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Town of Hillsborough's  
Community and  
Government

**Greenhouse Gas  
Emissions Inventory**

Summary Report

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Town of Hillsborough

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June 2009

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## Background

The Town of Hillsborough has joined more than 800 local governments in recognizing human-created climate change and its potentially disruptive effects to Hillsborough's residents and joined Local Governments for Sustainability (formerly known as ICLEI). Hillsborough recognized that government plays an important role in mitigating the potential impacts of climate change and has committed to advancing climate protection. The City Council endorsed the United States Mayor's Climate Protection Agreement in 2008 and also directed the Sustainable Hillsborough Task Force to develop a Climate Action Plan. The Town has already taken action on several policies and programs that reduce greenhouse gas emissions that include: City Council's approval of the Residential Green Building Ordinance, approval of the Civic Green Building Ordinance, the Solar Community Program and the elimination of solar permit fees.

As a member of the Local Governments for Sustainability, the Town can use resources that are designed to facilitate Climate Action Plan development. The following framework provides the milestones for identifying and reducing greenhouse gas emissions:

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

### The ICLEI 5-Milestone Process



This document is a summary of the results-to-date associated with Milestone One above—the inventory of greenhouse gas emissions. This summary is of both the *community* inventory and the more detailed *government* inventory which was recently completed for the Town's base year

of 2005. The government inventory is considered a subset of the community inventory and accounts for about 1.5% of total community emissions. These inventories provide the basis for the creation of an emissions forecast, and allow for the quantification of emissions reductions associated with new program and policies recommendations.

The community inventory includes emissions from government activities to the extent that these emissions are contained in the larger community-wide data sets that were analyzed for the community inventory. These government emissions are rolled into the “commercial” sector of the community inventory. The separate inventory of government operation emissions, summarized in this document is far more detailed and provides a baseline against which the Town can set its own emissions reductions goals and measure progress towards those goals. Furthermore, it allows the Town to understand the scale of emissions from various sources within its operations.

## **Base Year**

Providing for a meaningful and consistent comparison of emissions over time required setting a base year with which to compare current and future emissions. 1990 is the base year established and utilized by the United Nations Framework Convention on Climate Change, the Kyoto Protocol and AB 32, The Global Warming Solutions Act. AB 32 sets the goal of reducing emissions to 1990 levels by 2020 and to 80% below 1990 levels by 2050. However, emissions data from 1990 is often prohibitively difficult or impossible to collect. Rather than using the unreliable method of back-casting to calculate 1990 emissions levels, calendar year 2005 was chosen as the base year for Hillsborough’s inventory as it was reasonable to expect that accurate records of key emission sources exist for that year in sufficient detail to conduct an accurate inventory. Using 2005 as a base year is also consistent with the base years being used by other Bay Area cities in their greenhouse gas inventories. A base year several years in the past, rather than the most recent year also enables accounting of emissions benefits of any recent sustainability actions.

## **Emissions Sources and Inventory Methodology**

The community-wide inventory comprises emissions resulting from within the geographic boundaries of the community. These emissions come from residential, commercial as well as transportation and waste management sources (also referred to as sectors). The inventory methodology broadly categorizes these sources as either stationary or mobile sources. It also categorizes the sources according to “scope,” which generally reflects where the emissions are generated. Scopes help determine which emissions should be inventoried and organize emissions according to degree of control and the potential for reduction. These scopes are defined below.

- ✧ Scope 1 emission sources within the context of community-scale emissions analyses include all direct emissions generated within the community boundaries (e.g., vehicle emissions). In the context of the government emissions, scope 1 refers to direct emissions from sources within a local government's operations that it owns and/or controls. This includes, for example, stationary combustion to produce heat and power equipment; mobile combustion of fuels, and fugitive emissions from leaked refrigerants.
- ✧ Scope 2 emission sources within the context of both community and government emissions analyses include all emissions generated outside the community's geographic boundaries but generated due to activity occurring inside the boundaries (e.g., emissions from power plants associated with electricity consumption within the City's boundaries).
- ✧ Scope 3 emissions are all other emissions sources that hold policy relevance to the local government that can be measured and reported. This includes all indirect emissions not covered in Scope 2 that occur as a result of activities within the operations of the local government. Sources over which the local government does not have any financial or operational control over would be accounted for here. Scope 3 emission sources include (but are not limited to) tailpipe emissions from employee commutes, employee business travel, and emissions resulting from the decomposition of government-generated solid waste.

Creating the inventory required the collection of data from a variety of entities. Community and municipal electricity and natural gas data were provided by Pacific Gas and Electric Company (PG&E). The Metropolitan Transportation Commission and Bay Area Air Quality Management District (BAAQMD) were sources of transportation data from which fuel usage was derived. Solid waste data was provided by the California Integrated Waste Management Board and Republic Services, Inc. (Allied Waste). ICLEI facilitated the acquisition of much of the community-level data for Hillsborough and other jurisdictions in the region.

Efforts were made to include all possible emission sources in the inventories. However, emission sources that met the following criteria were generally excluded

- ✧ Small and unimportant – “De minimis” sources that, when combined, totaled less than 5% of the total of the emissions from the community or government.
- ✧ Prohibitively difficult to track with accuracy – Including off-highway construction equipment, non-combustion industrial emission sources and fuel not delivered by PG&E (e.g., wood, charcoal, propane, kerosene).
- ✧ Largely located outside the jurisdiction's boundaries – Sources such as intercity transportation fuel usage for air and rail travel.

## CACP Software and Emission Factors

ICLEI's Clean Air and Climate Protection (CACP) software package was used to calculate emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used.

Greenhouse gas emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO<sub>2</sub>e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is 21 times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents. All greenhouse gases measured have been converted to CO<sub>2</sub>e.

The emissions coefficients and quantification method employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form 1605). At the time of this writing, the CACP software has been used by more than 160 U.S. cities and towns to inventory their greenhouse gas emissions. However, it is worth noting that, although the software provides Hillsborough with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation rather than an exact value.

# Community Greenhouse Gas Emissions Inventory

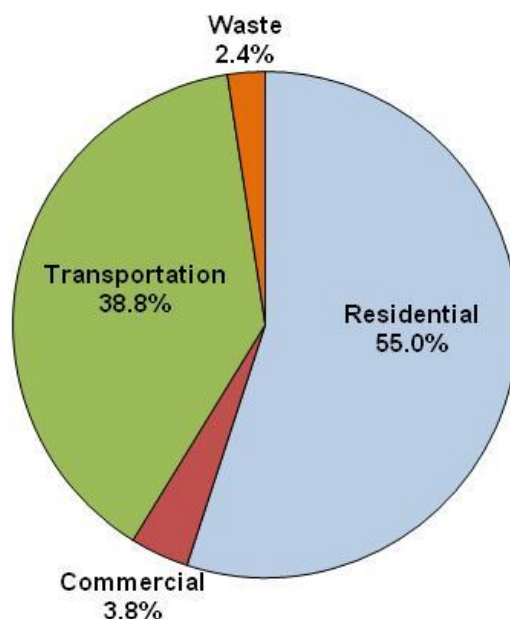
## Sector Analyses

The Community of Hillsborough emitted approximately 82,724 metric tons of CO<sub>2</sub>e in the base year of 2005. As illustrated in Figure 1 and Figure 2, the residential (55%) and transportation (38.8%) sectors were the largest sources of greenhouse gas emissions comprising 94% of total emissions. Given the limited commercial base in Hillsborough, emissions from that sector were relatively small (3.8%) compared to the residential sector. The waste sector contributed 2.4% of total emissions.

**Figure 1: GHG Emissions by Sector**

Sector	CO <sub>2</sub> e (metric tons)	% of Total GHG
Residential	45,511	55.0
Commercial	3,106	3.8
Transportation	32,117	38.8
Waste	1,991	2.4
<b>Total</b>	<b>82,724</b>	<b>100</b>

**Figure 2: GHG Emissions by Sector**



The above source sectors can be broken down by the energy types consumed within each sector. As illustrated in [Figure 3](#), use of gasoline for transportation (32.5%), residential natural gas (37.8%), and residential electricity (17.2%) were the largest sources greenhouse gas emissions in Hillsborough. These were followed by the burning of diesel fuel in the transportation sector which resulted in approximately 6% of emissions and the release of methane and CO<sub>2</sub> from landfilled waste material which resulted in less than 3% of total emissions.

**Figure 3: GHG Emissions by Sector and Fuel Type**

Sector and Fuel Type	CO <sub>2</sub> e (metric tons)	% of Total GHG
Residential Sector		
Electricity	14,253	17.2
Natural Gas	31,258	37.8
Commercial Sector		
Electricity	2,233	2.7
Natural Gas	873	1.1
Transportation Sector		
Diesel	5,224	6.3
Gasoline	26,893	32.5
Waste Sector		
Food Waste	363	0.4
Paper Products	1,094	1.3
Plant Debris	244	0.3
Wood or Textiles	290	0.4
<b>Total</b>	<b>82,724</b>	<b>100.0</b>

## Residential and Commercial

As a result of Hillsborough's small commercial sector, residential emissions far surpass those of the commercial sector. Residential natural gas and electricity use accounted for a significant



55% of the community's emissions and is the obvious candidate for reduction measures which can now be measured against this baseline.

## Transportation

As with other San Francisco Bay Area cities, travel by motorized vehicle measured by vehicle miles traveled (VMT) produces a significant percentage of emissions. A total of 38.8% of total emissions were a result of transportation within Hillsborough's borders. Approximately 72% of the emissions in the transportation sector (or 27.9% of total emissions) came from VMT on Town roads. Because Hillsborough has two heavily traveled State Highways (280 and 82) within its borders, approximately 11% of the greenhouse gas emissions in the transportation sector are attributed to highway travel.

**Figure 4: GHG Emissions by Road Type**

Sector	CO <sub>2</sub> e (metric tons)	% of Total GHG
State Highway VMT	9,053	10.9
Town Roads VMT	23,064	27.9
<b>Total</b>	<b>32,117</b>	<b>38.8</b>

## Waste

The emissions from waste generated by Hillsborough residents and businesses that was landfilled in other locations in 2005 emitted 1,991 metric tons of CO<sub>2</sub>e, accounting for 2.4% of the Town's total emissions. Waste characterization studies by the California Integrated Waste Management Board were used to allocate shares of waste types to the total organic waste tonnage in the Town's waste stream. Emissions factors developed by ICLEI were applied to the waste types to determine total emissions from the sector.

# Government Greenhouse Gas Emissions Inventory

This section summarizes Hillsborough's emissions from government operations in 2005, rolling up and comparing emissions across sectors and sources as appropriate. Utilizing the data gathered during the inventory process, a more thorough analysis of the inventory can be provided to identify specific sources of emissions (such as a particular building) that can help staff and Council best target municipal emissions reduction activities as part of a climate action plan.

This inventory uses a national standard developed and adopted by the California Air Resources Board (ARB) in conjunction with ICLEI, the California Climate Action Registry, and The Climate Registry. This Local Government Operations Protocol (LGOP) provides standard accounting principles, boundaries, quantification methods, and procedures for reporting greenhouse gas emissions from local government operations. It will facilitate how inventories are conducted and reported and provide a common national framework for all local governments to establish their emissions baseline. This and all emissions inventories represent an estimate of emissions using the best available data and calculation methodologies. Emissions estimates are subject to change as better data and calculation methodologies become available in the future. The findings of this inventory analysis provide a solid base against which the Town can begin planning and taking action to reduce its greenhouse gas emissions.

This inventory was conducted with the help of numerous Hillsborough staff members and guidance from ICLEI. Raw data, data sources, and calculation methods used in this inventory have been documented. It is advised though that future inventories should improve upon the data and methods used in this inventory, and that the Town institutionalize internal data collection in order to ensure that the recommended methods outlined in LGOP can be met.

## Summary by Sector

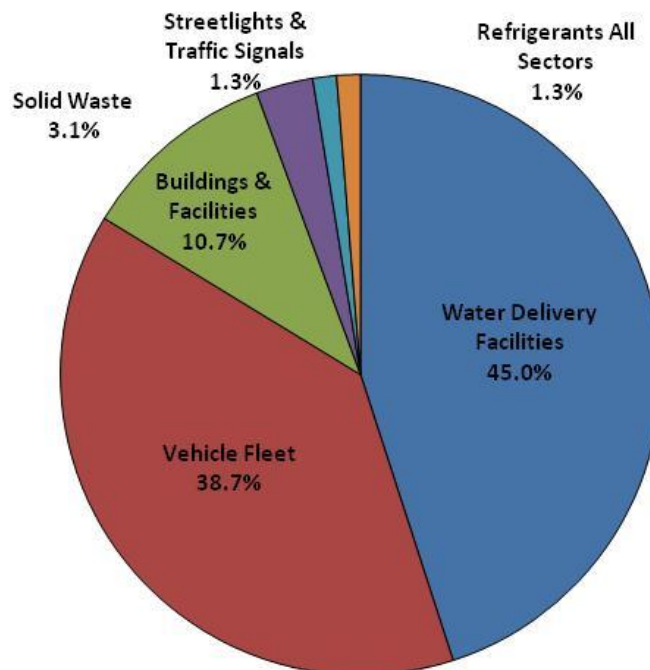
Reporting emissions by activity sector is a useful way to understand the sources of Hillsborough's emissions. By better understanding the relative scale of emissions from each of the sectors, Hillsborough can more effectively focus emissions reductions strategies to achieve the greatest emissions reductions.

Figure 5 shows that water delivery facilities were the largest emitter (528 metric tons CO<sub>2</sub>e or 45% of total) in 2005. Emissions from the vehicle fleet produced the second highest quantity of emissions, resulting in 454 metric tons of CO<sub>2</sub>e. Hillsborough's buildings and facilities produced 125 metric tons of CO<sub>2</sub>e of total emissions. The remainder of emissions came from solid waste, refrigerants, and streetlights and traffic signals.

**Figure 5: GHG Emissions by Sector**

Sector	CO <sub>2</sub> e (tons)	% of Total GHG
Water Delivery Facilities	528	45.0
Vehicle Fleet	454	38.7
Buildings and Facilities	125	10.6
Solid Waste	36	3.1
Streetlights & Traffic Signals	15	1.2
Refrigerants All Sectors	15	1.3
<b>Total</b>	<b>1,173</b>	<b>100</b>

**Figure 6: GHG Emissions by Sector**



## Summary by Resource

When considering how to reduce emissions, it is helpful to look not only at which sectors are generating emissions, but also at the specific raw resources and materials (gasoline, diesel, electricity, natural gas, solid waste, etc.) whose use and generation directly result in the release

of greenhouse gases. This analysis can help target resource management in a way that will successfully reduce greenhouse gas emissions. **Figure 7** provides a summary of Hillsborough's government operations 2005 greenhouse gas emissions by fuel type and material.

**Figure 7: GHG Emissions by Fuel / Material Resource**

Resource	CO <sub>2</sub> e (metric tons)	% of Total GHG
Electricity	634	54.1
Gasoline	359	30.6
Diesel	94	8.0
Waste (Methane)	36	3.1
Natural Gas	34	2.9
Refrigerants	15	1.3
<b>Total</b>	<b>1,173</b>	<b>100</b>

## Sector Analyses

### Water and Wastewater Transport

Largely due to topography, water and wastewater transport results in the largest amount of emissions for the Town due to the electricity required for pumping. In 2005, the operation of Hillsborough water transport equipment produced approximately 528 metric tons of CO<sub>2</sub>e or 45% of total emissions.

### Vehicle Fleet and Mobile Equipment

The majority of local governments use vehicles and other mobile equipment as an integral part of their daily operations—from maintenance trucks to police cruisers and fire trucks. These vehicles and equipment burn gasoline, diesel, and other fuels (currently), which results in greenhouse gas emissions. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle. Emissions from vehicles and mobile equipment compose a significant portion of emissions within most local governments.

In 2005, emissions from fuel burning by the vehicle fleet and mobile equipment were 454 tons or 38.7 percent of total emissions. Leaked refrigerant from vehicle air conditioning systems resulted in 14 tons of emissions. Additional analysis can be performed to identify vehicle emissions by department.

## Buildings and Other Facilities

Through their use of energy for heating, cooling, lighting, and other purposes, buildings and other facilities operated by local governments constitute a significant amount of greenhouse gas emissions. Hillsborough's facilities include buildings utilized for the Town Hall and Administration, Corp Yard, Water Department, Police Department and two fire stations (which were included in this inventory though part of a JPA and therefore not under formal "operational control" by the Town as defined by the Local Government Operations Protocol). Facility operations contribute to greenhouse gas emissions in two major ways. Facilities consume electricity and fuels such as natural gas and diesel (backup generators), and this consumption contributes the majority of greenhouse gas emissions from facilities. In addition, fire suppression, air conditioning, and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants or fire suppressants.

In 2005, the operation of Hillsborough's facilities produced at least 125 metric tons of CO<sub>2</sub>e from electricity, natural gas and diesel consumption. Figure 8 depicts 2005 emissions by facility/department. Of total facility emissions, 73% came from the consumption of electricity (scope 2) and 27% came from the combustion of natural gas (scope 1).

**Figure 8: GHG Emissions by Building / Facility**

Buildings and Facilities	CO <sub>2</sub> e from Electricity (metric tons)	CO <sub>2</sub> e from Natural Gas (metric tons)	% of Emissions from Facilities
Fire Department	19	29	38.1%
Police Department	38	0	30.2%
Public Works Department	16	5	16.7%
Town Hall	19	0	15.1%
<b>Total</b>	<b>92</b>	<b>34</b>	

## Streetlights, Traffic Signals, and Other Public Lighting

Compared to many cities Hillsborough operates very few streetlights and a relatively limited amount of public lighting. Electricity consumed in the operation of this infrastructure generated 1.2% of government emissions, producing approximately 15 metric tons CO<sub>2</sub>e in 2005.

## Government-Generated Solid Waste

Many local government operations generate solid waste, much of which is eventually sent to a landfill. Typical sources of waste in local government operations include paper and food waste from offices and facilities, construction waste and plant debris from public works departments. Organic materials in government generated solid waste (including paper, food scraps, plant

debris, textiles, wood waste, etc.) generate methane as they decay in the anaerobic environment of a landfill. Estimating emissions from waste generated by government operations is an important component of a comprehensive emissions inventory.

Inventorying emissions from government-generated solid waste is considered optional by LGOP emissions for two reasons. First, the emissions do not result at the point of waste generation (as with fuel combustion), but in a landfill located outside of Hillsborough's jurisdictional boundaries. In addition, the emissions are not generated in the same year that the waste is disposed, but over a lengthy decomposition period. Since inventorying these emissions is considered optional, LGOP does not provide guidance on recommended methods for quantifying these types of emissions. ICLEI therefore devised data collection and calculation methods based upon previous experience and national standards. It is estimated that the waste disposed by government facilities in 2005 will cumulatively produce 36 metric tons of CO<sub>2</sub>e in the form of methane gas or 3.1% of emissions.

## Conclusion

This inventory provides an important foundation for Hillsborough's comprehensive approach to reducing the greenhouse gas emissions from its operations and in the community. Specifically, this inventory serves to:

- Establish a baseline for setting emissions reductions targets.
- Identify the largest sources of emissions from both community and local government operations.

The emissions baseline can be used by the Town to move forward to Milestone Two of the previously described *ICLEI Five Milestone* process—setting emissions reduction targets for both the community and government operations. The greenhouse gas emissions reduction targets represent the percentages by which the Town would seek to reduce total greenhouse gas emissions below base year levels by a chosen future target year.