

UNINCORPORATED COUNTY OF MARIN

GREENHOUSE GAS INVENTORY FOR
UNINCORPORATED COMMUNITY EMISSIONS
FOR THE YEAR 2019

August 2021

Prepared by the
Marin Climate & Energy Partnership



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EXECUTIVE SUMMARY

THE TAKEAWAY:

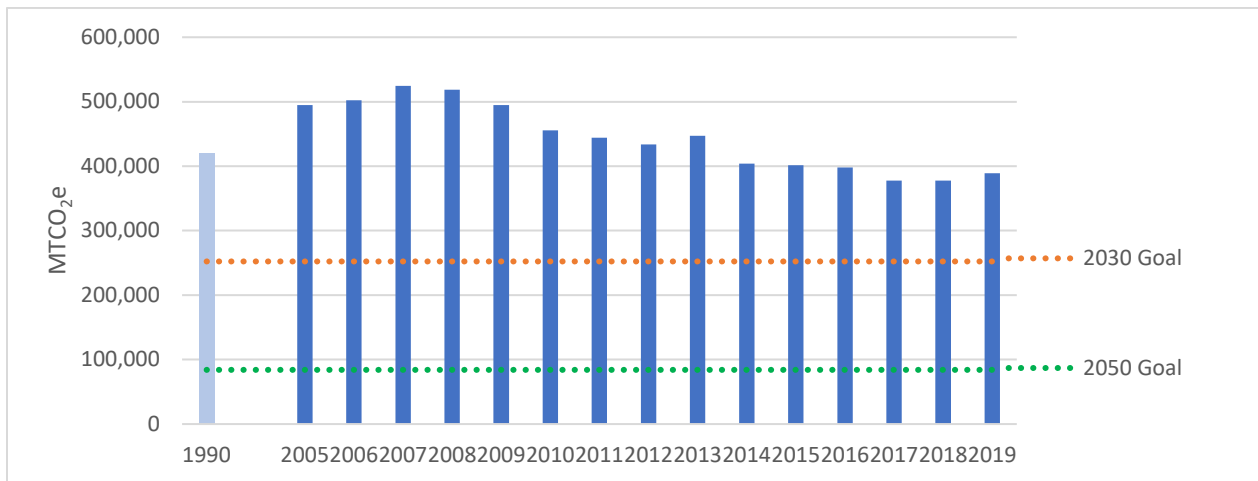
UNINCORPORATED MARIN'S
COMMUNITYWIDE EMISSIONS
DOWN 21% SINCE 2005

The County publishes annual community greenhouse gas (GHG) emissions estimates through the Marin Climate & Energy Partnership (MCEP). Annual inventories help the County to monitor its progress in meeting its Climate Action Plan (CAP) goal to reduce community emissions 40% below the 1990 level by 2030 through mitigation measures. The County's CAP goal also establishes targets for reducing emissions 60% below the 2005 level by 2030 through mitigation and sequestration measures. Ultimately, the County's goal

is to achieve carbon neutrality by 2045.

This report reviews emissions generated from the unincorporated Marin area ("the County") from 2005 through 2019, the most recent year data is available. The inventory shows that the County has reduced emissions 21% since 2005, which is equivalent to 7% below estimated 1990 levels. Emissions dropped from about 494,613 metric tons carbon dioxide equivalents (MTCO_{2e}) in 2005 to 389,023 MTCO_{2e} in 2019. The community emissions trend and targets are shown below. The County needs to reduce emissions another 136,770 MTCO_{2e} to meet its 2030 mitigation target and another 304,939 MTCO_{2e} to meet the State mitigation target for 2050, which is 80% below 1990 levels.

FIGURE 1: UNINCORPORATED COUNTY GREENHOUSE GAS EMISSIONS AND TARGETS



Recognizing the need for a collaborative approach to greenhouse gas reductions, town, city, and county leaders launched the Marin Climate and Energy Partnership (MCEP) in 2007. The County of Marin is a member of MCEP and works with representatives from the Marin cities and towns to address and streamline the implementation of a variety of greenhouse gas reduction measures. Funding for this inventory was provided by the Marin County Energy Watch Partnership, which administers public goods charges collected by PG&E. Community inventories are available on the MCEP website at marinclimate.org and are used to update the [Marin Sustainability Tracker](#).

INTRODUCTION

PURPOSE OF INVENTORY

The objective of this greenhouse gas emissions inventory is to identify the sources and quantify the amounts of greenhouse gas emissions generated by the activities of the unincorporated Marin communities in 2019. This inventory provides a comparison to 2005 emissions and estimated 1990 emissions and identifies the sectors where significant reductions in greenhouse gas emissions have occurred. In some instances, previous year emissions were updated with new data and/or recalculated to ensure the same methodology was employed for all inventory years.

GENERAL METHODOLOGY

This inventory uses national standards for the accounting and reporting of greenhouse gas emissions. The [U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, version 1.2 \(July 2019\)](#) was used for the quantification and reporting of community emissions. Quantification methodologies, emission factors, and activity and source data are detailed in the appendix.

Community emissions are categorized according to eight sectors:

- Built Environment - Electricity
- Built Environment – Natural Gas
- Transportation
- Off-Road Vehicles and Equipment
- Waste
- Water
- Wastewater
- Agriculture

CALCULATING EMISSIONS

Emissions are quantified by multiplying the measurable activity data – e.g., kilowatt hours of electricity, therms of natural gas, and gallons of diesel or gasoline – by emissions factors specific to the energy source. Most emissions factors are the same from year to year. Emission factors for electricity, however, change from year to year due to the specific sources that are used to produce electricity. For example, electricity that is produced from coal generates more greenhouse gases than electricity that is generated from natural gas and therefore has a higher emissions factor. Electricity that is produced solely from renewable energy sources such as solar and wind has an emissions factor of zero.

This inventory calculates individual greenhouse gases – e.g., carbon dioxide, methane and nitrous oxide – and converts each greenhouse gas emission to a standard metric, known as “carbon dioxide equivalents” or CO₂e, to provide an apple-to-apples comparison among the various emissions. Table 1 shows the greenhouse gases identified in this inventory and their global warming potential (GWP), a measure of the amount of warming each gas causes when compared to a similar amount of carbon dioxide. Methane, for example, is 28 times as potent as carbon dioxide; therefore, one metric ton of methane is equivalent to 28 metric tons of carbon dioxide. Greenhouse gas emissions are reported in this inventory as metric tons of carbon dioxide equivalents, or MTCO₂e.

TABLE 1: GREENHOUSE GASES

Gas	Chemical Formula	Emission Source	Global Warming Potential
Carbon Dioxide	CO ₂	Combustion of natural gas, gasoline, diesel, and other fuels	1
Methane	CH ₄	Combustion, anaerobic decomposition of organic waste in landfills and wastewater	28
Nitrous Oxide	N ₂ O	Combustion, wastewater treatment	265

Source: IPCC Fifth Assessment Report (2014)

TYPES OF EMISSIONS

Emissions from each of the greenhouse gases can come in a number of forms:

- **Stationary or mobile combustion** resulting from the on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat or electricity, or to power vehicles and equipment.
- **Purchased electricity** resulting from the generation of power from utilities outside the jurisdictional boundary.
- **Fugitive emissions** resulting from the unintentional release of greenhouse gases into the atmosphere, such as leaked refrigerants and methane from waste decomposition.
- **Process emissions** from physical or chemical processing of a material, such as wastewater treatment.

UNDERSTANDING TOTALS

The totals listed in the tables and discussed in the report are a summation of emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for due to a lack of data or robust quantification methods. For example, greenhouse gas emissions associated with air travel and the production of goods outside the community's boundary are not included in the inventory. Additionally, the community inventory does not include refrigerants released into the atmosphere from the use of air conditioning in cars and buildings.

COMMUNITY INVENTORY

COMMUNITY INVENTORY SUMMARY

In 2005, the activities taking place in unincorporated Marin County resulted in approximately 494,613 metric tons of CO₂e. In 2019, those activities resulted in approximately 389,023 metric tons of CO₂e, a reduction of 21% from 2005 levels, which is equivalent to 7% below estimated 1990 levels.

The community inventory tracks emissions in seven sectors:

- The **Built Environment – Electricity** sector represents emissions generated from the use of electricity in unincorporated Marin homes and commercial, industrial, and governmental buildings and facilities¹.
- The **Built Environment – Natural Gas** sector represents emissions generated from the use of natural gas in unincorporated Marin homes and commercial, industrial, and governmental buildings and facilities. Propane used as a primary heating source is also included, although it represents less than 1% of emissions in this sector.
- The **Transportation** sector includes tailpipe emissions from passenger vehicle trips originating and ending in unincorporated Marin areas, as well as a share of tailpipe emissions generated by medium and heavy-duty vehicles and buses travelling on Marin County roads. The sector also includes emissions from Marin Transit and Golden Gate Transit buses and the SMART train as these vehicles travel within the unincorporated area. Electricity used to power electric vehicles is embedded in electricity consumption reported in the Built Environment - Electricity sectors.
- The **Waste** sector represents fugitive methane emissions that are generated over time as organic material decomposes in the landfill. Although most methane is captured or flared off at the landfill, approximately 25% escapes into the atmosphere.
- The **Off-Road** sector represents emissions from the combustion of gasoline and diesel fuel from the operation of off-road vehicles and equipment used for construction and landscape maintenance.
- The **Water** sector represents emissions from energy used to pump, treat, and convey potable water from the water source to unincorporated Marin water users.
- The **Wastewater** sector represents stationary, process and fugitive greenhouse gases that are created during the treatment of wastewater generated by the community, as well as emissions created from electricity used to convey and treat wastewater.
- The **Agriculture** sector includes methane emissions from enteric fermentation and manure decomposition and treatment, and nitrogen oxide emissions from fertilizer application.

Table 2 shows how emissions in each sector have changed since 2005. The greatest reductions have occurred in the Built Environment - Electricity sector (-60,106 MTCO₂e), followed by the Transportation sector (-24,192 MTCO₂e) and the Built Environment – Natural Gas sector (15,600 MTCO₂e). The likely reasons for the largest emissions

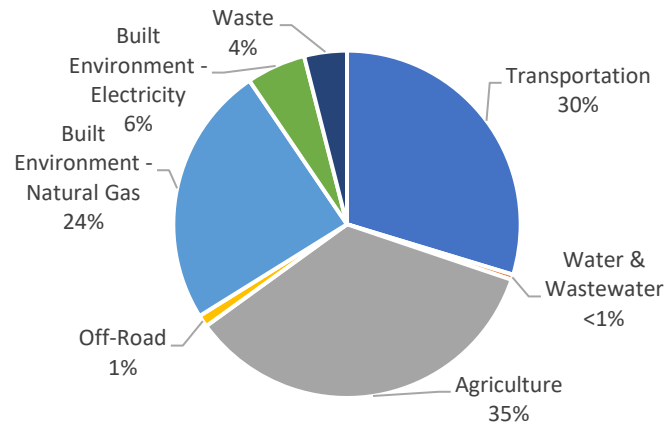
¹ Previous inventories categorized emissions from electricity, natural gas, and propane in the built environment according to the Residential and Non-Residential sectors. Beginning with this inventory, we are categorizing emissions in the built environment as Electricity and Natural Gas in order to align and better track with the Climate Action Plan's goals to electrify the built environment.

decreases are described in the remainder of this report. Figure 2 shows the relative contribution of emissions from these sectors in 2019. Agriculture is the largest sector, representing 35% of community emissions.

TABLE 2: EMISSIONS SUMMARY BY SECTOR (MTCO₂E), 2005 THROUGH 2019

Year	Built Environment - Electricity	Built Environment – Natural Gas	Transportation	Waste	Water	Wastewater	Off-Road	Agriculture	Total	% Change from 2005
2005	81,581	110,354	139,691	22,779	2,743	2,677	5,944	128,845	494,613	
2006	75,494	110,774	142,504	22,447	2,488	2,620	6,131	139,634	502,092	2%
2007	105,848	108,837	144,114	20,061	2,824	2,949	7,232	132,541	524,406	6%
2008	112,719	107,759	140,721	16,677	2,732	2,989	6,107	129,096	518,801	5%
2009	104,606	106,059	139,458	14,364	2,775	2,800	5,447	119,528	495,036	0%
2010	71,508	107,735	129,370	14,027	1,513	2,399	5,169	123,860	455,579	-8%
2011	64,684	109,730	129,161	13,748	1,104	2,433	5,139	118,147	444,145	-10%
2012	66,758	103,369	130,097	14,115	1,143	2,480	5,085	110,834	433,881	-12%
2013	61,723	103,201	129,957	14,173	1,310	2,477	5,001	129,132	446,974	-10%
2014	53,972	85,335	128,039	14,360	1,201	2,346	4,922	113,862	404,036	-18%
2015	51,839	85,423	126,599	14,901	947	2,319	4,830	114,823	401,682	-19%
2016	41,853	90,597	122,449	17,444	712	2,207	4,725	117,950	397,937	-20%
2017	20,784	92,993	120,182	18,250	233	1,982	4,608	118,665	377,696	-24%
2018	22,338	92,428	117,767	16,221	126	1,934	4,471	122,371	377,655	-24%
2019	21,475	94,754	115,499	15,476	110	1,797	4,328	135,585	389,023	-21%
Change from 2005	-60,106	-15,600	-24,192	-7,303	-2,633	-880	-1,616	6,740	-105,590	
% Change from 2005	-74%	-14%	-17%	-32%	-96%	-33%	-27%	5%	-21%	

FIGURE 2: EMISSIONS BY SECTOR, 2019

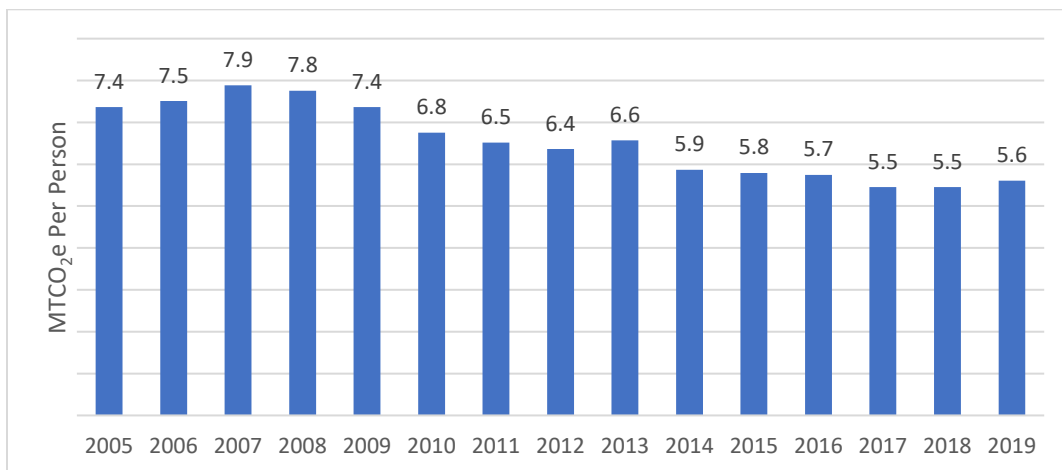


PER CAPITA EMISSIONS

Per capita emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one community’s emissions with neighboring cities and against regional and national averages. That said, due to differences in emission inventory methods, it can be difficult to produce directly comparable per capita emissions numbers. Per capita emission rates may be compared among Marin jurisdictions, although some jurisdictions may have higher rates due to the presence of commercial and industrial uses.

Dividing the total communitywide GHG emissions by residents yields a result of 7.4 metric tons CO₂e per capita in 2005. Per capita emissions decreased 24% between 2005 and 2019, falling to 5.6 metric tons per person. Figure 3 shows the trend in per capita emissions over time. It is important to understand that this number is not the same as the carbon footprint of the average individual living in Marin, which would include lifecycle emissions, emissions resulting from air travel, etc.

FIGURE 3: EMISSIONS PER CAPITA



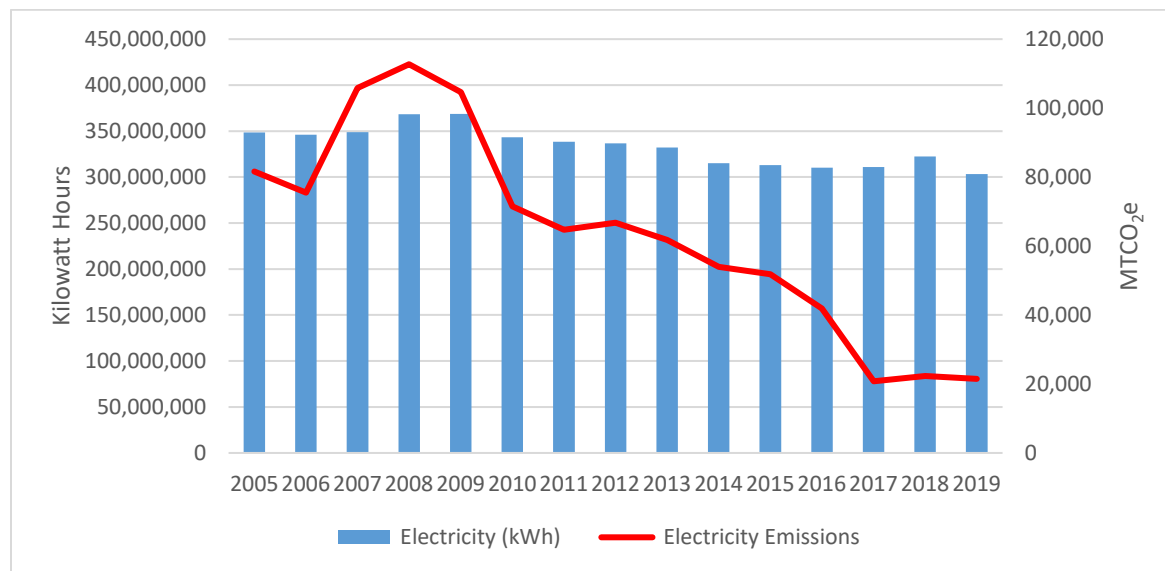
SECTOR SPOTLIGHTS

The following sections provide a year-by-year analysis of the changes in GHG emissions from some highlighted sectors: electricity, natural gas, transportation, waste, water use, and agriculture. Whenever possible, each section discusses the change in emissions from previous years and the likely influence of state and local programs or policies and external factors on reducing emissions.

BUILT ENVIRONMENT - ELECTRICITY

Electricity use in homes and businesses in unincorporated Marin decreased about 13% between 2005 and 2019. Greenhouse gas emissions from electricity consumption decreased 74% since 2005, as shown in Figure 4. This is primarily due to the lower carbon intensity of electricity. PG&E has been steadily increasing the amount of renewable energy in its electricity mix. In 2019, PG&E electricity came from a mix of renewable (29%), large hydroelectric (27%), and nuclear (44%) energy sources and was virtually GHG-free.² The carbon intensity of MCE Light Green electricity was more carbon intensive in 2019 than the previous two years but was still below the 10-year average. In 2019, about 15.6% of MCE electricity purchased by unincorporated Marin customers was 100% renewable Deep Green electricity. The County also purchases Deep Green for its government operations.

FIGURE 4: ELECTRICITY CONSUMPTION AND EMISSIONS



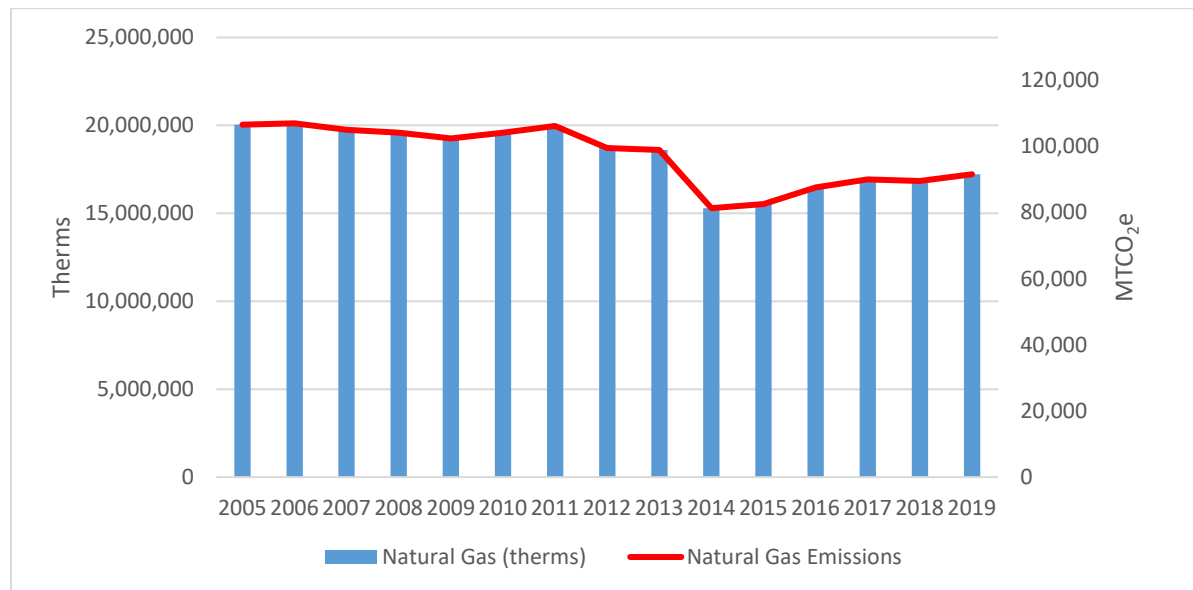
BUILT ENVIRONMENT - NATURAL GAS

Natural gas is used in residential and commercial buildings to provide space and water heating and power appliances. Use of natural gas is highly variable typically depending on the weather conditions. This variability has led natural gas use consumption in unincorporated Marin to fluctuate from year to year, from a high of 20.0 million therms in 2005 to a low of 15.3 million therms in 2014. Emissions from natural gas consumption increased 2% between 2018 and 2019. Overall, natural gas use has declined 14% since 2005. Residential natural gas consumption increased 3%

² PG&E, 2019 Power Mix, https://www.pge.com/pge_global/common/pdfs/your-account/your-bill/understand-your-bill/bill-inserts/2020/1220-PowerContent-ADA.pdf

between 2018 and 2019 and has dropped 9% since 2005. Natural gas consumption in commercial and industrial buildings and facilities is estimated to have increased 1% between 2018 and 2019 and to have decreased 26% since 2005.

FIGURE 5: NATURAL GAS CONSUMPTION AND EMISSIONS



Reduction in energy use may also be attributed to energy efficiency programs and rebates, the County’s local green building ordinance, and State building codes. California’s goal is to require all new residential and commercial buildings to be zero net energy by 2030.

TRANSPORTATION

Transportation activities accounted for approximately 30% of unincorporated Marin’s emissions in 2019. Vehicle miles traveled have increased 1% since 2005. Transportation emissions have decreased 17% due to more fuel-efficient and alternatively fueled vehicles (Figure 6). As shown in Figure 7, most transportation emissions come from passenger vehicles, accounting for 85% of transportation emissions in 2019. Marin County continues to be a leader in zero emission vehicles (ZEVs) – second only to Santa Clara County – with 8,600 ZEVs in Marin at the end of 2019, or about 4% of registered automobiles. ZEVs include battery electric cars, plug-in hybrid electric cars, hydrogen fuel cell cars, and zero-emission motorcycles.

While it is difficult to pinpoint exactly how each land use and transportation policy affects emissions, the County has undertaken many efforts to reduce transportation emissions. The County encourages workforce housing and has made it easier for residents to use carbon-free modes of transportation, such as bicycling and walking, through improvements to the transportation network.

FIGURE 6: VEHICLE MILES TRAVELED AND TRANSPORTATION EMISSIONS

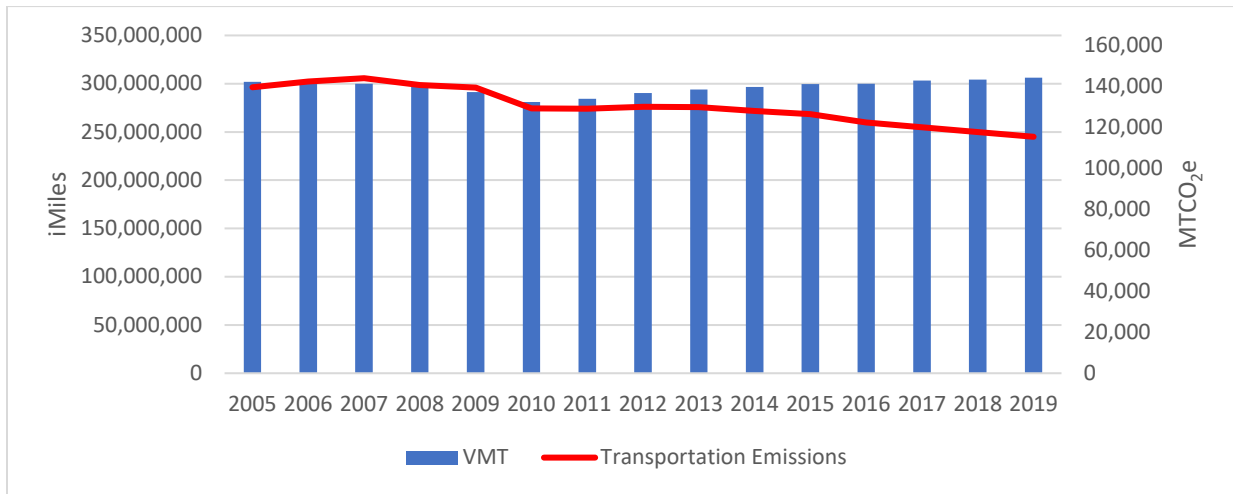
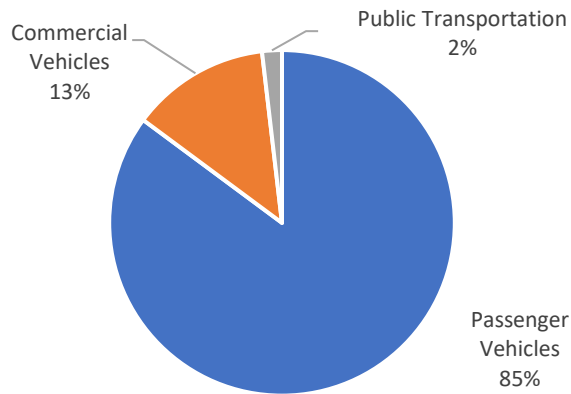


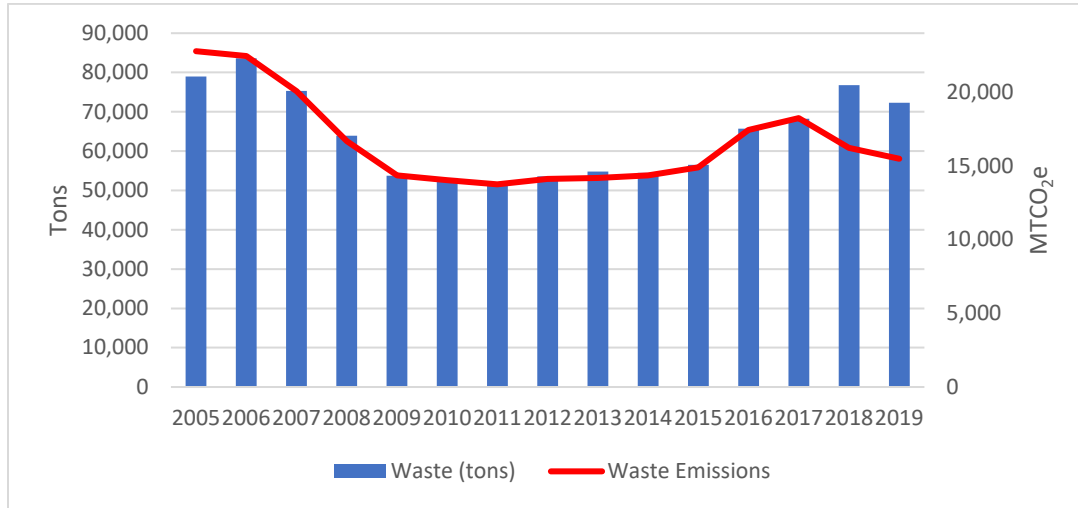
FIGURE 7: TRANSPORTATION EMISSIONS BY VEHICLE TYPE, 2019



WASTE

Waste generated by the community hit a low in 2011 but has since increased from that level as shown in the chart below (based on countywide disposal data). Landfilled waste decreased 6% between 2018 and 2019 and was 8% below 2005 levels in 2019. Emissions from waste disposal decreased 32% primarily due to the lower organic content landfilled waste and material used for alternative daily cover.

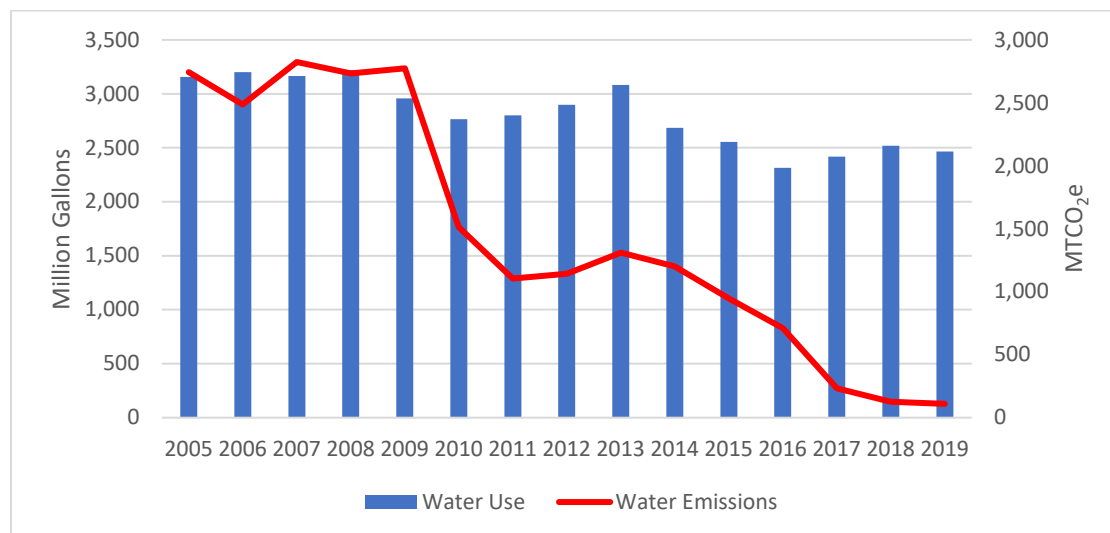
FIGURE 8: DISPOSED WASTE AND EMISSIONS



WATER

The Marin Municipal Water District (MMWD) and the North Marin Water District (NMWD) serve most of the water customers in unincorporated Marin. Water consumption declined 22% between 2005 and 2019. Emissions, which are based on an estimate of energy used to pump, treat, and convey water from the water source to the water users, dropped 96% between 2005 and 2019 (Figure 9). The additional reduction is due to the lower carbon intensity of electricity. Both MMWD and NMWD purchases MCE Deep Green for their electricity needs, and the Sonoma County Water Agency (SCWA), which supplied approximately 24% of MMWD’s water and 59% of NMWD’s water in 2019, uses renewable and carbon-free sources for its electricity needs; a small amount of emissions comes from stationary and mobile combustion of fuels used in SCWA’s operations.

FIGURE 9: WATER USE AND EMISSIONS



MMWD and NMWD provide rebates and programs to reduce water use. MMWD provides rebates to replace fixtures with high-efficiency clothes washers and to purchase cisterns and rain barrels. MMWD also provides free home and landscape water-use evaluations as well as free high-efficiency showerheads and faucet aerators.

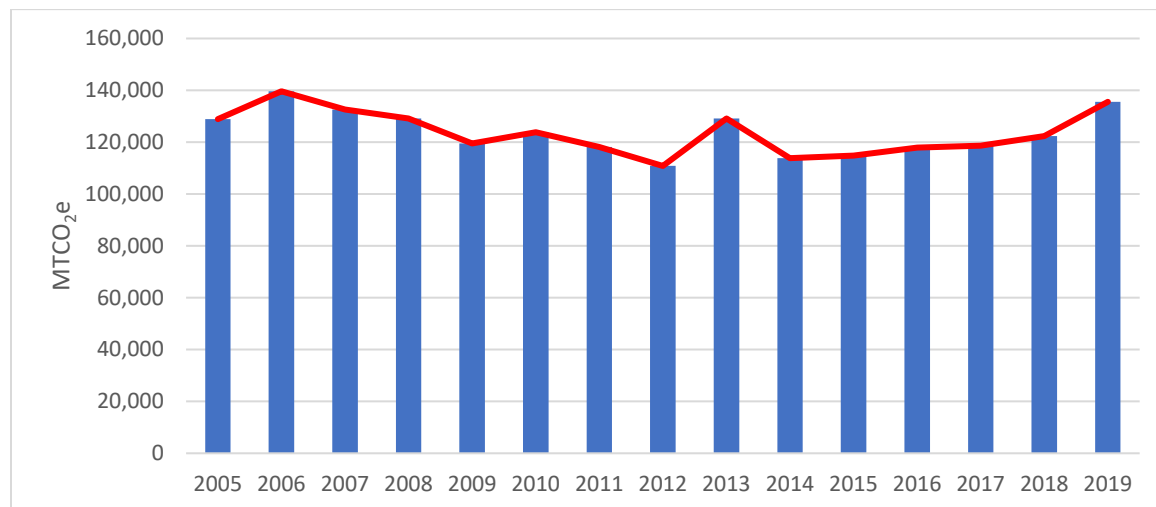
NMWD provides rebates to replace fixtures with high-efficiency toilets and clothes washers, and to purchase pool covers, hot water recirculating systems, water-efficient landscapes, graywater systems, and rain barrels. NMWD provides free home and landscape water-use evaluations.

AGRICULTURE

Of all the local CAPs in Marin, the unincorporated County's is the only one to include emissions from agriculture. This sector includes GHG emissions from manure management (fugitive emissions of methane and nitrous oxide), enteric fermentation (fugitive emissions of methane and nitrous oxide), and fertilizer use (fugitive emissions of nitrous oxide). Agricultural emissions have increased 5% since 2005. (Figure 10). Emissions from enteric fermentation and the management of manure make up the biggest share and hence drive agricultural emissions. Emissions reductions from carbon sequestration, which are quantified in the CAP, are not balanced against agricultural emissions here.

Certain agricultural variables, such as composition of feed for cattle or chickens, can significantly alter livestock emissions factors. Detailed data on how feed proportions have changed since 2012 was not collected for the GHG assessment. As a proxy, emissions factors used in the 2012 inventory are assumed are used for all inventory years. As a result, emissions are dependent upon livestock counts and acreage under agricultural production. Livestock counts, in particular, can vary significantly from year to year, and some are estimated due to privacy concerns.

FIGURE 10: AGRICULTURE EMISSIONS



APPENDIX: COMMUNITY INVENTORY

Community GHG Emissions Summary Table

Jurisdiction: Unincorporated County of Marin

Inventory Year: 2019

Population: 69,343 in 2019 (CA Department of Finance)

Number of Households: 26,421 (CA Department of Finance)

Date Prepared: July 29, 2021

Reporting Framework: Communitywide Activities

ID	Emissions Type	Source or Activity	Included, Required Activities	Included, Optional Activities	Excluded (IE, NA, NO or NE)	Notes	Emissions (MTCO ₂ e)
1.0	Built Environment						
1.1	Use of fuel in residential and commercial stationary combustion equipment	Both	•				94,754
1.2	Industrial stationary sources	Source			NE		
1.3	Power generation in the community	Source			NO		
1.4	Use of electricity in the community	Activity	•			Includes transmission and distribution losses	21,475
1.5	District heating/cooling facilities in the community	Source			NE		
1.6	Use of district heating/cooling facilities in the community	Activity			NE		
1.7	Industrial process emissions in the community	Source			NO		
1.8	Refrigerant leakage in the community	Source			NE		
2.0	Transportation and Other Mobile Sources						
2.1	On-road passenger vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.2	On-road passenger vehicles associated with community land uses	Activity	•				98,008
2.3	On-road freight and service vehicles operating within the community boundary	Source			IE	Obtained data for preferred activity-based method instead	
2.4	On-road freight and service vehicles associated with community land uses	Activity	•				14,955
2.5	On-road transit vehicles associated with community land uses	Activity		•			2,132
2.6	Transit rail vehicles operating with the community boundary	Source			NO		403
2.7	Use of transit rail travel by the community	Activity			NE		

2.8	Inter-city passenger rail vehicles operating within the community boundary	Source			NO		
2.9	Freight rail vehicles operating within the community boundary	Source			NO		
2.10	Marine vessels operating within the community boundary	Source			NE		
2.11	Use of ferries by the community	Activity			NE		
2.12	Off-road surface vehicles and other mobile equipment operating within the community boundary	Source		•			4,328
2.13	Use of air travel by the community	Activity			NE		
3.0	Solid Waste						
3.1	Operation of solid waste disposal facilities in the community	Source			NE		
3.2	Generation and disposal of solid waste by the community	Activity	•			Includes alternative daily cover	15,476
4.0	Water and Wastewater						
4.1	Operation of water delivery facilities in the community	Source			IE	Energy use is included in 1.1 and 1.4.	
4.2	Use of energy associated with use of potable water by the community	Activity	•				110
4.3	Use of energy associated with generation of wastewater by the community	Activity	•				85
4.4	Process emissions from operation of wastewater treatment facilities located in the community	Source			NE		
4.5	Process emissions associated with generation of wastewater by the community	Activity	•				878
4.6	Use of septic systems in the community	Source			NE		919
5.0	Agriculture						
5.1	Domesticated animal production	Source		•			72,694
5.2	Manure decomposition and treatment	Source		•			62,512
6.0	Upstream Impacts of Communitywide Activities						
6.1	Upstream impacts of fuels used in stationary applications by the community	Activity			NE		
6.2	Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community	Activity			IE	Transmission and distribution losses included in 1.4.	
6.3	Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	Activity			IE	Included in 4.2 and 4.3.	
6.4	Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community.	Activity			NE		

Legend

IE – Included Elsewhere: Emissions for this activity are estimated and presented in another category of the inventory. The category where these emissions are included should be noted in the explanation.

NE – Not Estimated: Emissions occur but have not been estimate or reported (e.g., data unavailable, effort required not justifiable).

NA – Not Applicable: The activity occurs but does not cause emissions; explanation should be provided.

NO – Not Occurring: The source or activity does not occur or exist within the community.

Community Emissions Data Sources and Calculation Methodologies

Sector/ID	Emissions Source	Source and/or Activity Data	Emission Factor and Methodology
1.0 Built Environment			
1.1 Stationary Combustion	Stationary Combustion (CO ₂ , CH ₄ & N ₂ O)	Known and estimated fuel use (meter readings by PG&E) and estimated fuel use (American Community Survey 5-Year Estimates, and U.S. Energy Information Administration Household Site Fuel Consumption data).	Default CO ₂ , CH ₄ & N ₂ O emission factors by fuel type (U.S. Community Protocol v. 1.1 Tables B.1 and B.3). U.S. Community Protocol v. 1.1, Appendix C, Method BE.1.1 and BE.1.2.
1.4 Electricity Use	Electricity Use (CO ₂ , CH ₄ & N ₂ O)	Estimated and known electricity use (meter readings by PG&E and MCE) and estimated direct access electricity consumption.	Verified utility-specific emission factors (PG&E and MCE) and eGrid subregion default emission factors. U.S. Community Protocol v. 1.1, Appendix C, Method BE.2.1.
	Electric Power Transmission and Distribution Losses (CO ₂ , CH ₄ & N ₂ O)	Estimated electricity grid loss for Western region from eGrid.	U.S. Community Protocol v. 1.1, Appendix C, Method BE.4.1.
2.0 Transportation and Other Mobile Sources			
2.2 On-Road Passenger Vehicle Operation	On-Road Mobile Combustion (CO ₂)	Estimated passenger vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CO ₂ for on-road passenger vehicles quantified in the EMFAC2017 model. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
	On-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated vehicle miles traveled associated with origin and destination land uses (Metropolitan Transportation Commission, http://capvmt.us-west-2.elasticbeanstalk.com/data).	CH ₄ and N ₂ O for on-road passenger vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. Passenger vehicle emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.1.A.
2.4 On-Road Freight and Service Truck Freight Operation	On-Road Mobile Combustion (CO ₂)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing the 2017 Regional Transportation Plan).	CO ₂ for on-road commercial vehicles quantified in the EMFAC2017 model. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
	On-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated commercial vehicle miles traveled within the boundary (Metropolitan Transportation Commission utilizing Plan Bay Area 2040 and the 2017 Regional Transportation Plan).	CH ₄ and N ₂ O for on-road commercial vehicles quantified in the EMFAC2017 model and adjusted for IPCC AR5 100-year values. Emissions allocated utilizing LEHD data according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.2.A.
2.5 On-Road Transit Operation	On-Road Mobile Combustion (CO ₂)	Estimated vehicle miles traveled within the boundary (Marin Transit and Golden Gate Transit) and estimated diesel fuel efficiency for transit fleet (Golden Gate Transit). Fuel type provided by Marin Transit and Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN . U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.A.
	On-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated vehicle miles traveled within the boundary (Marin Transit and Golden Gate Transit) and estimated diesel fuel efficiency for transit fleet (Golden Gate Transit). Fuel type provided by Marin Transit and Golden Gate Transit.	Renewable diesel emission factor provided by NEXGEN . U.S. Community Protocol v. 1.1, Appendix D, Method TR.4.B.

2.6 Passenger Rail	Mobile Combustion (CO ₂ , CH ₄ & N ₂ O)	Estimated train-miles by multiplying the number of train cars per day (in both directions, according to the SMART published schedule) by the railway track mileage located within the community boundary (Marin Map). Average Diesel Multiple Unit fuel efficiency provided by SMART.	U.S. Community Protocol v. 1.1, Appendix D, Method TR.5. Emission factors from Equation TR.5.2.
2.12 Off-Road Vehicles and Equipment	Off-Road Mobile Combustion (CO ₂)	Estimated fuel use from OFFROAD 2007 for Lawn and Garden and from OFFROAD2017 for Construction and Agriculture equipment. All categories are allocated by share of countywide households.	CO ₂ emissions calculated according U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in Table TR.1.6.
	Off-Road Mobile Combustion (CH ₄ & N ₂ O)	Estimated fuel use from OFFROAD 2007 for Lawn and Garden and from OFFROAD2017 for Construction and Agriculture equipment. All categories are allocated by share of countywide households.	CH ₄ and N ₂ O emissions calculated according to U.S. Community Protocol v. 1.1, Appendix D, Method TR.8. Emission factors provided in the Local Government Operations Protocol Table G.11 and G.14.
3.0 Solid Waste			
3.2 Solid Waste Generation and Disposal	Fugitive Emissions from Landfilled Waste (CH ₄)	Estimated landfilled tons based on reporting to CalRecycle by Marin County Solid and Hazardous Waste JPA and allocated to jurisdiction based on share of countywide population. Waste characterization based on the Statewide Waste Characterization Study (2008 , 2014 and 2018) and Alternative Daily Cover by Jurisdiction of Origin and Material Type as reported to CalRecycle.	Emission factors calculated utilizing U.S. Community Protocol for Accounting and Report of Greenhouse Gas Emissions, Version 1.1, July 2013, Appendix E, Method SW.4.
4.0 Water and Wastewater			
4.2 Water Supply & Conveyance, Treatment and Distribution	Electricity Use (CO ₂)	Water consumption (district-wide gpcd) and electricity usage provided by Marin Municipal Water District (MMWD) and North Marin Water District (NMWD). Water consumption for Stinson Beach Water District estimated based on 2012 inventory. Electricity use for Stinson Beach Water District estimated using CEC report, "Refining Estimates of Water-Related Energy Use in California," 2006. Assumed 3,500 kWh /MG. Sonoma County Water Agency (SCWA) water delivery amount provided by SCWA .	Verified utility-specific emission factors (PG&E, MCE and SCWA). Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.
	Electricity Use (CH ₄ & N ₂ O)	Water consumption (district-wide gpcd) and electricity usage provided by Marin Municipal Water District (MMWD) and North Marin Water District (NMWD). Water consumption for Stinson Beach Water District estimated based on 2012 inventory. Electricity use for Stinson Beach Water District estimated using CEC report, "Refining Estimates of Water-Related Energy Use in California," 2006. Assumed 3,500 kWh /MG.	eGrid subregion default emission factors. Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.14.

4.5 Treatment of Wastewater	Stationary Emissions from Combustion of Digester Gas (CH ₄)	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Sewerage Agency of Southern Marin (SASM), Central Marin Sanitation Agency, Sausalito-Marín City Sanitation Agency, and Novato Sanitary District. Known amount of digester gas produced per day (2016) and known percent of methane in digester gas (2017) provided by Las Gallinas Valley Sanitary District. Estimated service population and percent of methane in digester gas provided by Sanitary District No. 5.	SASM emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.1.a. Sanitary District No.5 emissions calculated according to Method WW.1.(alt).
	Stationary Emissions from Combustion of Digester Gas (N ₂ O)	Known amount of digester gas produced per day and known percent of methane in digester gas provided by Sewerage Agency of Southern Marin (SASM), Central Marin Sanitation Agency, Sausalito-Marín City Sanitation Agency, and Novato Sanitary District. Known amount of digester gas produced per day (2016) and known percent of methane in digester gas (2017) provided by Las Gallinas Valley Sanitary District. Estimated service population and percent of methane in digester gas provided by Sanitary District No. 5.	SASM emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.2.a. Sanitary District No.5 emissions calculated according to Method WW.2.(alt).
	Process Emissions from Wastewater Treatment Plant without Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by SASM and Central Marin Sanitation Agency.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.8.
	Process Emissions from Wastewater Treatment Plant with Nitrification or Denitrification	Estimated population served by wastewater treatment plant provided by Sanitary District No. 5, Las Gallinas Valley Sanitary District, Sausalito-Marín City Sanitation Agency, and Novato Sanitary District.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.7.
	Fugitive Emissions from Effluent Discharge (N ₂ O)	Estimated population served by wastewater treatment plant provided by SASM, Sanitary District No.5, Central Marin Sanitation Agency, Sausalito-Marín City Sanitation Agency, and Novato Sanitary District. Assumed significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12(alt).
	Fugitive Emissions from Effluent Discharge (N ₂ O)	Estimated population served by wastewater treatment plant provided by Las Gallinas Valley Sanitary District. Assumed no significant industrial or commercial input.	Emissions calculated according to U.S. Community Protocol v. 1.1, Appendix F, Method WW.12.
5.0 Agriculture			
5.1	Domesticated animal production	Estimated livestock population from the County of Marin Department of Agriculture, Weights and Measures.	Emissions calculated according to 2015 CAP inventory method.
5.2	Manure decomposition and treatment	Estimated livestock population from the County of Marin Department of Agriculture, Weights and Measures.	Emissions calculated according to 2015 CAP inventory method.