional projects, subject to financial feasibility and/or technical viability, for direct action. UC Davis campus personnel have calculated the GHG reduction potential of the following proposed projects, which are not reflected in Table 3.8-6:

- Energy efficiency projects, including the Active Commissioning Enterprise, and Phase 3 of the Smart Lighting Initiative, with estimated emission reductions of 14,211 $MTCO_2e$.
- The District Heating Infrastructure Steam to Hot Water Conversion Project, with estimated emission reductions of 17,179 to 19,994 $MTCO_2e$, depending upon hot water generation technology mix.
- On-site renewable energy generation through additional solar installation (electricity generation) and biodigester operation changes (biomethane production), with estimated emission reductions of 3,396 $MTCO_2e$.
- Green energy purchases to replace existing fossil fuel energy sources (biomethane purchases and green electricity purchases), with estimated emission reductions of up to 69,509 $MTCO_2e$.
- Electrification of the Unitrans bus fleet, with estimated emission reductions of 1,079 $MTCO_2e$.

Additional solutions are being analyzed now for cost and GHG reduction performance, and include high performance new buildings, behavior-based conservation programs, fleet renewal, and space planning solutions. However, because clear figures for reduction have not been determined yet, these solutions do not have attributed reduction quantities and therefore have not been included.

If all implemented in total, these projects could result in a total reduction of Scopes 1 and 2 emissions 105,374 $MTCO_2e$ which would decrease the modeled Scope 1 and 2 emissions of 122,434 $MTCO_2e$, resulting in remaining Scope 1 and 2 emissions of 17,060 $MTCO_2e$. These upcoming emission reductions would reduce the projected 2030 Scope 1 and 2 emissions but are

not expected to fully achieve the 2025 climate neutral policy for Scopes 1 and 2. In the case where the actions to reduce emissions on campus, as described above, would not completely reduce UC Davis campus emissions to the 2025 target, UC Davis would purchase carbon offsets to meet the GHG reduction goals.

The projected remaining Scope 1 and 2 emissions of 17,060 $MTCO_2e$ would be offset to achieve Scope 1 and 2 climate neutrality in accordance with the UC Sustainable Practices Policy. The potential costs of offsets would present an incentive to achieve the expected campus emission reductions and to consider further efforts at on-campus emission reductions leading up to the decision to purchase carbon offsets. The following comparative pricing analysis uses a banded set of pricing values from \$21.00/$MTCO_2e$ to \$61.00/$MTCO_2e$ (Table 3.8-7). The low value reflects a trended price based on discounting CARB-approved Golden California Carbon Offsets (CCOs) 10 percent from the floor price for California Carbon Allowances. The higher value uses a social cost of carbon based on a study conducted by CalTech. The campus used the higher value in a life-cycle cost analysis to assess the steam-to-hot-water district heating infrastructure solution listed above. Both high and low values are very conservative and reflect higher pricing than offsets that can be purchased in the voluntary market, some of which run as low as \$1.50/$MTCO_2e$.

Table 3.8-7 Comparison of Carbon Offset Pricing and Costs Associated with Reducing the UC Davis Scope 1 and Scope 2 Emissions to Zero

Emissions Source	Offsets priced at \$21.00/$MTCO_2e$	Offsets priced at \$61.00/$MTCO_2e$
Scope 1 and 2 emissions remaining to reduce, in $MTCO_2e$	17,060	17,060
Cost to the campus	\$358,260	\$1,040,660

Notes: $MTCO_2e$ = metric tons of carbon dioxide equivalents

Source: Data provided by UC Davis in 2018.

Table 3.8-8, compares the UC Davis emissions between 2016 and 2020 and 2030 with implementation of the 2018 LRDP. With the upcoming implementation of the UC Sustainable Practices Policy as well as sustainability actions outlined in the UC Davis CAP, the 2018 LRDP Scope 1 and 2 emissions would be reduced to zero by 2025. Emissions from 1990 in Table 3.8-8 are provided as context for comparing the UC Davis projected emission reductions to similar state GHG reduction targets reductions that utilize 1990 as an important benchmark year.

Table 3.8-8 UC Davis GHG Emissions under the 2018 LRDP Under the UC Carbon Neutrality Initiative ($MTCO_2e$/year)

Emissions Source	1990 Reference Emissions	Existing 2016 (Baseline LRDP EIR Emissions)	LRDP EIR Projection 2020 with 2018 LRDP Implementation	LRDP EIR Projection 2030 with 2018 LRDP Implementation
Scopes 1 & 2 [1]				
New AALU under 2018 LRDP	0	0	570	0
Other LRDP growth under 2018 LRDP	0	0	0	0
Rest of Davis Campus [2]	120,991	101,087	109,878	0
Total Scope 1 and 2 Emissions	**120,991**	**101,087**	**110,449**	**0**
Scope 3 [3]				
Mobile Source Emissions [4]	88,901	101,377	98,094	88,214
2018 LRDP Construction5[7]	0	0	938	938

Table 3.8-8 UC Davis GHG Emissions under the 2018 LRDP Under the UC Carbon Neutrality Initiative ($MTCO_2e$/year)

Emissions Source	1990 Reference Emissions	Existing 2016 (Baseline LRDP EIR Emissions)	LRDP EIR Projection 2020 with 2018 LRDP Implementation	LRDP EIR Projection 2030 with 2018 LRDP Implementation
Changes to on-campus vegetation from existing [6]	0	0	-595	-1,683
Total Scope 3 Emissions	**88,901**	**101,377**	**98,437**	**87,392**
Total Emissions from Scopes 1, 2, and 3	**209,892**	**211,464**	**208,886**	**87,469**
Non-Scope 1, 2, or 3 Emissions				
Public-private partnership projects before 2017[2]	11,376	3,273	3,273	3,273
West Village Expansion (Scopes 1 and 2 only)	0	0	2,725	2,725
Orchard Park Redevelopment (Scopes 1 and 2 only)	0	0	648	648
Solar Generation at WVE and OPR	0	0	-4,145	-4,145
Total from Non-Scope 1,2, or 3 Emissions	**11,376**	**3,273**	**2,500**	**2,500**
Total Emissions from all Scopes	**221,268**	**205,737**	**211,386**	**89,970**
Percent Change from 1990	**0%**	**-3%**	**-4%**	**-59%**
State GHG Reduction Targets (Percent Change from 1990)			**0%**	**-40%**
Meets State GHG Reduction Targets?			**Yes**	**Yes**

Notes: Emissions shown in 2016, 2030, and 2050 were adjusted to use global warming potential factors from IPCC's Third Assessment Report, which is consistent with the factors used in UC Davis' 1990 emissions inventory (UC Davis 2010). See Appendix C for additional details.

$MTCO_2e$ = metric tons of carbon dioxide equivalents; AALU = academic and administrative designated land use; LRDP = Long Range Development Plan, WVE=West Village Expansion, OP = Orchard Park Redevelopment

Notes:

1 Includes emissions from electricity and natural gas combustion in buildings, Campus fleet, electricity, waste (including those associated with the potential composting facility), and stationary sources.

2 Include campus fleet, Unitrans, and existing stationary sources.

3 Only includes on-road mobile and construction sources for the purposes of the 2018 LRDP.

4 Includes all on-road mobile emissions, including commuting, vendor trips, and trucks trips, excluding campus fleet and Unitrans operations.

5 Total construction emissions under the 2018 LRDP amortized over a 30-year building lifespan.

6 Accounts for the net change in carbon sequestration rates and carbon losses due to removal and new plantings of trees. Net reduction in carbon losses.

Source: UC Davis 2010; data compiled by Ascent Environmental in 2018

UC Davis produces an annual GHG inventory to track GHG emission volumes and sources. Through this tracking system, GHG reductions are expected to continue the overall downward trend that has occurred since 2008. The annual UC Davis GHG inventory will be used to determine the need for purchasing carbon offsets in the year 2025 to ensure emission reductions match the climate neutral 2025 requirement for Scopes 1 and 2 emissions. The 2050 annual inventory will be used to track compliance with the Scope 3 climate neutral requirement, but 2050 is outside of the 2018 LRDP planning period. Nevertheless, by achieving (or exceeding) 2030 GHG reduction goals, UC Davis would demonstrate it is on a path toward achieving 2050 statewide GHG reduction goals.

As shown in Table 3.8-8, with implementation of the UC Sustainable Practices Policy, the 2018 LRDP would result in GHG emissions that are four percent less than 1990 levels by 2020 and 59 percent less than 1990 levels by 2030. The implementation of the UC Sustainable Practices Policy may include the aforementioned energy efficiency projects (see bulleted list above), such as the District Heating Infrastructure Steam to Hot Water Conversion Project, and green energy projects. UC Davis plans to prioritize reducing emissions through on-site projects before purchasing carbon offset credits. Both the 2020 and 2030 emissions would meet and exceed the state's GHG reductions goals of reducing GHG

emissions to 1990 levels by 2020 and 40 percent below 1990 levels by 2030, as proportionally applied to UC Davis. Therefore, the 2018 LRDP would be consistent with the statewide GHG reduction goals and would not considerably contribute to climate change. This impact would be **less than significant**.

Mitigation Measures

No mitigation measures are necessary.

Impact 3.8-2: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

Implementation of the 2018 LRDP would achieve targets established in the UC Sustainable Practices Policy through anticipated planning and policy actions. As achievement of the Sustainable Practices Policy would meet or exceed statewide targets for 2030 and not impede the ability to achieve statewide 2050 targets, including continued implementation of SACOG's MTP/SCS, the 2018 LRDP would not conflict with an applicable plan, policy, or regulations intended to reduce GHG emissions. **No impact** would occur.

As described above in Impact 3.8-1, the UC Davis GHG emission reduction strategies will result in large scale emission reductions compared to both existing (absolute) emissions and per-capita reductions. While the 2018 LRDP would result in actions and activities with increased Scope 1, 2, and 3 emissions, the UC Davis GHG emission reduction strategies and requirements would apply to these increased emissions caused by the 2018 LRDP and the upcoming emission reduction strategies will account for and plan reduction efforts or offset purchases for the increased emissions,

Specific items in the 2018 LRDP such as large increases in on campus student housing have been incorporated into the LRDP because they are supportive and complementary to the GHG emission reduction strategies for the Scopes 1, 2, and 3 reduction requirements.

Proposed land uses, population increases, building development and redevelopment, and planned infrastructure for the 2018 LRDP are required through UC policies to achieve the University's goal of reducing GHG emissions generated by the campus. Individually, these elements would not reduce GHG emissions and, in contrast, could increase emissions relative each respective baseline condition due to the campus' expansion under the 2018 LRDP. However, with implementation of the 2018 LRDP:

- Existing campus facilities would be redeveloped to be more energy efficient, resulting in less energy use and generating less emissions than existing conditions;
- New on-campus facilities would be developed to meet or exceed energy efficiency standards with a commitment to achieve LEED Gold, thereby resulting in fewer emissions from electricity and natural gas use compared to similar new facilities built elsewhere in the states;
- New solar generation facilities would be operated on campus, off-setting emissions associated with electricity generation;
- Land use and planned infrastructure would be developed to discourage personal vehicle use, such as through limited parking for personal vehicles and shared vehicle provisions, as well as the construction of bicycle and transit infrastructure, thereby reducing transportation-related emissions; and
- Any remaining GHG emissions that need to be reduced after the physical implementation of the 2018 LRDP to meet UC Davis' GHG reduction targets would be abated by verified carbon offset purchases made by UC Davis.

The combination of these actions would lead to the emissions reductions shown in Table 3.8-8 despite increases in campus population under the 2018 LRDP.

The UC Sustainable Practices Policy sets specific dates of 2025 for Scope 1 and 2 climate neutrality and 2050 for Scope 3 climate neutrality, consistent with the goals set in the UC Carbon Neutrality Initiative. The implementation of 2018 LRDP will help UC Davis achieve the UC Sustainable Practices Policy requirement of reducing GHG emissions to 1990 levels by 2020, as shown in Tables 3.8-6 and Table 3.8-8. The UC Sustainable Practices Policy sets the ambitious goals for Scopes 1 and 2 and has no requirement for climate neutrality or offset purchases for interim year emissions between 2020 and 2025. However, if the campus were to, for some reason, not meet the 2020 policy target of 1990 levels of emissions, the campus would purchase sufficient offsets to reduce emissions to 1990 levels. The activities planned under the 2018 LRDP EIR would likely contribute interim year emissions described in this document while the campus would be concurrently implementing emission reduction efforts leading up to the 2025 Scope 1 and 2 requirement.

As described in the impact discussion for Impact 3.8-1, UC Davis produces an annual GHG inventory to track GHG emission volumes and sources. The annual GHG inventory will be used to determine the need for purchasing carbon offsets in the year 2025 to ensure emission reductions match the climate neutral 2025 requirement for Scopes 1 and 2 emissions. In consideration of future reduction targets beyond the forecast period for this EIR, the 2050 annual inventory will be used to track compliance with the Scope 3 climate neutral requirement, but 2050 is outside of the 2018 LRDP planning period. Nevertheless, by achieving (or exceeding) 2030 GHG reduction goals, UC Davis would demonstrate it is on a path toward achieving 2050 statewide GHG reduction goals. The 2018 LRDP would not preclude or create obstacles to future attainment of the 2050 reduction goal. Compliance with the 2050 goal is anticipated by the year 2050 but analysis of detailed compliance with the 2050 reduction goal is not feasible at this time.

Although SACOG's 2035 MTP/SCS has a per-capita GHG target for vehicle emissions in the region in which UC Davis lies, the discussion of the 2018 LRDP's consistency with SACOG's 2035 MTP/SCS is located in Section 3.16, "Transportation, Circulation, and Parking." As noted in Section 3.16, the modeling conducted for the 2018 LRDP, includes SACOG's planned transportation projects under the 2035 MTP/SCS as part of the future condition analysis and would not limit SACOG's ability to implement projects under the 2035 MTP/SCS. As a result, the 2018 LRDP is not anticipated to conflict with the implementation of the 2035 MTP/SCS. Further, as discussed above, CARB estimated that the 2035 MTP/SCS would meet the SB 375's GHG reduction targets for the Sacramento region (CARB 2016a:3). Therefore, the 2018 LRDP would not conflict with or impeded SACOG's ability to achieve GHG reduction targets through continued implementation of the 2035 MTP/SCS.

Based on this discussion, the 2018 LRDP would implement the UC Sustainable Practices Policy which is consistent with the UC Carbon Neutrality Initiative, which in turn supports the state's GHG reduction plans. Additionally, the 2018 LRDP would not conflict with the implementation of the 2035 MTP/SCS. Thus, the adoption of the 2018 LRDP would not conflict with the applicable plan, policy, or regulations for GHG emission reductions. **No impact** would occur.

Mitigation Measures

No mitigation measures are necessary.