Pinecrest Village

2018 Inventory of Communitywide and Government Operations Greenhouse Gas Emissions

April 2020

Produced by the Pinecrest Office of the Village Manager
With Assistance from ICLEI - Local Governments for Sustainability USA

Credits and Acknowledgements

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ICLEI-Local Governments for Sustainability USA

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Executive Summary

The Village of Pinecrest recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, wellbeing, and prosperity of our community.

Pinecrest has a long history of commitment of sustainability, including the following activities:

- Development of three previous greenhouse gas inventories (2010, 2012, and 2014), 2016 Climate Action Plan, 2009 Green Action Plan, 2010 Strategic Action Plan Sustainability Element, 2010 Going Green Conference
- Establishment of the first free municipal electric vehicle fast charging station, a green procurement policy, green regulations and sustainable building ordinances, the Earth Day Festival, the Climate Action Rally, Sustainability Fund, and a PACE District
- Commitment to the Climate Action Compact with Miami-Dade County Public Schools and a collaborative relationship with CLEO Institute.

This report presents Pinecrest's fourth inventory of greenhouse gas emissions from the community as a whole, as well as from the Village's government operations in the year 2018.

Key Findings

Figure ES-1 shows communitywide emissions by sector. The largest contributor is transportation and mobile sources with 62% of emissions. The next largest contributors are residential energy (16%) and commercial energy (17%). Actions to reduce emissions in all of these sectors will be a key part of any future climate action efforts. Water & wastewater and solid waste were responsible for the remaining (less than 6%) of emissions.

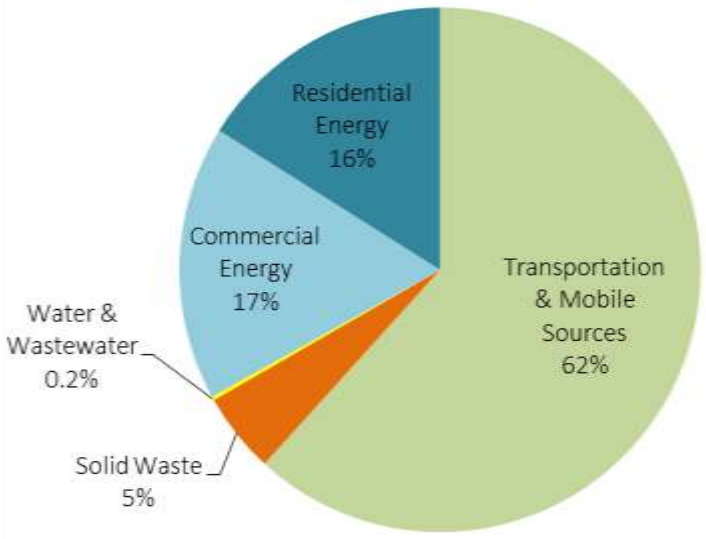

Figure ES- 1 Communitywide Emissions by Sector

Figure ES-2 shows local government operations emissions. The Buildings and Facilities sector accounts for a vast majority (42%) of these emissions. The next largest contributor is vehicle fleet (21%), followed by employee commute (23%). Solid Waste was responsible for the remainder (14%) of local government operations emissions.

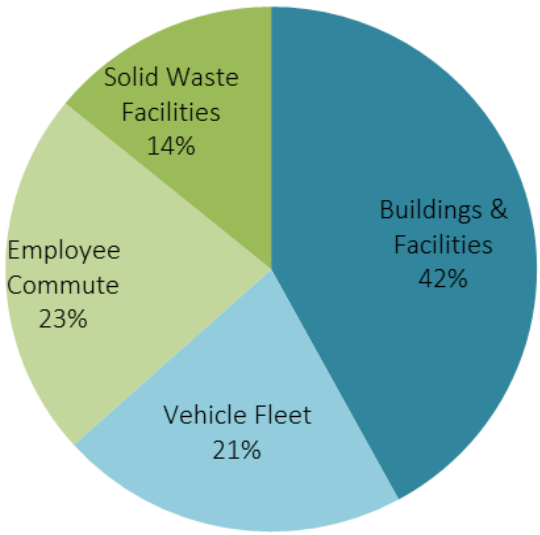

Figure ES- 2 Government Operations Emissions by Sector

The Inventory Results section of this report provides a detailed profile of emissions sources within Pinecrest; information that is key to guiding local greenhouse gas reduction efforts. These data will also provide a baseline against which the Village will be able to compare future performance and demonstrate progress in reducing emissions.

Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. Over the last century and a half human activities, primarily the burning of fossil fuels for transportation and electricity, have increased these gasses concentrations in the atmosphere resulting in the trapping of more heat leading to changes in the global climate. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise. Global climate change influences seasonal patterns and intensifies weather events, threatening the safety, quality of life, and economic prosperity of communities everywhere[1]. Many regions are already experiencing the consequences of global climate change, and Pinecrest is no exception.

According to the 2014 National Climate Assessment, the southeast U.S. will experience potentially devastating impacts from seasonal changes and hazards occurring at unprecedented magnitudes. Southeast Florida, including Pinecrest, is at particular risk for coastal hazards, such as flooding, erosion, and hurricanes that will continue to intensify with sea-level rise. So many people visit and move to this region to enjoy the beautiful coast, but its seaside location also puts it at extreme risk. In addition, climate change will continue to produce warmer seasons and extreme temperatures that threaten many sectors within Pinecrest and the greater region, most notably tourism, public health, and agriculture[2].

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, money not spent on energy is more likely to be spent a local businesses and add to the local economy. Reducing fossil fuel use improves air quality, and increasing opportunities for walking and bicycling improves residents' health.

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[1] International Panel on Climate Change. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. Retrieved from https://www.ipcc.ch/report/ar5/syr/

[2] U.S. Global Change Research Program. 2014. National Climate Assessment – Ch 19: Southeast. Retrieved from https://nca2018.globalchange.gov/chapter/19/

ICLEI Climate Mitigation Milestones

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along Five Milestones, also shown in Figure 1:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions reduction target;
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

Figure 1 ICLEI Climate Mitigation Milestones

This report represents the completion of ICLEI's Climate Mitigation Milestone One, and provides a foundation for continued work to reduce greenhouse gas emissions in Pinecrest.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from both the Pinecrest community as a whole, and from operations of the Village of Pinecrest government. The government operations inventory is a subset of the community inventory, as shown in Figure 2. For example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

Figure 2 Relationship of Community and Government Operations Inventories

As local governments have continued to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions (LGO Protocol), both of which are described below.

Three greenhouse gases are included in this inventory: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Many of the charts in this report represent emissions in "carbon dioxide equivalent" (CO_2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 5th Assessment Report:

Table 1 Global Warming Potential Values (IPCC, 2014)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous Oxide (N_2O)	265

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions[3] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of natural gas by the community
- On-road passenger and freight motor vehicle travel
- Use of energy in potable water and wastewater treatment and distribution
- Generation and processing of solid waste by the community

The community inventory also includes the following activities:

- Other wastewater treatment activities

Local Government Operations Protocol

In 2010, ICLEI, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) released Version 1.1 of the LGO Protocol.[4] The LGO Protocol serves as the national standard for quantifying and reporting greenhouse emissions from local government operations. The purpose of the LGO Protocol is to provide the principles, approach, methodology, and procedures needed to develop a local government operations greenhouse gas emissions inventory.

The following activities are included in the LGO inventory:

- Electricity consumption from buildings & facilities
- On-road transportation from employee commute and vehicle fleet
- Solid waste generated by government operations

[3] ICLEI. 2012. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/tools/ghg-protocol/community-protocol

[4] ICLEI. 2008. Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/programs/climate/ghg-protocol/ghg-protocol

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities".

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Pinecrest's community greenhouse gas emissions inventory utilizes 2018 as its baseline year, because it is the most recent year for which the necessary data are available.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

1. Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
2. Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used: Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath tool.

Community Emissions Inventory Results

The total communitywide emissions for the 2018 inventory are shown in Table 2 and Figure 3.

Table 2 Communitywide Emissions Inventory

Sector	Fuel or source	2018 Usage	Usage unit	2018 Emissions ($MTCO_2e$)
Residential energy	Electricity (Florida Power & Light)	96,988.06	mWh	29,706
	Natural Gas (Florida City Gas)	18,692.16	therms	99
			Residential energy total	**29,805**
Commercial energy	Electricity	102386.9	mWh	31,359
			Commercial energy total	**31,359**
On-road transportation	Passenger Vehicles & Light Trucks (Gasoline)	131,393,162.66	vehicle miles	54,462
	Passenger Vehicles, Light Trucks, And Heavy Trucks (Diesel)	9,889,807.94	vehicle miles	13,774
Transit use	Tri-Rail (Diesel)	4,869.72	gallons	50
Air Transport	Passenger Travel (Jet Kerosene)	4,768,634.72	gallons	46,064
			Transportation total	**114,350**
Solid Waste	Landfilled	5,768.53	short tons	7,119
	Combusted	23,096.72	short tons	1,999
			Solid waste total	**9,118**
Water and wastewater	Digester Gas Combusted	7,754.38	standard cubic ft/day	0.84
	Digester Gas Flared	4,990.94	standard cubic ft/day	26
	Nitrogen Effluent Discharge	515.3	kg/day	397.2
	Nitrous Oxide Emissions	0.078	metric tons	20.62
			Water and wastewater total	**446**
			Total communitywide emissions	**185,153**

Figure 3 shows the distribution of communitywide emissions by sector. Transportation & mobile sources is the largest contributor, followed by residential and commercial energy.

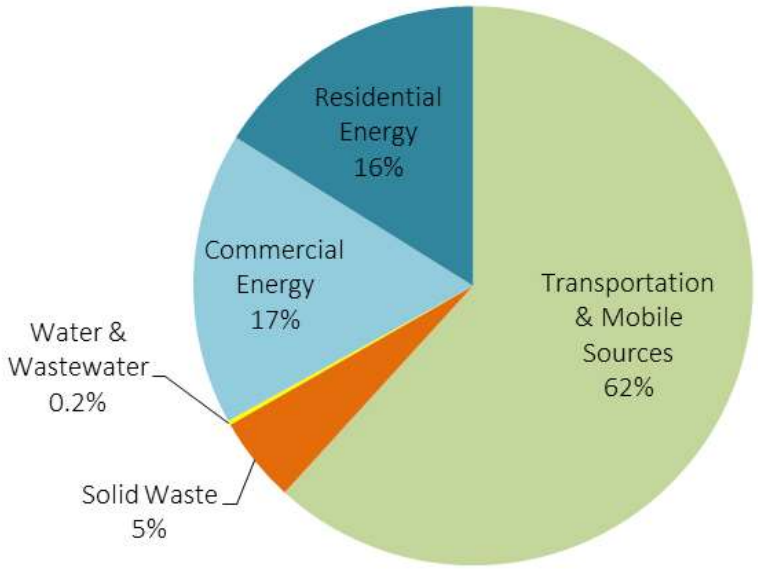

Figure 3 Communitywide Emissions by Sector

Next Steps

The inventory results should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

- Install more bike lanes on arterial and collector roads to encourage cycling
- Create and host a carpool match system
- Advocate for increased frequency and efficiency of the transit system through participation in regional transportation planning efforts
- Encourage businesses to utilize virtual conferencing software for meetings to reduce unnecessary air travel
- Research the feasibility of Community Choice Aggregation to increase renewable energy usage
- Create and distribute educational materials to residents and businesses on how to increase energy efficiency, emphasizing the potential cost-savings

Completion of another GHG inventory in two to five years is recommended in order to assess progress resulting from any actions implemented. The detailed methodology section of this report, as well as the master data Excel file provided to the Village of Pinecrest, will be helpful to complete a future inventory consistent with this one.

Government Operations Emissions Inventory Results

Government operations emissions for 2018 are shown in Table 3 and Figure 4.

Table 3 Local Government Emissions Inventory

Sector	Fuel or source	2018 Usage	Usage unit	2018 Emissions ($MTCO_2e$)
Buildings & Facilities	Electricity	2,406,233	kWh	736
Vehicle Fleet	Gasoline (on-road)	42,294	gallons	373
Employee Commute	Gasoline	997,008	vehicle-miles	395
Solid Waste	Government-generated waste	795.6	short tons	245
			Total government emissions	**1,749**

Figure 4 shows the distribution of emissions among the four sectors included in the inventory. Buildings and facilities represents the vast majority of emissions, followed by vehicle fleet and employee commute. Public street lights/traffic signals and water & wastewater treatment facilities account for a very small portion of emissions.

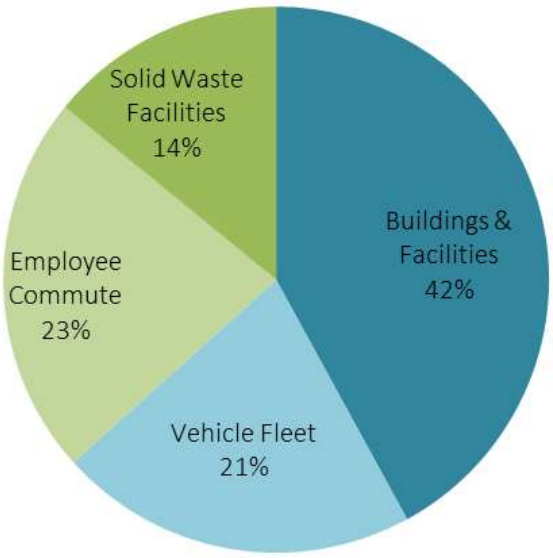

Figure 4 Local Government Operations Emissions by Sector

Next Steps

The local government operations emissions inventory points to a need for energy conservation and greater use of low-carbon transportation options, as energy use, employee commute, and vehicle fleet account for over 86% of emissions. The following are some steps that the Village of Pinecrest could take to reduce emissions from municipal activities:

- Identify opportunities to retrofit government buildings and facilities for energy efficiency
- Educate Village staff on how to conserve energy and water
- Certify as a SolSmart Community
- Create incentives and requirements for solar energy systems
- Adopt requirements for new construction of Village buildings that maximize energy efficiency (e.g. LEED criteria) and on-site energy production (e.g. solar)
- Identify opportunities for onsite energy production and energy retrofits on existing government buildings
- Install LEDs and auto shut-off lights in government buildings
- Develop requirements for "right-sizing" the fleet and purchasing electric/hybrid vehicles as much as possible
- Develop requirements for employee activities that involve using a vehicle, such as more efficient route design and efficient driving behavior. Utilize the GIS systems to identify behavior and policy modification options. Install systems that allow vehicles to use auxiliary systems without idling engines.
- Encourage staff to utilize virtual conferencing to replace in person off-site meetings as much as possible.
- Facilitate a carpooling program that matches employees with each other based on commute route and work schedule
- Offer a subsidy for commuters who choose to carpool, bike, or take transit. Many respondents said they would be more likely to carpool, bike, or take transit if there was a subsidy
- Start a Guaranteed Ride Home program that ensures employees will be able to get home if there is an emergency or an unexpected barrier to taking transit or carpooling home on any given day.
- Install more electric vehicle charging stations at all government buildings and develop a policy to allow for employees to charge personal vehicles.
- Allow flexibility in work schedules for employees, if appropriate for their position and responsibilities, such as an alternative work schedule (4/10 or 9/80) and/or to telework a certain number of days per year.

Conclusion

This inventory marks completion of Milestone One of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, set an emissions reduction target, and build upon the existing Climate Action Plan with more quantified strategies that can cumulatively meet that target. In addition, Pinecrest should continue to track key energy use and emissions indicators on an on-going basis. ICLEI recommends updating the inventory at least every five years to measure emissions reduction progress. Furthermore, ICLEI offers the Contribution Analysis tool, which will allow Pinecrest to more accurately determine what influences changes in emissions over time. As Pinecrest is an ICLEI member, the community will continue to have access to Clearpath and can utilize the forecasting, planning, and monitoring modules for next steps following this inventory.

This inventory shows that communitywide energy use and transportation patterns will be particularly important to focus on. Fortunately, Pinecrest is almost entirely powered by the grid (as opposed to natural gas), which means that any effort to make the grid cleaner will result in substantial emissions reductions. Pinecrest also has relatively flat terrain and comfortable weather for most of the year, which are conditions that the Village can leverage in efforts to encourage more walking and bicycling. Through these efforts and others, the Village of Pinecrest can achieve additional environmental, economic, and social benefits beyond reducing emissions.

Appendix: Methodology Details

Energy

The following table shows each activity related to energy consumption, data source, and notes on data gaps. The emissions factors used for electricity are provided in Table 5.

Table 4 Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Residential & commercial electricity consumption	Florida Power & Light	Florida Power & Light did not provide data for 2018. Consistent with previous inventories, Miami-Dade County electricity consumption data was scaled down to Pinecrest's population (Pinecrest accounts for 0.69% of Countywide Activity).
Residential & commercial natural gas consumption	Florida City & Gas	Florida City Gas did not provide data for 2018, so the number from the 2012 inventory was extrapolated to 2018 using a per-capita value.
Local Government Operations		
Electricity consumption in buildings & facilities	Florida Power & Light	It assumed that these numbers include electricity used for public street lights and traffic signals.

Table 5 Emissions Factors for Electricity Consumption

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2018	671	66	9
Note: Florida Power & Light reports a CO2 emission factor, but does not report emissions factors for CH4 and N2O, so the EPA's Emissions & Generation Resource Integrated Database (eGRID)[5] 2018 values were used for those gases.			

[5] EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Transportation

Table 6 Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Vehicle miles travelled	Miami-Dade County	Consistent with previous inventories, Miami-Dade County's VMT and transit ridership were scaled down to Pinecrest's population (Pinecrest accounts for 0.69% of Countywide Activity).
Transit ridership	Miami-Dade County	
Local Government Operations		
Government vehicle fleet	Office of the Village Manager	Fuel types were not provided, but vehicle types were provided and they were all vehicles that typically use gasoline. Thus, it is assumed that the vehicle fleet only uses gasoline.
Employee commute	Office of the Village Manager	Estimated annual vehicle miles traveled using employee zip codes, average number of working days a year, and the distance from those zip codes to the main government building.

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for CO_2, CH_4 and N_2O to each vehicle type. The factors used are shown in Table 7.

Table 7 MPG[6] and Emissions Factors[7] by Vehicle Type

Fuel	Vehicle type	MPG	g CO_2/gal	g CH_4/mile	g N_2O/mile
Gasoline	Passenger car	24.21	8,310	0.0186	0.0093
Gasoline	Light truck	17.52	8,310	0.201	0.0167
Diesel	Passenger car	24.21	10,210	0.0005	0.001
Diesel	Light truck	17.52	10,210	0.001	0.0015
Diesel	Heavy truck	6.22	10,210	0.0051	0.0048

Water & Wastewater

Table 8 Water & Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide & Local Government Operations		
Nitrogen Effluent Discharge	Miami-Dade County	Consistent with previous inventories, Miami-Dade County's wastewater and water treatment activity data was scaled down to Pinecrest's population (Pinecrest accounts for 0.69% of Countywide Activity).
Nitrous Oxide Process Emissions		
Digester Gas Combustion/Flaring		
Energy used for water and wastewater processes		

[6] Federal Highway Administration (2018). Highway Statistics. http://www.fhwa.dot.gov/policyinformation/statistics.cfm

[7] Derived from EPA (2018). Emissions Factors for Greenhouse Gas Inventories. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Solid Waste

Table 9 Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Combustion of solid waste	Miami-Dade County	Consistent with previous inventories, Miami-Dade County's solid waste activity data was scaled down to Pinecrest's population (Pinecrest accounts for 0.69% of Countywide Activity). Used Miami-Dade's 2017 waste characterization values to estimate emissions from landfilled solid waste (see table 10).
Landfilled solid waste		
Local Government Operations		
Solid waste generation	Office of Village Manager	Based on number of dumpster pick-ups, size of the dumpsters, and an average weight of dumpsters. Used Miami-Dade's 2017 waste characterization values (see table 10).

Table 10 Waste Characterization for Miami-Dade County (2017)

Waste Type	Percentage	CH4/wet short ton waste[8]
Mixed Municipal Solid Waste	22.23%	0.060
Newspaper	4.952%	0.043
Office Paper	4.313%	0.203
Corrugated Cardboard	9.536%	0.120
Magazines/Third Class Mail	9.716%	0.049
Food Scraps	3.664%	0.078
Grass	4.344%	0.038
Leaves	4.344%	0.030
Branches	4.344%	0.062

Inventory Calculations

The 2018 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. As discussed in Inventory Methodology, the IPCC 5th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO_2 equivalent units. ClearPath's inventory calculators allow for input of the sector activity (e.g. kWh or VMT) and emission factor to calculate the final CO_2e emissions.

[8] MSW factor: EPA (1998). U.S. EPA Emission Factor Database, Chapter 2.4 Municipal Solid Waste Landfills.

Other factors: EPA (2019)—Exhibit 6 of Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM). https://www.epa.gov/sites/production/files/2019-06/documents/warm_v15_management_practices.pdf