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# **APPENDIX G**

## CLIMATE CHANGE AND GHG EMISSIONS CALCULATIONS

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# **GREENHOUSE GAS EMISSIONS INVENTORY CALCULATIONS**

## **MOBILE SOURCE AND AREA SOURCE EMISSIONS – URBEMIS RESULTS ADJUSTMENTS**

Please refer to the URBEMIS model results. These results, reported in tons of CO<sub>2</sub> per year, were converted to CO<sub>2</sub> equivalent emissions using standard conversion factors. The converted emissions volumes are reported in metric tons per year.

The URBEMIS model does not provide estimates of other GHGs associated with combustion, namely CH<sub>4</sub> and N<sub>2</sub>O. Therefore, in order to account for emissions of these compounds, adjustments were made to the URBEMIS results. The adjustments also provide reporting of mobile source and area source emissions in terms of CO<sub>2</sub> equivalents and in metric tons per year rather than short tons. The following two tables illustrate the conversions made for mobile source and area source emissions reported by URBEMIS.

## **INDIRECT SOURCE GHG EMISSIONS FROM ELECTRICITY GENERATION**

### ***Electricity Used by Project Residential Units***

The California Energy Consumption Data Management System (ECDMS) includes energy consumption data for individual counties. In 2008, ECDMS data shows that residential development in San Benito County consumed approximately 120,000,000 kilowatt hours (kWh) of energy. U.S. Census data for 2008 indicate that there were approximately 17,827 housing

**Table GHG-4 Operational Motor Vehicle GHG Emissions**

Emissions Scenario	ITE Code	Units	Base Trip Rate (ADT/unit)	Annual CO <sub>2</sub> Emissions <sup>1</sup> (Tons CO <sub>2</sub> /Yr)	CO <sub>2</sub> to CO <sub>2</sub> e Ratio <sup>2</sup>	Annual CO <sub>2</sub> e Emissions (MTCO <sub>2</sub> e/yr)
Proposed Project Single Family Housing	210	220.00 DU	9.57	3,627	0.95	3,464

**Sources:**

1. Estimated CO<sub>2</sub> emissions from URBEMIS2007 Environmental Management Software.
2. U.S. Environmental Protection Agency, Emission Facts - Greenhouse Gas Emissions from a Typical Passenger Vehicle, (2005) 4. It is assumed that CO<sub>2</sub> accounts for 95% of the greenhouse gas emissions, while CH<sub>4</sub>, N<sub>2</sub>O, and HFCs account for 5% of emissions.

**Notes:**

- ADT Average daily trips
- CO<sub>2</sub> Carbon dioxide
- CO<sub>2</sub>e Carbon dioxide equivalent

**Area Source GHG Emissions**

Emissions Scenario	CO <sub>2</sub> Emission Factor GWP = 1 (kg/MMBtu)	CH <sub>4</sub> Emission Factor GWP = 21 (kg/MMBtu)	N <sub>2</sub> O Emission Factor GWP = 310 (kg/MMBtu)	Annual CO <sub>2</sub> Emissions <sup>4</sup> (Tons CO <sub>2</sub> /yr)	Annual CO <sub>2</sub> e Emissions (MTCO <sub>2</sub> e/yr)
Proposed Project					
Natural Gas <sup>1</sup>	56.06	0.005	0.0001	642.24	584.04
Landscape Maintenance <sup>2</sup>	70.88	0.011	0.0006	1.42	1.30
Hearths (Natural Gas) <sup>1</sup>	56.06	0.005	0.0001	179.21	162.97
Hearths (Wood) <sup>3</sup>	93.87	0.316	0.0042		-
<b>Subtotal</b>				<b>822.87</b>	<b>748.31</b>

**Sources:**

1. URBEMIS2007 uses a CO<sub>2</sub> emission factor of 120,000 pounds per million cubic feet for natural gas. This value was converted to kg/MMBtu based on 1.03 therms per cubic feet.
2. California Climate Action Registry, General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, (2009) 101, 103. Landscape maintenance equipment were assumed to be fueled with motor gasoline.
3. California Climate Action Registry, General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, (2009) 102, 103.
4. Estimated CO<sub>2</sub> emissions from URBEMIS2007 Environmental Management Software.

**Notes:**

CH <sub>4</sub>	Methane	MMBtu	Million British thermal units
CO <sub>2</sub>	Carbon dioxide	MT	Metric ton
CO <sub>2</sub> e	Carbon dioxide equivalent	N <sub>2</sub> O	Nitrous oxide
GWP	Global warming potential	yr	Year
kg	Kilogram		

units in the County. This data can be used to estimate that a single dwelling unit in the County consumed an average of approximately 6,732 kWh of energy in 2008. Using this factor, the 220 proposed residential units would create a total average demand for approximately 1,481,040 kWh per year of electricity or approximately 1,481 megawatt hours (MWh) per year for on-site use.

### ***Electricity Used To Transport and Treat Water and To Pump and Treat Wastewater***

Energy used in water pumping and wastewater treatment is a notable source of GHG emissions. Please refer to Section 3.12, Public Services, of the Draft EIR for information on project water demand and wastewater generation.

The Local Government Operations Protocol (LGOP) energy use factor for off-site water pumping is 1,450 kilowatt hours (kWh) per 1,000,000 gallons of water consumed. Water demand for the project is estimated at 71,550 gallons per day. This equates to approximately 26.1 million gallons of water per year and the associated energy use is estimated at approximately, 37,845 kWh per year, or approximately 38 MWh per year.

The proposed project is expected to generate approximately 60,818 gallons per day of wastewater. This equates to 22.2 million gallons per year. The LGOP energy demand factor for wastewater pumping and treatment is about 2,500 kWh per 1 million gallons of wastewater treated. Electricity demand from wastewater pumping and treatment would, therefore, be approximately 55,500 kWh per year or approximately 56 MWh per year.

#### **Estimated Annual Electricity Demand**

<b>Sources of Demand</b>	<b>Demand (MWh)/Year</b>
On-Site Electricity Use	1,481
Water Supply Transport and Treatment	38
Wastewater Pumping and Treatment	56
<b>Total</b>	<b>1,575</b>

*Source:* EMC Planning Group 2010

**GHG Emissions from Electricity Generation**

Projected Electricity Demand from Future Development (MWh)	GHG Type	GHG Emissions Factor (lbs/MWh) <sup>1</sup>	Global Warming Potential	CO <sub>2</sub> e(metric tons/yr) <sup>2</sup>
1,575	CO <sub>2</sub>	559.0	1	399
1,575	CH <sub>4</sub>	0.029	21	1
1,575	N <sub>2</sub> O	0.011	310	2
<b>Total</b>				<b>402</b>

Source: EMC Planning Group 2010

1. CO<sub>2</sub> factor from PG&E 2011; CH<sub>4</sub> and N<sub>2</sub>O factors from Local Government Operations Protocol, 2010.
2. CO<sub>2</sub> Equivalent is calculated as (electricity use) x (emissions factor) x (warming potential) / (2,204.62 lb/metric ton). Figures shown are rounded to the nearest metric ton.

**TOTAL PROJECT UNMITIGATED GHG EMISSIONS**

**Total Unmitigated GHG Operational Emissions (metric tons/year CO<sub>2</sub>e)**

GHG Emissions Source	GHG Emissions Volume
Mobile Sources	3,464
Area Source	748
Electricity Demand	402
Solid Waste	-----
Fugitive Emissions from Heating/Cooling Systems	-----
<b>Total</b>	<b>4,614</b>

Source: EMC Planning Group 2010

## Climate Change Scoping Plan Measures

**AB 32 Scoping Plan Measures (SPMs)**, lists CARB's preliminary recommendations for achieving GHG emissions reductions under AB 32 along with a brief description of the requirements and applicability.

### AB 32 Scoping Plan Measures (SPMs)

Scoping Plan Measure	Description
SPM-1: California Cap-and-Trade Program linked to Western Climate Initiative	Implement a broad-based cap-and-trade program that links with other Western Climate Initiative Partner programs to create a regional market system. Ensure California's program meets all applicable AB 32 requirements for market-based mechanisms. Capped sectors include transportation, electricity, natural gas, and industry. Projected 2020 business-as-usual emissions are estimated at 512 MTCO <sub>2e</sub> ; preliminary 2020 emissions limit under cap-and-trade program are estimated at 365 MTCO <sub>2e</sub> (29 percent reduction).
SPM-2: California Light-Duty Vehicle GHG Standards	Implement adopted Pavley standards and planned second phase of the program. AB 32 states that if the Pavley standards (AB 1493) do not remain in effect, CARB shall implement equivalent or greater alternative regulations to control mobile sources.
SPM-3: Energy Efficiency	Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts. The Scoping Plan considers green building standards as a framework to achieve reductions in other sectors, such as electricity.
SPM-4: Renewables Portfolio Standard	Achieve 33 percent Renewables Portfolio Standard by both investor-owned and publicly owned utilities.
SPM-5: Low Carbon Fuel Standard	CARB identified the Low Carbon Fuel Standard as a Discrete Early Action item and the final regulation was adopted on April 23, 2009. In January 2007, Governor Schwarzenegger issued Executive Order S-1-07, which called for the reduction of the carbon intensity of California's transportation fuels by at least 10 percent by 2020.
SPM-6: Regional Transportation-Related Greenhouse Gas Targets	Develop regional greenhouse gas emissions reduction targets for passenger vehicles. SB 375 requires CARB to develop, in consultation with metropolitan planning organizations (MPOs), passenger vehicle greenhouse gas emissions reduction targets for 2020 and 2035 by September 30, 2010. SB 375 requires MPOs to prepare a sustainable communities strategy to reach the regional target provided by CARB.
SPM-7: Vehicle Efficiency Measures	Implement light-duty vehicle efficiency measures. CARB is pursuing fuel-efficient tire standards and measures to ensure properly inflated tires during vehicle servicing.
SPM-8: Goods Movement	Implement adopted regulations for port drayage trucks and the use of shore power for ships at berth. Improve efficiency in goods movement operations.
SPM-9: Million Solar Roofs Program	Install 3,000 MW of solar-electric capacity under California's existing solar programs.
SPM-10: Heavy/Medium-Duty Vehicles	Adopt heavy- and medium-duty vehicle and engine measures targeting aerodynamic efficiency, vehicle hybridization, and engine efficiency.



Scoping Plan Measure	Description
SPM-11: Industrial Emissions	Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce greenhouse gas emissions and provide other pollution reduction co-benefits. Reduce greenhouse gas emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.
SPM-12: High Speed Rail	Support implementation of a high-speed rail (HSR) system. This measure supports implementation of plans to construct and operate a HSR system between Northern and Southern California serving major metropolitan centers.
SPM-13: Green Building Strategy	Expand the use of green building practices to reduce the carbon footprint of California’s new and existing inventory of buildings.
SPM-14: High GWP Gases	Adopt measures to reduce high global warming potential gases. The Scoping Plan contains 6 measures to reduce high-GWP gases from mobile sources, consumer products, stationary sources, and semiconductor manufacturing.
SPM-15: Recycling and Waste	Reduce methane emissions at landfills. Increase waste diversion, composting, and commercial recycling. Move toward zero-waste.
SPM-16: Sustainable Forests	Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation. The federal government and California’s Board of Forestry and Fire Protection have the regulatory authority to implement the Forest Practice Act to provide for sustainable management practices. This measure is expected to play a greater role in the 2050 goals.
SPM-17: Water	Continue efficiency programs and use cleaner energy sources to move water. California will also establish a public goods charge for funding investments in water efficiency that will lead to as yet undetermined reductions in greenhouse gases.
SPM-18: Agriculture	In the near-term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020. Increase efficiency and encourage use of agricultural biomass for sustainable energy production. CARB has begun research on nitrogen fertilizers and will explore opportunities for emission reductions.

Source: California Air Resources Board, *Climate Change Scoping Plan*, (2008).



Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: \\Emc-w23\emcdata\Projects\ENV Projects\500 Series\ENV-543 (Fairview Residential SEIR)\Technical Reports\AQ\Residential\Fairview\Gavilan.urb924

Project Name: Gavilan Fairview - Residential

Project Location: San Benito County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
2007 TOTALS (tons/year unmitigated)	0.08	0.61	0.33	0.00	4.03	0.04	4.07	0.84	0.03	0.87	48.29
2008 TOTALS (tons/year unmitigated)	3.86	3.08	5.65	0.00	1.67	0.20	1.86	0.35	0.18	0.53	529.01

AREA SOURCE EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	4.00	0.64	8.02	0.02	1.11	1.06	822.87

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	2.67	4.33	25.13	0.03	5.94	1.19	3,626.57

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
TOTALS (tons/year, unmitigated)	6.67	4.97	33.15	0.05	7.05	2.25	4,449.44

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>	<u>CO2</u>
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2008	3.86	3.08	5.65	0.00	1.67	0.20	1.86	0.35	0.18	0.53	529.01
Asphalt 12/28/2007-01/11/2008	0.04	0.14	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	11.96
Paving Off-Gas	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	5.73
Paving On Road Diesel	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.64
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59
Fine Grading 11/30/2007-01/11/2008	0.03	0.22	0.13	0.00	1.65	0.01	1.66	0.34	0.01	0.36	18.67
Fine Grading Dust	0.00	0.00	0.00	0.00	1.65	0.00	1.65	0.34	0.00	0.34	0.00
Fine Grading Off Road Diesel	0.03	0.22	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	17.84
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
Building 01/11/2008-08/22/2008	0.57	2.71	5.36	0.00	0.02	0.17	0.19	0.01	0.16	0.16	491.32
Building Off Road Diesel	0.37	2.11	1.21	0.00	0.00	0.15	0.15	0.00	0.14	0.14	181.87
Building Vendor Trips	0.02	0.28	0.22	0.00	0.00	0.01	0.01	0.00	0.01	0.01	40.21
Building Worker Trips	0.17	0.32	3.93	0.00	0.01	0.01	0.02	0.01	0.01	0.01	269.24
Coating 08/08/2008-09/05/2008	3.22	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.06
Architectural Coating	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.06

Phase Assumptions

Phase: Fine Grading 11/30/2007 - 1/11/2008 - Default Fine Site Grading Description

Total Acres Disturbed: 73.33

Maximum Daily Acreage Disturbed: 18.33

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

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On Road Truck Travel (VMT): 0

Off-Road Equipment:

- 1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day
- 1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day
- 1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day
- 3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day
- 1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 12/28/2007 - 1/11/2008 - Default Paving Description

Acres to be Paved: 18.33

Off-Road Equipment:

- 1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day
- 2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day
- 2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 1/1/2008 - 8/22/2008 - Default Building Construction Description

Off-Road Equipment:

- 1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day
- 3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day
- 1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day
- 3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day
- 1 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 8/8/2008 - 9/5/2008 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOx</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM2.5</u>	<u>CO2</u>
Natural Gas	0.04	0.50	0.21	0.00	0.00	0.00	642.24
Hearth	1.52	0.13	6.93	0.02	1.11	1.06	179.21
Landscape	0.16	0.01	0.88	0.00	0.00	0.00	1.42
Consumer Products	1.96						
Architectural Coatings	0.32						
TOTALS (tons/year, unmitigated)	4.00	0.64	8.02	0.02	1.11	1.06	822.87

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>ROG</u>	<u>NOX</u>	<u>CO</u>	<u>SO2</u>	<u>PM10</u>	<u>PM25</u>	<u>CO2</u>
Single family housing	2.67	4.33	25.13	0.03	5.94	1.19	3,626.57
TOTALS (tons/year, unmitigated)	2.67	4.33	25.13	0.03	5.94	1.19	3,626.57

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2020 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006



Summary of Land Uses

Land Use Type	Acres	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	73.33	9.57 dwelling units		220.00	2,105.40	18,658.69
					2,105.40	18,658.69

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	36.2	0.0	99.7	0.3
Light Truck < 3750 lbs	18.1	0.0	96.7	3.3
Light Truck 3751-5750 lbs	19.3	0.0	100.0	0.0
Med Truck 5751-8500 lbs	8.8	0.0	98.9	1.1
Lite-Heavy Truck 8501-10,000 lbs	2.0	0.0	75.0	25.0
Lite-Heavy Truck 10,001-14,000 lbs	1.2	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	1.1	0.0	18.2	81.8
Heavy-Heavy Truck 33,001-60,000 lbs	4.3	0.0	2.3	97.7
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.0	0.0	0.0	0.0
Motorcycle	7.6	40.8	59.2	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.2	0.0	83.3	16.7

Travel Conditions

Residential	Home-Shop	Home-Other	Commute	Non-Work	Customer
Home-Work	11.8	8.3	7.1	11.8	4.4
Urban Trip Length (miles)				4.4	4.4

Travel Conditions

	Residential				Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer	
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4	
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0	
% of Trips - Residential	32.9	18.0	49.1				

% of Trips - Commercial (by land use)