Appendix F: Air Quality and Greenhouse Gas Analysis

June 21, 2016

Perry Hariri
Urban Dynamic, LLC
phariri@urbandynamicllc.com

Subject: Cypress Preserve Environmental Assessment: Final Air Quality and Greenhouse Analysis

Dear Mr. Hariri:

Ascent Environmental, Inc. (Ascent) appreciates this opportunity to assist with the air quality and greenhouse gas (GHG) analysis to support the Cypress Preserve Environmental Assessment. See Attachment A below for the Final Air Quality and Greenhouse Gas Analysis.

Please feel free to contact me directly at honey.walters@ascentenvironmental.com or at 530-574-0772 if you have any questions.

Sincerely,

Honey Walters
Principal

Attachment:

A Final Air Quality and Greenhouse Gas Analysis

ATTACHMENT A

Cypress Preserve Environmental Assessment

Final Air Quality and Greenhouse Gas Analysis

AIR QUALITY

Regulatory Background

The proposed project site is located in Contra Costa County, within the San Francisco Bay Area Air Basin (SFBAAB). Air quality within the project area is regulated by the U.S. Environmental Protection Agency (EPA) and the California Air Resources board (ARB) at the federal and state levels, respectively, and locally by the Bay Area Air Quality Management District (BAAQMD).

At the federal level, EPA implements the national air quality programs. EPA's air quality mandates are drawn primarily from the Federal Clean Air Act (CAA), enacted in 1970. The most recent major amendments were made by Congress in 1990. The CAA requires EPA to establish National Ambient Air Quality Standards (NAAQS). EPA has established primary and secondary NAAQS for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (i.e., respirable particulate matter [PM_{10}] and fine particulate matter [$PM_{2.5}$]), and lead (Pb). The primary standards protect public health and the secondary standards protect public welfare. The CAA also requires each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The Federal Clean Air Act Amendments (CAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. EPA reviews all state SIPs to determine whether they conform to the mandates of the CAA and its amendments and whether implementing them will achieve air quality goals. If EPA determines a SIP to be inadequate, a Federal Implementation Plan that imposes additional control measures may be prepared for the nonattainment area. If the state fails to submit an approvable SIP or to implement the plan within the mandated time frame, sanctions may be applied to transportation funding and stationary air pollution sources in the air basins.

Specifically, Section 176 (C) of the CAA (42 U.S.C. 7506 [C]) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the CAA (42 U.S.C. 7401 [a]) before the action is otherwise approved. In this context, conformity meant that such federal actions must be consistent with the SIP's purpose of the elimination or reduction the severity and number of violation of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action that is proposed by the agency and that is subject to the regulation implementing the conformity requirements would, in fact conform to the applicable SIP before the action is taken.

On November 30, 1993, EPA promulgated final general conformity regulations at 40 CFR 93 Subpart B for all federal activities except those covered under the transportation conformity. The general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutant and precursor emissions caused by the proposed action equal or exceed certain *de minimis* amounts; thus, requiring the federal agency to make a determination of general conformity. The manner in which this regulatory information applies to the proposed Cypress Preserve project (Proposed Action) is discussed below.

Affected Environment

EPA designates each county (or portions of counties) within California as attainment, maintenance, or nonattainment based on the area's ability to maintain ambient air concentrations below the applicable standards (i.e., NAAQS). Areas are designated as attainment if ambient air concentrations of a criteria pollutant (or precursor) are below the NAAQS. Areas are designated as nonattainment if ambient air concentrations are above the NAAQS. Areas previously designated as nonattainment that subsequently demonstrated compliance with the NAAQS are designated as maintenance. Table 1 shows the designation status of the primary study area located within the SFBAAB for each air pollutant.

Table 1 Attainment Status

Pollutant	Federal Classification
Ozone (Nitrogen Oxides [NO_X] and Volatile Organic Compounds [VOC])	Nonattainment (Marginal)
Respirable Particulate Matter (PM_{10})	Attainment
Fine Particulate Matter ($PM_{2.5}$)	Nonattainment (Moderate)[a] (2006 24-hr Standard) Attainment (1997 Annual Standard)
Carbon Monoxide (CO)	Maintenance (Moderate)
Nitrogen Dioxide (NO_2)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA 2015; BAAQMD 2010,2012, and 2014.

[a] In January 2013, EPA determined that the SFBAAB attained the $PM_{2.5}$ 24-hour federal standard; however, this determination is only applicable to State Implementation Planning requirements and is not applicable to the General Conformity Rule (EPA 2013, Kelly, pers. comm., 2015).

As mentioned above, a general conformity determination is required if a federal action results in the generation of air pollutants for which the total of direct and indirect emissions equals or exceeds the *de minimis* thresholds as shown below in Table 2. These emission rates are expressed in units of tons per year and are compared to the total of direct and indirect emissions caused by the project for each calendar year when construction activities would take place.

It should be noted that because ozone is a secondary pollutant (i.e., it is not emitted directly into the atmosphere, but formed in the atmosphere from the photochemical reactions in the presence of sunlight), its *de minimis* level is based on the primary emissions of precursor pollutants – NO_X and VOCs. If the net emissions of either NO_X or VOCs exceeds the *de minimis* level for ozone, the project is subject to a GCD. In addition, there are no *de minimis* levels for pollutants for which the SFBAAB is designated as an attainment area.

Table 2 *De Minimis* Thresholds for Determining Applicability of General Conformity Requirements for Federal Actions

Pollutant	Federal Classification	General Conformity *De Minimis* Levels (tons per year)
Ozone	Nonattainment (Marginal)	NA
VOC (as an ozone precursor)		100
NO_x (as an ozone precursor)		100
CO	Maintenance (Moderate)	100
$PM_{2.5}$	Nonattainment (Moderate) (2006 24-hour Standard) Attainment (1997 Annual Standard)	100

Source: EPA 2014, EPA 2015.

NA: Not Applicable

Environmental Consequences

Construction and operational emissions were calculated using a combination of model (e.g., the California Emissions Estimator Model [CalEEMod]) and off-model methods (e.g., the California Emissions Factors Database 2014 [EMFAC2014]) based on assumptions outlined in the project description, prescribed project attributes (see Table 5), and default model settings. The project attributes discussed in the Climate Change section below were specifically included to reduce GHG emissions from model defaults, but also have co-benefits in reducing criteria air pollutants from natural gas and mobile sources. See attached modeling results for further detail.

As shown in Table 3 and more detailed in Table 4, calculated emissions are below the *de minimis* thresholds for the SFBAAB; therefore, there would be **no adverse air quality impacts** associated with this Proposed Action and a conformity analysis pursuant to the CAA is not required.

Table 3 Unmitigated Combined Construction and Operational Annual Emissions for the Proposed Action (Criteria Air Pollutants)

Year	Activity	Tons per Year				
		VOC[a]	NO_X	CO	Exhaust PM_{10}	Exhaust $PM_{2.5}$
2017	Construction of Phase 1	0.19	0.74	7.74	0.02	0.02
2018	Construction of Phase 1	1.28	5.17	27.88	0.09	0.09
2019	Construction of Phase 1	1.49	6.98	33.59	0.12	0.12
2020	Construction of Phase 1	1.22	5.54	24.71	0.10	0.09
2021	Construction of Phase 1	1.02	4.16	18.25	0.07	0.07
2022	Construction of Phase 1	3.21	4.44	25.08	0.09	0.09
2023	Construction of Phase 1	6.95	1.99	14.07	0.05	0.05
2024	Construction of Phase 2 + Operation of Phase 1[b]	16.07	8.05	64.35	2.59	1.16
2025	Construction of Phase 2 + Operation of Phase 1[b]	16.31	9.49	72.21	2.62	1.19
2026	Construction of Phase 2 + Operation of Phase 1[b]	16.51	10.33	75.15	2.64	1.21
2027	Construction of Phase 2 + Operation of Phase 1[b]	16.48	10.25	73.33	2.63	1.20
2028	Construction of Phase 2 + Operation of Phase 1[b]	16.47	10.17	72.75	2.63	1.20
2029	Construction of Phase 2 + Operation of Phase 1[b]	16.57	9.80	70.61	2.62	1.19
2030	Construction of Phase 2 + Operation of Phase 1[b]	24.15	8.06	59.77	2.58	1.15
2031	Operation of Full Build-Out	29.09	8.71	78.88	4.87	2.12
	de minimis Threshold	100	100	100	NA	100
	Threshold Exceeded?	No	No	No	NA	No

Notes: Construction emissions based on calculations in CalEEMod using equipment assumptions within the CalEEMod model, the Road Construction Emissions Model, and information provided by the applicant. Emissions assume all construction equipment use Tier 4 Final engines and solar powered changeable message signs are used to direct traffic during construction. Emissions in bold exceed applicable thresholds.

BAAQMD = Bay Area Air Quality Management District, CO = carbon monoxide, CO_2=carbon dioxide, CO_2e=carbon dioxide equivalents, CH_4=methane, GHG=greenhouse gas, MT=metric tons, N_2O=nitrous oxide, PM_{10}=particulate matter, $PM_{2.5}$=fine particulate matter, ROG=reactive organic gases, TPY=tons per year, VOC=volatile organic compounds

[a] Emissions reported as ROG from CalEEMod and EMFAC2014 models, based on ARBs list of ROG emissions. However, EPA has a *de minimis* threshold for VOCs. Most pollutants between ARB's definition of ROG and EPA's definition of VOC overlap. Generally, most ROG emissions are included as a subset of VOCs. Thus, ROG is assumed to be a suitable substitute for VOC for the purposes of this analysis.

[b] Represents the overlap of activity between the operation of Phase 1 and the construction of Phase 2.

Source: Data compiled by Ascent Environmental in 2016.

Table 4 Detailed Unmitigated Operational Annual Emissions for the Proposed Action (Criteria Air Pollutants)

Source	Tons per Year				
	VOC[a]	NO_X	CO	Exhaust PM_{10}	Exhaust $PM_{2.5}$
Phase 1 (2017-2030)					
Mobile Sources – Light Duty[b]	6.09	4.98	42.51	2.31	0.98
Mobile Sources – Heavy Duty[b]	0.39	1.67	2.81	0.17	0.07
Building Natural Gas Use	0.04	0.31	0.14	0.02	0.02
Area Sources	9.20	0.10	9.09	0.06	0.06
Watercraft	<0.01	<0.01	0.01	<0.01	-
TOTAL	15.71	7.07	54.56	2.56	1.13
Build Out (2031)					
Mobile Sources – Light Duty[b]	8.51	5.29	57.31	4.38	1.82
Mobile Sources – Heavy Duty[b]	0.56	2.59	3.70	0.33	0.14
Building Natural Gas Use	0.07	0.63	0.30	0.05	0.05
Area Sources	19.94	0.20	17.56	0.11	0.11
Watercraft	<0.01	<0.01	0.02	<0.01	-
TOTAL	29.09	8.71	78.88	4.87	2.12
de minimis Threshold	100	100	100	NA	100
Threshold Exceeded?	No	No	No	NA	No

Notes: All emissions calculated from CalEEMod using data provided by the applicant, unless otherwise noted. Emissions in bold exceed applicable thresholds.

CO = carbon monoxide, CO_2=carbon dioxide, CO_2e=carbon dioxide equivalents, MT=metric tons, PM_{10}=particulate matter, $PM_{2.5}$=fine particulate matter, ROG=reactive organic gases, TPY=tons per year, VOC=volatile organic compounds

[a] Emissions reported as ROG from CalEEMod and EMFAC2014 models, based on ARBs list of ROG emissions. However, EPA has a *de minimis* threshold for VOCs. Generally, most ROG emissions are included as a subset of VOCs. Thus, ROG is assumed to be a suitable substitute for VOC.

[b] Mobile source emissions based on VMT data from Fehr and Peers and EMFAC2014 emission factors for each phase build out year. Vehicle activity generated by Cypress Preserve is assumed to be 96% light duty (less than 14,000 pounds of gross vehicle weight) and 4% heavy duty.

Source: Data compiled by Ascent Environmental in 2016

GLOBAL CLIMATE

Regulatory Background

An evolving body of laws, regulations, and case law, governs climate change and GHG emissions. Below are summaries of some of the key regulations that apply to the Proposed Action.

Federal

Supreme Court Ruling of Carbon Dioxide as Pollutant

EPA is the federal agency responsible for implementing the 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.

EPA has issued regulatory actions under the CAA as well as other statutory authorities to address climate change issues. In 2009, EPA issued a rule (40 CFR Part 98) for mandatory reporting of GHGs by large source

emitters and suppliers that emit 25,000 metric tons of carbon dioxide equivalent emissions ($MTCO_2e$) per year. The rule is intended to collect accurate and timely emission data to guide future policy decisions on climate change.

National Program to Cut Greenhouse Gas Emissions and Improve Fuel Economy for Cars and Trucks

On August 28, 2014, EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) finalized a new national program that would reduce GHG emissions and improve fuel economy for all new cars and trucks sold in the U.S. (NHTSA 2012). EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act. This proposed national program allows automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both Federal programs and the standards of California and other states. While this program will increase fuel economy to the equivalent of 54.5 miles per gallon for cars and light-duty trucks by Model Year 2025, additional phases are being developed by NHTSA and EPA that address GHG emission standards for new medium- and heavy-duty trucks (NHTSA 2014).

Council of Environmental Quality National Environmental Protection Agency Guidelines

The Council on Environmental Quality (CEQ) has provided revised draft guidance for federal lead agencies to address impacts of GHG emissions in regards to documentation required under the National Environmental Protection Act (NEPA). The draft guidelines provide that each federal agency has discretion to establish thresholds against which to assess the significance of an action's GHG and climate change effects. However, the draft guidance sets forth a reference point of 25,000 $MTCO_2e$ on an annual basis "below which a quantitative analysis of GHG emissions is not warranted[.]". (CEQ 2014). The Bureau of Reclamation has used 25,000 $MTCO_2e$ per year as a significance threshold for other projects under its jurisdiction (BOR 2013, 2014, and 2015).

State

The following state regulations would affect future project emissions.

Executive Order S-3-05

Executive Order 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 problems, the Executive Order established total GHG emission targets for the State. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

As described below, legislation was passed in 2006 (Assembly Bill 32, the California Global Warming Solutions Act of 2006 [AB 32]) to limit GHG emissions to 1990 levels by 2020 with continued "reductions in emissions" beyond 2020, but no specific additional reductions were enumerated in the legislation. Further, Senate Bill 375 (sustainable community strategies/transportation) established goals for emissions from light duty truck and automobiles for 2020 and 2035.

Executive Order B-30-15

On April 20, 2015 Governor Edmund G. Brown Jr. signed Executive Order B-30-15 to establish a California GHG reduction target of 40 percent below 1990 levels by 2030. The Governor's executive order 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 current target of reducing GHG emissions to 1990 levels by 2020, as established in the California Global Warming Solutions Act of 2006 (AB 32, discussed below). California's new emission reduction target of 40 percent below 1990 levels by 2030 will make it possible to reach the ultimate goal of reducing emissions 80 percent under 1990 levels by 2050. This is in line with the scientifically established levels needed in the U.S.

to limit global warming below 2 °C - the warming threshold at which there will likely be major climate disruptions such as super droughts and rising sea levels according to scientific consensus.

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

In September 2006, Governor Schwarzenegger signed 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 these reductions "...shall remain in effect unless otherwise amended or repealed. (b) It is the intent of the Legislature that the statewide greenhouse gas emissions limit continue in existence and be used to maintain and continue reductions in emissions of greenhouse gases beyond 2020. (c) The (Air Resources Board) 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]

Assembly Bill 32 Climate Change Scoping Plan and Update

In December 2008, ARB adopted its Climate Change Scoping Plan, which contains the main strategies California will implement to achieve reduction of approximately 118 million metric tons of carbon dioxide equivalent ($MMTCO_2$), or approximately 21.7 percent from the state's projected 2020 emission level of 545 $MMTCO_2e$ under a business-as-usual scenario (this is a reduction of 47 $MMTCO_2e$, or almost 10 percent, from 2008 emissions). ARB's original 2020 projection was 596 $MMTCO_2e$, but this revised 2020 projection takes into account the economic downturn that occurred in 2008. The Scoping Plan reapproved by ARB in August 2011 includes the Final Supplement to the Scoping Plan Functional Equivalent Document, which further examined various alternatives to Scoping Plan measures. The Scoping Plan also includes ARB-recommended GHG reductions for each emissions sector of the state's GHG inventory. ARB estimates the largest reductions in GHG emissions to be achieved by 2020 will be by implementing the following measures and standards:

- improved emissions standards for light-duty vehicles (estimated reductions of 26.1 $MMTCO_2e$);
- the Low-Carbon Fuel Standard (15.0 $MMTCO_2e$);
- energy efficiency measures in buildings and appliances (11.9 $MMTCO_2e$);
- a renewable portfolio and electricity standards for electricity production (23.4 $MMTCO_2e$); and
- the Cap-and-Trade Regulation for certain types of stationary emission sources (e.g., power plants).

In May 2014, ARB released and has since adopted the *First Update to the Climate Change Scoping Plan* to identify the next steps in reaching AB 32 goals and evaluate the progress that has been made between 2000 and 2012. According to the update, California is on track to meet the near-term 2020 GHG limit and is well positioned to maintain and continue reductions beyond 2020. The update also reports the trends in GHG emissions from various emission sectors.

As noted in the discussion of AB 32 above, ARB is tasked with making a recommendation for targets beyond 2020 as part of the legislation. ARB is currently working on a second update to the Scoping Plan to reflect the 2030 target established in Executive Order B-30-15. The State Legislature is currently considering a bill to establish overall GHG targets, along the lines provided in AB 32, for the period after 2020. However, no such bills have been passed as of this writing (March 2016).

Senate Bill 375

Senate Bill (SB) 375, signed by the Governor 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. ARB, 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 Metropolitan Transportation Commission (MTC) serves as the MPO for the nine counties in the SFBAAB, including Contra Costa County. MTC develops a long-range regional transportation and land-use blueprint, called Plan Bay Area, every four years. The current update effort started in spring 2015 and is called Plan Bay Area 2040. The existing Plan Bay Area was adopted jointly by the Association of Bay Area Governments (ABAG) and MTC in July 2013. The adopted Plan included a companion Environmental Impact Report (EIR) and supplemental documents.

Advanced Clean Cars Program

In January 2012, ARB 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 standards for vehicle model years 2017 through 2025. By 2025, when the rules will be fully implemented, the statewide fleet of new cars and light trucks will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions than the statewide fleet in 2016.

Senate Bill X1-2, the California Renewable Energy Resources Act of 2011

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.

Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015

In consideration of the approaching expiration of SB X1-2 goals, SB 350 of 2015 calls for 1) a new objective for procure 50 percent of the state's electricity from renewables by 2030 and 2) a doubling of statewide energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030 with annual targets established by the California Energy Commission (CEC).

California Building Efficiency Standards (Title 24, Part 6)

Buildings in California are required to comply with California's Energy Efficiency Standards for Residential and Nonresidential Buildings established by the CEC regarding energy conservation standards and found in Title 24, Part 6 of the California Code of Regulations. California's Energy Efficiency Standards for Residential and Nonresidential Buildings was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated on an approximately three-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 July 1, 2014 must follow the 2013 standards (CEC 2012). Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases GHG emissions. The CEC Impact Analysis for California's 2013 Building Energy Efficiency Standards estimates that the 2013 Standards are 23.3 percent more efficient than the previous 2008 standards for multi-family residential construction and 21.8 percent more efficient for non-residential construction (CEC 2013:3).

CEC adopted the 2016 Building Energy Efficiency Standards in 2015. The 2016 Title 24 standards will go into effect on January 1, 2017. For single-family residences, the 2016 Title 24 standards will result in about 28 percent less energy use for lighting, heating, cooling, ventilation and water heating than the 2013 Title 24 standards (CEC 2015a). For non-residential land uses, the 2016 standards would result in 5 percent less energy use than those built to 2013 standards (CEC 2015b).

See Appendix B for an analysis of Project compliance with relevant State and Federal regulatory programs established to achieve applicable greenhouse gas reduction goals.

Environmental Consequences

Method of Analysis

Construction and operational emissions were calculated using a combination of model (e.g., CalEEMod) and methods (e.g., EMFAC2014) based on assumptions outlined in the project description; default model settings; VMT estimates provided by Fehr and Peers; and conducted in accordance with EPA and ARB recommendations and guidelines (Fehr and Peers 2016). Default electricity CO_2 emission factors from CalEEMod were replaced with forecasted emission factors for PG&E for 2031 (262 lbs CO_2/MWh). This emissions factor was calculated assuming PG&E would maintain linear progress between a 33 percent renewable portfolio in 2020 and a 50 percent portfolio by 2050 based on SB X1-2 and SB 350 objectives (PG&E 2015). All other emission factors were provided by either CalEEMod (for construction and land-use emissions) or EMFAC2014 model defaults (for mobile source emissions).

Due in part to limitations in the CalEEMod software and VMT estimates, several adjustments were made to model defaults to incorporate the effect of various project attributes. These adjustments apply to operational emission estimates only and are discussed individually below. Construction emissions estimates did not require off-model adjustments.

Project Assumptions

As described in the project description, the following project design features and regulatory mandates would be implemented under the Proposed Action:

1. All buildings would be built to 2016 Building Energy Efficiency Standards under Title 24.
2. Low flow water fixtures would be installed in all facilities.
3. All residential and non-residential appliances would be electrically powered except for cooking appliances, which would be fueled by natural gas.
4. All major residential appliances would be Energy Star rated.
5. 11,198 new trees would be planted as part of the land use design
6. Transportation Demand Management (TDM) measures, such as shuttles to the future Antioch BART station, would be implemented to reduce vehicle activity.

Assumptions 2 through 6 are considered unique project attributes and the effects of these attributes over minimum building requirements are summarized in Table 5. Description of each project assumption and its effect on the project's annual GHG emissions is as follows.

Building Energy Efficiency Standard Updates

CalEEMod defaults assume buildings would adhere to the 2008 Title 24 Building Energy Efficiency Standards, which were updated in 2013 and 2016. Default electricity and natural gas use from CalEEMod were adjusted to be consistent with the 2016 standard. Based on CEC reports, residential and commercial buildings built to 2016 standards would use 48 and 34 percent less energy, respectively, than those built to 2008 standards (see Appendix C) (CEC 2013, 2015b). As mentioned, the 2016 standards apply to buildings permits filed on or after January 1, 2017. The 2019 standards, which are anticipated to take the final steps needed to achieve zero net energy in new residential construction, would apply to building permits filed in early 2020. However, because the 2019 standards have not yet been adopted, calculations conservatively assume that the 2016 building energy efficiency standards would apply. Under the 2016 Building Energy Efficiency Standards, the Proposed Action would use 10,097 MWh less electricity, 337,155 therms less natural gas, and 3,022 $MTCO_2e$ less emissions than if the project were built to 2008 standards.

In section 110.10 of the 2013 and 2016 Building Energy Efficiency Standards, the State requires all new single family residences and certain multi-family units and non-residential buildings to be "solar ready." This means that the applicable buildings would have the wiring and structural support needed for roof-top solar panels built into the construction. According to a CEC staff report released in May 2016, 9.2 percent of homeowners of newly constructed homes chose to install solar panels in the first quarter of 2016, and 25 percent chose to install solar panels if solar PV systems were offered as an option (CEC 2016:15-16). Another study by the California Utilities Statewide Codes and Standards Team estimated that solar penetration rates would increase over the long term up to 25 percent over a 30-year period based on current policies supporting renewables and the trajectory of solar market growth (CUSCST 2011: 93-96). As a conservative approach, this analysis assumes 10 percent of homeowners in Cypress Preserve would choose to install and operate solar panels. A 10 percent solar penetration rate would result in additional reductions of 1,017 $MTCO_2e$ per year under building energy emissions occurring under 2016 building standards. See Appendix C for detailed calculations.

Project Attributes

Low-Flow Water Fixtures

CalEEMod was used to estimate the effect of low-flow water fixtures on default project emissions. In the attached CalEEMod modeling results, the default operational emissions are labelled as "unmitigated" and Proposed Action emissions are labelled as "mitigated". The effect of low-flow water fixtures can be found in the "mitigated" scenario of the CalEEmod outputs. Low-flow water fixtures include low-flow bathroom and kitchen faucets, shower heads, toilets, and water efficient irrigation systems. CalEEMod estimates that low flow water fixtures would reduce annual water use by 56 million gallons per year and emissions by 94 $MTCO_2e$ per year. A detailed breakdown of water reductions by fixture are available in Appendix C.

All Electric Appliances except for Cooking

The Propose Action would operate electric-only appliances in both residential and non-residential land uses, except for appliances used for cooking. Although many appliances use electricity as their primary fuel source, natural gas is often used for space heating and water heating purposes. Switching natural gas appliances for electric appliances allows renewable electricity generation, such as from on-site solar panels, to be better used. Also, renewable natural gas sources are not as readily available. To estimate the energy and emissions implications of this attribute, total default natural gas use was subtracted by natural gas used for cooking and then converted to electricity, assuming equivalent energy units for estimation purposes (e.g. British thermal units). The share of natural gas used for cooking was available from residential and commercial survey data from the Energy Information Administration (EIA 2009a, 2009b). This attribute would result in an increase of 8,754,006 kWh of electricity and a reduction of 298,699 therms of natural gas per year from building energy emissions which result in a net decrease of 553 $MTCO_2e$ per year.

All Energy Star-Certified Appliances

All residential electric appliances would be Energy Star certified. Average annual energy savings per appliance were calculated from percent savings from equivalent non-Energy star-related appliances reported on the Energy Star website (Energy Star 2016a). Only savings from Energy Star certified electric clothes washers, clothes dryers, dishwashers, refrigerators, and water heater were quantified. Electric water heaters and dryers were assumed to use heat pump technology instead of standard electric heating, because heat pump technology has been shown to be far more efficient than those using standard electric heating elements. For example, typical Energy Star certified electric dryers use 20 percent less energy than conventional models, but those with heat pump technology can achieve approximately 50 percent less energy (Energy Star 2016a, Myers et. al. 2010). To calculate project-level savings, annual savings per appliance were multiplied by the total

number of proposed homes, assuming each residence has one of each appliance. This attribute would save 5,226,471 kWh and 627 $MTCO_2e$ per year. Individual appliance savings and other detailed calculations are shown in Appendix C.

New Tree Plantings

According to the project description, the Proposed Action would plant approximately 11,198 trees across the project site as part of residential, commercial, and open space land use design in accordance with the City of Oakley's landscape design requirements set forth in the East Cypress Corridor Specific Plan. As a conservative estimate, 10,000 new trees are assumed to be planted. Assuming miscellaneous tree species, CalEEMod estimates that these new trees would sequester 7,080 $MTCO_2$ per year.

Transportation Demand Management

The Proposed Action would implement feasible TDM measures, pursuant to Mitigation Measure 3.4-1 of the East Cypress Specific Plan EIR, to reduce vehicle-related emissions. The Proposed Action would include regular shuttles to the planned Antioch BART station for commuting residents of Cypress Preserve, implement a school bus program for the elementary schools planned as part of the project, and traffic calming designs for roadways on the project site. According to discussions with Fehr and Peers, who developed the VMT estimates for Cypress Preserve, such actions could result in a 3 to 5 percent reduction in VMT (Tellez, pers. comm., 2016). The VMT analysis for Cypress Preserve provided by Fehr and Peers does not include these reductions. Assuming a 4 percent reduction in VMT and using EMFAC 2014 emission factors, this project attribute would reduce default vehicle emissions by 766 $MTCO_2e$. See Appendix C for more details.

Summary of Project Assumptions

Model defaults estimate that the Proposed Action would result in annual emissions of 35,571 $MTCO_2e$ per year. Application of 2016 building standards, including conservative solar penetration rates, would reduce default emissions by 4,039 $MTCO_2e$ per year. The implementation of the five project attributes described above would reduce GHG emissions by 9,120 $MTCO_2e$ per year. Detailed calculations are shown in attached appendices and summarized in Table 5.

Table 5 Effect of Project Attributes and Assumptions on Model Default Emissions at Build Out (2031)

Project Assumption	Description	Annual Electricity Use (kWh)	Annual Natural Gas Use (therms)	Annual GHG Emissions ($MTCO_2e$)
Default Energy Use and Emissions				
Model Defaults	Uses CalEEMod to calculate emissions from building energy use, area sources, waste, and water use. CalEEMod assumes buildings are built to 2008 Building Energy Efficiency Standards. Separately calculates mobile source emissions from Fehr and Peers VMT estimates and EMFAC2014 emission factors. Includes electricity use in streetlights and stormwater pumping and amortized construction emissions over a 40-year lifetime.	23,687,832	738,525	35,571
2016 Energy Efficiency Standards	Calculates annual reductions from energy use between 2008 and 2016 Building Energy Efficiency Standards. Assumes energy efficiency improvements of 48% and 34% for residential and commercial land uses, respectively.	-10,097,475	-337,155	-3,022
Solar Penetration Rate	Reductions from default electricity use assuming a 10% penetration rate in residential land uses.	-8,470,662	-	-1,017
	Annual Energy Use and Emissions without Project Attributes	5,119,454	401,370	31,532
Reductions due to Project Attributes				
Low Flow Water Fixtures	Reductions associated with implementation of low-flow water fixtures and water efficient irrigation systems. Uses CalEEMod built-in assumptions. Reduces up-stream electricity use needed for conveyance, distribution, and treatment only.	0[a]	0[a]	-94
All Electric Appliances except for Cooking	Net change in energy use due to all electric appliances except for those used for cooking. Assumes any appliances that would have used natural gas as a default would use electricity instead, assuming the same energy efficiency.	-8,754,006	298,699	553
All Energy Star Appliances	Reductions associated with using Energy Star appliances instead of standard versions. Applies to clothes washers, clothes dryers, dishwashers, refrigerators, and water heaters only. Assumes dryers and water heaters use heat pump technology. Assumes electric only appliances.	5,226,471	0	627
New Tree Plantings	Carbon sequestration effects of 11,198 new trees that would be planted as part of the land use design.	0[b]	0[b]	-7,080
Transportation Demand Management	*Combined reductions associated with the following TDM measures.* *BART Shuttle/Transit service: Implements a shuttle service or transit service providing regular access between neighborhoods, shopping, and the planned BART station in Antioch.* *School Bus Program: Transports students to and from school.* *Traffic calming: Installs traffic calming designs, such as roundabouts.*	0[c]	0[c]	766
	Total Annual Reductions from Project Attributes	-3,527,536	298,699	9,120
	Annual Energy Use and Emissions with Project Attributes	8,647,232	102,671	22,411

Notes: CO_2e=carbon dioxide equivalents, GHG=greenhouse gas, MT=metric tons. Totals may not sum due to rounding.

[a] Does not result in electricity reductions from land use, but would result in emissions savings from upstream electricity use needed for water conveyance, distribution, and treatment. CalEEMod does not provide estimated electricity reduction.

[b] Would result in an increase in carbon sequestration potential from new trees. Would not affect electricity or natural gas use as long as trees are not designed primarily as shade trees.

[c] Would reduce gasoline and diesel fuel consumption in vehicles. Reductions in electric vehicle electricity use are negligible.

Source: Data compiled by Ascent Environmental in 2016.

Applicable Thresholds

As discussed above, CEQ has provided revised draft guidance for federal lead agencies to address impacts of GHG emissions in regards to documentation required under NEPA. The revised draft guidance sets forth a threshold of 25,000 $MTCO_2e$ below which project GHG emissions need not be quantified. Also, in 2009, EPA issued a rule (40 CFR Part 98) for mandatory reporting of GHGs by large source emitters and suppliers that emit 25,000 $MTCO_2e$ per year or more. The rule is intended to collect accurate and timely emission data to guide future policy decisions on climate change and, for purposes of this analysis, provides context for the amount of GHG emissions the EPA considers to result in an adverse input. Consistent with the CEQA draft guidance and the EPA's GHG reporting requirements, this analysis relies on 25,000 $MTCO_2e$ per year as an indication of the amount of project GHG emissions that could result in a significant adverse impact.

Analysis Results

As shown in Table 6 and detailed further in Table 7 below, annual GHG emissions during construction and operation of the Proposed Action would result in approximately 22,411 $MTCO_2e$ per year. This estimate accounts for all project attributes discussed above and includes amortized construction emissions assuming a 40-year lifespan. The estimated annual emissions would not exceed the selected threshold of 25,000 $MTCO_2e$ per year. Thus, there would be **no adverse climate change impacts** associated with this Proposed Action.

In the event that the project would be subject to the 2019 Building Energy Efficiency Standards, the operation of ZNE homes would reduce estimated emissions by another 688 $MTCO_2e$[1]. This estimate does not account of other potential improvements that would occur under the 2019 standards as they are not known at this time.

[1] Equivalent to the remaining emissions from residential land uses under the Proposed Action after all attributes have been applied.

Table 7 Detailed Unmitigated Operational Annual Emissions for the Proposed Action (Greenhouse Gases)

Table 6 Combined Construction and Operational Annual Emissions for the Proposed Action (Greenhouse Gases)

Year	Activity	$MTCO_2$/year	$MTCH_4$/year	MTN_2O/year[a]	$MTCO_2e$/year
2017	Construction of Phase 1	1,291	0.38	-	1,300
2018	Construction of Phase 1	4,093	0.80	-	4,113
2019	Construction of Phase 1	5,390	0.85	-	5,411
2020	Construction of Phase 1	4,003	0.46	-	4,014
2021	Construction of Phase 1	3,056	0.25	-	3,063
2022	Construction of Phase 1	4,126	0.56	-	4,140
2023	Construction of Phase 1	2,429	0.41	-	2,439
2024	Construction of Phase 2 + Operation of Phase 1[b]	13,898	24.26	0.07	14,526
2025	Construction of Phase 2 + Operation of Phase 1[b]	15,390	24.44	0.07	16,023
2026	Construction of Phase 2 + Operation of Phase 1[b]	15,990	24.41	0.07	16,622
2027	Construction of Phase 2 + Operation of Phase 1[b]	15,740	24.25	0.07	16,368
2028	Construction of Phase 2 + Operation of Phase 1[b]	15,654	24.23	0.07	16,282
2029	Construction of Phase 2 + Operation of Phase 1[b]	15,195	24.17	0.07	15,822
2030	Construction of Phase 2 + Operation of Phase 1[b]	13,498	23.85	0.07	14,117
2031	Operation of Full Build-Out	19,894	55.83	0.19	21,345
				Total Construction Emissions from 2017 through 2030	42,673
				Amortized Construction Emissions over a 40-year lifespan	1,067
				Total Operational Emissions at Full Build-Out with Amortized Construction Emissions	22,411
				CEQ Reporting Threshold	25,000

Notes: Construction emissions based on calculations in CalEEMod using equipment assumptions within the CalEEMod model, the Road Construction Emissions Model, and information provided by the applicant. Emissions assume all construction equipment use Tier 4 Final engines and solar powered signals. Emissions in bold exceed applicable thresholds.

CO = carbon monoxide, CO_2=carbon dioxide, CO_2e=carbon dioxide equivalents, CH_4=methane, GHG=greenhouse gas, MT=metric tons, N_2O=nitrous oxide, PM_{10}=particulate matter, $PM_{2.5}$=fine particulate matter, ROG=reactive organic gases, TPY=tons per year, VOC=volatile organic compounds

[a] N_2O emissions not available from CalEEMod for construction activity

[b] Represents the overlap of activity between the operation of Phase 1 and the construction of Phase 2.

Source: Data compiled by Ascent Environmental in 2016

Source	$MTCO_2$/ year	$MTCH_4$/ year	MTN_2O/ year	$MTCO_2e$/ year	Percent of total (%)
Phase 1 (2017-2030)					
Mobile Sources – Light Duty	11,904	0.35	-	11,913	91
Mobile Sources – Heavy Duty	1,394	0.04	0.00	1,395	11
Waste	356	21.03	<0.01	882	7
Building Electricity Use	416	0.04	0.01	420	3
Building Natural Gas Use	268	0.01	0.06	270	2
Water and Wastewater[b]	100	2.31	<0.01	175	1
Area Sources	101	0.02	<0.01	102	1
Streetlights[c]	6	0.00	<0.01	6	0
Gas Wells (3 wells)[d]	0	0.03	0.00	1	0
Stormwater pumping[c]	1	0.00	<0.01	1	0
Watercraft	<1	<0.01	<0.01	<1	0
Lost Carbon Sequestration[a]	-2,083	-	-	-2,083	-16
TOTAL	12,464	23.82	0.07	13,081	100
Build Out (2031)					
Mobile Sources - Light Duty	18,374	0.49	<0.01	18,386	86
Mobile Sources - Heavy Duty	2,497	0.06	<0.01	2,601	12
Waste	832	49.19	-	2,062	10
Building Electricity Use	1,027	0.09	0.03	1,027	5
Building Natural Gas Use	547	0.01	0.09	5,205	3
Water and Wastewater[b]	242	5.94	0.14	324	2
Area Sources	196	0.03	<0.01	197	1
Streetlights[c]	12	<0.01	<0.01	12	0
Gas Wells (3 wells)[d]	-	0.03	-	1	0
Stormwater pumping[c]	1	<0.01	<0.01	1	0
Watercraft	<1	<0.01	<0.01	<1	0
Lost Carbon Sequestration[a]	-3,835	-	-	-3,835	-18
TOTAL without Amortized Construction Emissions	19,894	55.83	0.19	21,345	100
Amortized Construction Emissions	1,067	-	-	1,067	-
TOTAL with Amortized Construction Emissions	20,956	55.99	0.19	22,411	-
			CEQ Reporting Threshold	25,000	

Notes: All emissions calculated from CalEEMod using data provided by the applicant, unless otherwise noted. Mobile source emissions based on VMT data from Fehr and Peers and EMFAC2014 emission factors for each phase build out year. Emissions in bold exceed applicable thresholds.

"-"= no emissions, CO_2=carbon dioxide, CO_2e=carbon dioxide equivalents, CH_4=methane, GHG=greenhouse gas, MT=metric tons, N_2O=nitrous oxide

[a] Based on a loss of 371 acres of grassland in Phase 1 and 753 acres of grassland at build-out and planting of 10,000 miscellaneous trees.

[b] Based on default water energy intensity factors in CalEEMod. Since estimated water energy use from CalEEMod is greater than the water pumping energy estimates from PMA, CalEEMod defaults are assumed to include pumping estimates from PMA.

[c] Calculated separately using annual electricity assumptions provided by PMA.

[d] Calculated based on maximum allowable leakage rates as permitted by BAAQMD for natural gas wells.

Source: Data compiled by Ascent Environmental in 2016

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