



Municipal Greenhouse Gas Emissions Inventory Quality Management Plan

October 2014
2013 and Previous Inventory Years



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I. Revision History

This section contains a history of **major** changes made to the City of Fort Collins Municipal greenhouse gas (GHG) Inventory since 2005, the baseline year. A municipal inventory represents a useful tool for creating a quantitative understanding of emissions from City operations and provides a best estimate based upon current methodologies and data. That said - it is important to communicate to policymakers, staff, and community members that it does not represent a complete and unchanging picture of municipal emissions for. Inventories will evolve because the science, models, and data infrastructure behind available data are continually evolving, and for this reason, available data and emissions factors are continually being refined and made more accurate. Changes documented in this section generally include changes in overall methodology or significant changes in emissions factors, conversion factors, sources of activity data, or recalculations due to discovery of errors. A summary of the revision history is presented in Table 1:

Table 1. Revision History					
Date	Revision No.	Where Published	Description of Changes	Impact on 2005 Baseline	Originator
2009	1	2008 Climate Action Plan (CAP) Status Report published July 2009	The City of Fort Collins joined the Climate Wise Program in 2007 and began using the Climate Wise GHG Baseline Tool to calculate GHG Emissions in short tons of CO ₂ e. At the time the annual inventory included all electricity purchased by the City, natural gas used in buildings, and cubic yards of waste estimated to be collected. Employee airline miles and employee traveling for work-related travel were added during 2009. (Source: File = Muni2005baselinev62409-ls.xls)	YES Revisions were made to reflect these changes in methodology. The revised baseline for 2005 was 61,600 short tons = 55,900 MT CO ₂ e using Climate Wise GHG Baseline Tool v10.13.2007	Climate Wise Program, Environmental Services Department (ESD)
2009	2	2009 CAP Status Report & 2009 Municipal Operations Sustainability Report	The total 2005 gallons of fuel 2 (B20) consumed in 2005 that was entered into the Climate Wise Baseline Tool actually was comprised of 79 % diesel (2802 metric tons of CO ₂ e) and 21% B20 (589 metric tons of CO ₂ e), per S. Armfield, May 2010. (Source: File = 2005MunibaselineMay11-201-LRS.xls)	YES Revisions were made to reflect differences in metric tons of CO ₂ e emitted from the different fuel types during the baseline year 2005. The revised baseline for 2005 was 53,500 MT CO ₂ e.	Fleets Division

2010	3		Year 2006 fuel 2 data was changed from 330,094.12 gallons to 339,603 gallons based on data provided by S. Armfield.	NO Revision was made to the 2006 inventory to reflect these changes.	Fleets Division
June 2011	4	2010 Municipal Operations Sustainability Annual Report and 2010 CAP Status Report	<ul style="list-style-type: none"> • The Climate Wise GHG Baseline Tool itself was updated to reflect the following changes in v8.10.2010: <ul style="list-style-type: none"> ○ Electricity emission factor was updated to 2009 factor ○ Emissions factor for solid waste disposal was updated based on community inventory modeling of the Larimer County Landfill. This resulted in landfill emissions that were about 2/3 lower than in previous versions of the Baseline Tool, for the same volume of trash. ○ Upstream emission reductions for recycling based on 3rd edition of EPA’s WARM ○ The emissions inventory is now represented in metric tons • A new conversion rate of 80 lbs./cubic yard for solid waste and 50 lbs./cubic yard for recyclables was applied retroactively to all years back to the baseline year of 2005 for conversion of volumes to total weights based on sampling of a representative number of pulls. This significantly reduced solid waste 	YES Revisions were made to all categories of emissions in the baseline year (2005) and all subsequent inventory year numbers	Climate Wise Program, ESD

			<p>weights.</p> <ul style="list-style-type: none"> The GHG Emissions Management System (GEMS) was used to calculate CO₂e emissions from electricity sources and not the Climate Wise GHG Baseline Tool that was used previously. This change was retroactive back to 2005. 		
2012	5	2011 Municipal Operations Sustainability Annual Report and 2011 CAP Status Report	<p>The GHG Emissions Management System (GEMS) database was fully implemented and replaced all calculations previously accomplished using the Climate Wise GHG Baseline Tool and other calculation spreadsheets. This change over to GEMS resulted in increased precision for all calculations. The following additional changes were made that affected inventory years 2005 through 2011:</p> <ul style="list-style-type: none"> City solid waste that is self-hauled to the Larimer County landfill was added as a source of industrial waste for the municipality. Roll-offs for collection of municipal operations solid waste were added to the inventory as a source of industrial waste. The ground transportation methodology was updated to calculate separate emissions from the biogenic and traditional fuel fractions of biofuel (e.g., biodiesel, ethanol). Only the emissions from the traditional fuel fraction are now 	<p>YES GHG emission estimates were adjusted upward for years 2005 through 2010</p>	ESD

			<p>included in the inventory.</p> <ul style="list-style-type: none"> • The natural gas methodology was updated to include estimated emissions from N₂O and CH₄ in addition to CO₂. • Local vehicle travel miles for City employees were collected and entered for years 2005 through 2011. • An audit of historical inventory data from 2005 to 2010 was performed with resulting data entry and calculation corrections. • Electricity activity data provided by the Poudre Valley Rural Electric Association (PVREA) for Natural Area have been added. • Water use activity data for Natural Areas from 2 new Water Districts (East Larimer County (ELCO) and Fort Collins-Loveland) were added for Natural Areas. 		
2013	6	2012 Municipal Operations Sustainability Annual Report	<ul style="list-style-type: none"> • Corrections were made to solid waste totals for the years 2008 through 2011 for errors in the estimated weight of dead animal carcasses that were self-hauled to the Larimer County Landfill. The resulting emissions were therefore corrected as indicated below: 2008: a 6% decrease in total emissions 2009: a 5% decrease in total emissions 	<p>YES</p> <p>Less than a 1% change was made to the 2005 baseline and inventory years 2006, 2007, and 2010 due to new data added to the inventory. Years 2008, 2009, and 2011 had more significant changes (decreases) due to an error in estimating solid waste weights</p>	ESD

			<p>2010: < 1% decrease in total emissions 2011: a 4% decrease in total emissions</p> <ul style="list-style-type: none"> • Minor changes were made that impacted total emissions less than 1% during the years 2005-2007 and 2010: <ul style="list-style-type: none"> ○ Calculated and reported emissions from biofuels in 2 fractions: traditional fuel fraction and biofuel fraction ○ Corrected report totals in GEMS to include all sub-categories ○ New facilities and accounts were added for Natural Areas including the NIX shop, and Gateway and Bobcat Ridge Natural Area's buildings ○ A new category of fuel was added to the inventory : E50 	during those years.	
2014	7	2013 Municipal Operations Sustainability Report	<ul style="list-style-type: none"> • All 2005 to 2013 Fleet fuels data were updated from the new FASTER database and significant changes were seen in primarily conventional fuels, although some corrections were also made to LPG, CNG, and biofuels. • The solid waste methodology was updated to the 2012 ICLEI Community Protocol for Solid Waste Emissions 	<p>YES</p> <p>The 2005 baseline was revised downward by 12% and corrections were made to all years from 2006 to 2012 ranging from -9% to -17% adjustments</p>	ESD

			<ul style="list-style-type: none">○ Method SW.4 Fugitive CH₄ emissions from the municipal operation's materials that are disposed of in the landfill regardless of where the landfilling occurs.○ Method SW.5 CO₂e emissions from process emissions associated with the municipal operation's generated waste sent to the landfill.○ Method SW.6 CO₂e emissions from collection and transport emissions.		
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II. Introduction

The City of Fort Collins, incorporated in 1872, is the fifth largest city in Colorado in terms of population. It is located in northern Colorado at approximately 5,000 feet above sea level in the foothills of the Rocky Mountains and has a moderate climate with four seasons. Fort Collins is a home rule city, organized under provisions of the Colorado Constitution. The City Charter, adopted in 1953, provides for the council-manager form of local government. The City is organized into 8 different services areas and owns or operates 1,454,671 square feet of municipal facilities. Table 2 provides the profile information recommended by the International Council for Local Environmental Initiatives (ICLEI) for reporting greenhouse gas (GHG) inventories for local governments.

Table 2. 2013 Local Government Profile Information	
Size	56.61 square miles
Population	151,330 residents
Annual City Budget	\$484.9 million
City Employees	2,061
Climate Zone	Zone 5
Heating Degree Days (Base 50)	6,537
Cooling Degree Days (Base 70)	125



The City provides a full range of municipal government services to its residents including general government, public safety, streets and highways, culture and recreation, transportation, public works, development, and public utilities including electric distribution, water and wastewater treatment, storm drainage, and public outreach. Table 3 lists the major services provided by the City of Fort Collins to its citizens.

Table 3. 2013 Fort Collins City Services Provided to the Community	
Services Provided	Services Not Provided
Water treatment	Fire Protection
Water distribution	Mass transit (light rail)
Wastewater treatment	Mass transit (ferries)
Wastewater collection	Schools (primary/secondary)
Electric utility	Schools (colleges and universities)
Police	Solid waste collection
Mass transit (buses and bus rapid transit)	Solid waste disposal
Street lighting & traffic signals	Hospitals
	Airport
	Seaport/shipping terminal
	Marina
	Stadiums/sports venues
	Convention Center
	Natural gas utility

This Quality Management Plan (QMP) was developed to provide a detailed reference document for the City annual municipal greenhouse gas (GHG) emissions inventory and to provide complete transparency for the data sources, methods, and emissions and conversion factors used to prepare the inventory. The QMP also provides a record of major inventory revisions since the baseline year (2005) and establishes quality assurance and quality control (QA/QC) procedures to ensure data integrity. This QMP should be viewed as a “living document” that will be revised as necessary as changes occur and as new and improved methods become available for carbon accounting.

ICLEI’s Local Government Operations Protocol (LGOP), Version 1.1, May 2010 is the primary guidance used for the City’s quantification and reporting of GHG emissions during 2012. During 2013, Environmental Services Department (ESD) staff evaluated how closely Fort Collins’s methods and reporting mirrors this protocol and a summary of that evaluation is presented in Section IV of this QMP.

Contact Information for the Quality Management Plan

Name of Municipality: City of Fort Collins

Address: Environmental Services Department, 215 N. Mason, PO Box 580,
Fort Collins, CO 50522-0580

Inventory Contact: Bonnie Pierce, Environmental Data Analyst
Phone: (970) 416-2648
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In 2009, the City Manager approved the following greenhouse gas (GHG) goal for the municipal organization:

Reduce greenhouse gas (GHG) emissions (carbon dioxide and methane) from municipal operations at least 2% per year starting in 2009, in order to achieve a reduction of 20% below 2005 levels by December 31, 2020; and ultimately to achieve carbon neutrality for the municipal organization.

Additionally, data used to support the annual municipal GHG inventory are relevant to 5 out of 11 City sustainability goals. For more details regarding the City of Fort Collins sustainability goals refer to <http://citynet.fcgov.com/sustainability/goals-new.php>.

III. Baseline Year Selection (2005)

The year 2005 was selected as the Fort Collins municipal operations baseline year because the approved carbon reduction goal of the municipal organization, as well as the community, is to

reduce emissions 20% below the 2005 baseline year by 2020. 2005 is also the baseline year for the GHG goals of the State of Colorado and at least 20 other municipal governments across the country.

Baseline Recalculation Policy

From 2005 until 2010, the City of Fort Collins decided that the baseline year emissions would be recalculated if there were structural changes in the organizational boundary and/or changes in accepted calculation methodologies that would result in a 5% or greater change to the baseline year emissions. During this time frame the emission factors and state-of-the-art of GHG accounting methodologies underwent substantial changes necessitating reassessment of the baseline recalculation policy. The following constitutes the revised baseline recalculation policy effective since 2011:

The following conditions will always trigger a base year recalculation:

- a) Significant structural change to the City of Fort Collins (e.g., acquisitions and divestments)
- b) Outsourcing and in-sourcing of emitting activities, and
- c) Major changes in calculation methodology (e.g., new emissions factors)

The following conditions will only trigger a base year recalculation if the annual total of the following conditions exceed the 2% significance threshold:

- a) Changes due to data accuracy and availability
- b) Discovery of significant errors

IV. Boundary Conditions

Organizational Boundaries

For setting organizational boundaries and for municipal reporting of consolidated GHG emissions, the City of Fort Collins primarily uses the Operational Control Approach as described in ICLEI's LGOP. Under this approach, the City accounts for greater than 99% of the GHG emissions from operations over which it has control and where activity data is available. Table 4 lists the few exceptions to this approach.

Table 4. Summary of Exceptions to the Operational Control Approach	
Category	Exception
Buildings the City leases or rents to others	These are listed in the Operation Services Department's Utility Manager database as "Don't Track" and therefore are not reported in the municipal inventory.
One room in one building (Darah House) that the City leases for its own use	The City does not have operational control over this lease, and therefore doesn't track its GHG emissions.
Police District #1, Suites 1, 2, and part of Suite 3 at 144 Mason St.	The City has operational control over these suites, but they are not currently tracked nor included in the municipal inventory.
Fort Collins Capital Leasing Corporation	The City has operational control over it, but does not currently track its GHG emissions.
City leased vehicles and equipment	The City does not have complete operational control over these, but they are currently included in the City's Fleets activity data, and their GHG emissions are therefore included in the municipal inventory.
Water Treatment Plant and 2 Wastewater Treatment Plants	The City does have complete operational control over these facilities. Currently energy usage, fuel usage, air and ground transportation, and solid waste data are included in the GHG inventory. The City began tracking process emissions for all 3 facilities in its Community GHG Inventory during 2012.
Poudre Fire Authority	The City does not have operational control over these facilities. The municipal inventory only includes tracking of solid waste and recycling data (not electricity, natural gas, airline travel, fuel usage, or ground transportation).
Poudre River Library District	The City does not have operational control over most of these facilities. Electricity, natural gas, airline travel, ground transportation, solid waste, and recycling are included in the municipal inventory for only the Main Library at 201 Peterson St. and the Library Technical Annex at 256 Mountain Ave. All inventories to date include this information.

Generally, emissions from operations over which the City has no control will not be included in annual inventories. Operational Control means that the City of Fort Collins has the full authority to introduce and implement its operating policies "at the operation."

Facilities List

The City of Fort Collins owns or otherwise has operational control over facilities it owns. Real Estate Services maintains a listing of active City of Fort Collins facilities. A list of the current reporting year facilities included under the operational control approach is presented in Appendix A – City of Fort Collins Facilities. The facilities (or emissions associated with these operations),

shown in Table 5 below, were excluded from the City of Fort Collins QMP because the City does not have complete operational control over these locations:

Facility/Site Name	Address
Downtown Development Authority (DDA)	19 Old Town Square
Fort Collins Housing Authority (FCHA)	1715 W. Mountain Ave.
Urban Renewal Authority (URA)	City staff that provides management of the URA is located at 300 Laporte Ave. Emissions associated with the facility and City employees are included in the inventory, however, no GHG emissions resulting from activities related to the URA are included in the municipal inventory.
Fort Collins/Loveland Airport	4900 Earhart Road, Loveland

Local Government Sectors

One of the requirements of the LGOP is to report GHG emissions by 11 municipal sectors as part of the standard report. Table 6 identifies the municipal sectors that apply to the City of Fort Collins and the related GHG emissions for 2013.

Municipal Sector	GHG Reporting	2013 Emissions
Buildings and Other Facilities	Includes electricity and natural gas	20,262
Streetlights and Traffic Signals		6,447
Water Delivery Facilities	Includes electricity and natural gas	3,255
Wastewater Facilities	Includes electricity and natural gas	10,664
Port Facilities	NA*	NA*
Airport Facilities	NA*	NA*
Vehicle Fleet	Vehicle fleet emissions minus Transit Fleet emissions	2,848
Transit Fleet	Transit fleet emissions	956
Power Generation Facilities	NA*	NA*
Solid Waste Facilities	NA*	NA*
Other Process and Fugitive Emissions	Solid waste management and business-related travel	9,585
* NA = Not Applicable		

Voluntary Compliance with the Local Government Operating Protocol

The City's Climate Wise Baseline tool was the primary inventory tool that was used to guide the municipal inventory from 2005 through 2010. During 2012 and 2013, ESD staff made changes to the municipal GHG inventory to become more consistent with implementing ICLEI's version 1.1 LGOP, dated May 2010. This section addresses the extent of the City of Fort Collins' voluntary compliance with ICLEI's LGOP. There are several benefits to selecting an inventory protocol for

the annual GHG emissions inventory for the City's municipal operations and documenting our adherence to its methods and reporting requirements. Foremost is choosing a standardized set of guidelines that are used by local governments across the U.S. that was developed following internationally recognized GHG accounting and reporting principles with attention to the unique context of local government operations. Secondly, this practice allows the City to better compare its GHG emissions and progress towards carbon reductions with other U.S. communities. Table 7 summarizes the portions of the LGOP that have been implemented in the 2012 Fort Collins Municipal GHG Inventory and those components of the inventory yet to be incorporated.

Table 7. Status of Voluntary Compliance with Local Government Operating Protocol		
Requirements	Status	Notes
Local Government Profile Information	Compliant	See Table 2
Disclosure of services provided	Compliant	See Table 3
Government Sector Reporting	Compliant	See Table 6
Optional Scope 3 Reporting	Compliant	Includes reporting of employee business travel by personal vehicle and air, solid waste emissions from office and industrial wastes generated by City operations and public disposal of solid waste at City facilities
Activity Data Disclosure	Compliant	See Section VI Data Management, Activity
Reporting for all 6 GHGs	Not compliant	Currently reporting of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF ₆) are not included in the 2012 inventory due to the difficulty in obtaining source data.
Calendar year reporting	Compliant	
Selection of base year as performance datum	Compliant	2005 selected as base year and is consistent with the Community GHG Inventory and State reporting of performance
Recommended reporting using operational control approach	Compliant	
Reporting by GHG emissions scopes	Compliant	See Table 9 and Appendix I
Reporting of process emissions from water and wastewater treatment	Compliant	These process emissions have been incorporated into the Fort Collins community GHG inventories.
Reporting of emissions for employee commute	Not compliant	

Greenhouse Gas Emissions Types and Source Scopes

Setting operational boundaries involves identifying the GHG emissions associated with the City of Fort Collins operations and categorizing them as **Scope 1** – Direct Emissions, **Scope 2** – Indirect Electricity Emissions, or **Scope 3** – Other Indirect Emissions.

An Informational Category is used to document activities that impact net GHG emissions, such as recycling, although the City reports the municipal inventory and progress toward goals using gross GHG emissions (not considering the benefits of recycling.)

ESD and the Sustainability Team have identified the emission types (Table 8) and source scopes (Table 9) in consultation with the former Energy Management Team (EMT) now called the Community Carbon Team.

Table 8. City of Fort Collins Greenhouse Gas Emissions Types	
GHG	City of Fort Collins Operations/Sources
Carbon dioxide (CO ₂)	Mobile and stationary combustion: Purchased electricity; natural gas for heating buildings; fuel consumption for fleet and transit transportation and standby generators; street and traffic lights; electricity use associated with water and wastewater treatment; and employee reimbursed travel for work
Methane (CH ₄)	Natural gas and electricity usage; anaerobic decomposition of solid waste in landfills; jet fuel
Nitrous oxide (N ₂ O)	Natural gas and electricity usage, fuel combustion
Hydrofluorocarbons (HFCs)	Not included in inventory
Perfluorocarbons (PFCs)	Not included in inventory
Sulfur hexafluoride (SF ₆)	Not included in inventory

Scope 1 - Direct Emissions are from sources that are owned or controlled by the City of Fort Collins, such as emissions from stationary combustion (e.g., natural gas consumption for municipal buildings and fuel use by standby generators) or mobile combustion of fuels (e.g., fleet transportation).

Scope 2 – Indirect Emissions are from municipal operations consumption of purchased electricity from Platte River Power Authority (PRPA) and Xcel Energy.

Scope 3 – Other Indirect Emissions result from activities such as transport-related activities in vehicles not owned or controlled by the City of Fort Collins, and emissions from the City’s disposal of solid waste.

Informational Category includes all other activities that affect net GHG emissions (e.g., municipal recycling efforts).

GHG emission source scopes and data sources for municipal operations are detailed in Table 9 below.

Table 9. Greenhouse Gas Emissions Source Scopes

Emission Type	GHG Emission Category	Data Source and Owner
Natural gas for City buildings	Scope 1 - Direct	S. Reeve , Operations Services, Utility Manager database (tracks Xcel Energy accounts) Reeve
Natural gas for Water Treatment Facility	Scope 1 - Direct	R. DeCoursey (Xcel Energy account), Water Treatment
Natural gas for Wastewater Treatment Facility	Scope 1 – Direct	R. Kemp, (Xcel Energy account) Water Reclamation Facilities
Fleet fuel consumption	Scope 1 - Direct	T. Oschsner and S. Welsch, FASTER database - Fleets
Electricity for major city buildings and property	Scope 2 - Indirect	S. Reeve, Operations Services, Utility Manager database (tracks Fort Collins Utilities (FCU) electricity usage)
Electricity for streetlights	Scope 2 - Indirect	E. Switzer, Utilities
Electricity for traffic signals	Scope 2 - Indirect	E. Switzer, Utilities
Other electricity	Scope 2 - Indirect	Sum of all FCU electricity accounts minus energy from above 3 electricity emission types = other electricity (includes small meters like Parks' lights that are not in a "facility" – for example in a parking lot)
Electricity for Wastewater Treatment Facilities and Southwest Pump Station	Scope 2 – Indirect	E. Switzer, Utilities
Electricity for Water Treatment Facility	Scope 2 – Indirect	R. DeCoursey, Utilities
Electricity from Poudre Valley Rural Electric Association (PVREA) for Natural Areas facilities and property	Scope 2 – Indirect	B. Brock, Natural Areas
Employee airline travel	Scope 3 – Other Indirect	L. Brown, Finance
Employee vehicle travel for work (reimbursed)	Scope 3 – Other Indirect	L. Brown, Finance
Solid waste	Scope 3 – Other Indirect	Waste Management, Inc. and Larimer County landfill (self-hauls)
City of Fort Collins recycling and other waste diversion	Informational	Waste Management, Inc. (current vendor), RMP Recycling (metal recycling), Streets' Crushing Operations Site, City Parks and Forestry Departments (wood mulching and yard trimmings), City Purchasing (electronics recycling), ESD WR&R Program

V. Emissions Quantification

Background

Greenhouse gas emissions from the municipal organization have been quantified and reported in the 2001/2002, 2003/2004, and 2005/2006 Climate Status Reports. Many of these calculations were based on the methodology and emissions factors from the ICLEI Clean Air and Climate Protection (CACP) 2009 software or the EPA's Waste Reduction Model (WARM), with the exception of electricity, which applied a localized emissions factor provided by PRPA. These calculations were based on the best data available at the time.

When the City of Fort Collins joined the Climate Wise program in 2007, emissions from the municipal organization were reported using the Climate Wise GHG Baseline Tool also used by the vast majority of Climate Wise partners. Starting in 2008, municipal emissions data for the years 2005, 2006, 2007 and 2008 were reviewed and entered into the Climate Wise GHG Baseline Tool. The municipal GHG inventories reflected the efforts of staff to standardize the data sets used.

Beginning with the 2011 municipal GHG inventory, the GHG Emissions Management System (GEMS) database was fully implemented and used to calculate all inventory emissions replacing use of the Climate Wise GHG Baseline Tool spreadsheet. The methodologies described in the following sections reflect the City's most current inventory methods and its voluntary compliance with ICLEI's LGOP, version 1.1, dated May 2010.

Quantification Methods

A. Electricity

Current Electricity Method: The City uses ICLEI's LGOP recommended approach for calculating electricity emissions: Method 6.2.1. The boundary for calculating GHG emissions from electricity for municipal operations is based on operations and activities the City Operations has direct operational control over (e.g., electricity usage by City owned and operated facilities). Electricity data is compiled from a combination of data collected from Operation Services, Utilities, and Natural Areas as described in Section VI., Data Management. Most electricity data is generated from the Utility Manager database, where it has been reconciled by Operation Services with billing information from Fort Collins Utilities. The data is automatically uploaded to GEMS from the Utility Manager database in spreadsheet format, and additional data is submitted in summary table format by the Utilities and Natural Areas Departments for manual data entry into GEMS.

All electricity CO₂e emissions for 2005 through 2010 were recalculated during 2012 using the GEMS database and local PRPA emissions factors that estimate the contributions from N₂O and CH₄ emissions in addition to CO₂ and reflects the mix of renewable energy sources used for electricity generation. The GEMS database offers the flexibility to assign unique electricity emissions factors for each year, in alignment with the community GHG inventory and provides improved calculation precision.

B. Natural Gas

Current Natural Gas Method: The City uses ICLEI's LGOP recommended approach for calculating natural gas emissions: Method 6.1.1. Natural gas data is obtained from data compiled by Operations Services in the Utility Manager database for municipal buildings, and from summary tables provided by the City's Water Treatment Facility, two Water Reclamation Facilities, and from the Natural Areas Department as described in Section VI of this report. The Climate Wise GHG Baseline Tool has been replaced by the GEMS database for calculation of emissions from natural gas usage. The methodology now includes estimates for CH₄ and N₂O emissions in addition to CO₂, and all previous natural gas emissions from 2005 to 2010 have been updated consistent with this new methodology.

C. Water and Wastewater

Current Method for Electricity and Natural Gas Emissions Associated with Water Treatment and Water Reclamation Treatment: These calculations have been integrated into the Electricity and Natural Gas Methods described in this section of the QMP based on actual utility usage data. The methodologies have been updated as described in Section V, Quantification Methods, paragraphs A and B, above. The current approach is consistent with the ICLEI LGOP recommended methods 6.1.1 and 6.2.1.

Methods for Process Emissions Unique to Wastewater Treatment: The wastewater treatment process emissions for the City's two water reclamation facilities were calculated as part of the 2012 Community GHG Inventory for the first time during 2012/2013, and will continue to be estimated annually as part of the City's Community GHG Emissions Inventory. The calculations are based on the ICLEI 2012 Community Protocol which incorporates the following 5 methods:

- Method W.W.1.a, CH₄ Emissions from the combustion of anaerobic digester gas
- Method WW.2.a, N₂O emissions from the combustion of anaerobic digester gas
- Method WW.7, Process N₂O emissions from wastewater plants with denitrification
- Method WW.8, Process N₂O emissions from wastewater plants without nitrification or denitrification
- Method WW.12(alt), Fugitive N₂O emissions from effluent discharge

The inventory results for all previous years have also been calculated and are listed in Table 10, below. Complete details of these methods can be found in the current Community GHG Emissions Inventory Quality Management Plan located at:

<http://www.fcgov.com/airquality/>.

Year	Activity (ft³/day)	Scope 1 Results (mt CO₂e)	Scope 3 Results (mt CO₂e)
2005	111,419	1,125	1,782
2006	135,962	1,150	2,175
2007	132,070	1,161	2,112
2008	131,321	1,195	2,100
2009	131,845	1,240	2,109
2010	134,187	1,301	2,146
2011	95,479	1,286	1,527
2012	95,479	1,301	1,527
2013	122,392	1,367	1,958

D. Transportation

Current Fleet Fuel Consumption Method: The City uses ICLEI's LGOP recommended approach for calculating vehicle fleet emissions: Method 7.1.1.1. Data reported by the Fleets Division are downloaded from the new FASTER Fleet database and contain data by fuel type (gasoline, biodiesel (B10), diesel, liquid propane gas (LPG), compressed natural gas (CNG), and E85 (85% ethanol alcohol and 15% gasoline)) for each motorized vehicle, both on-road and off-road operated by City operations. These data also include stationary motorized equipment such as lawn maintenance equipment (e.g., blowers) and generators that require the fuels listed above. These data are then entered via an automated spreadsheet upload into the GEMS database to calculate monthly fuel totals by department and then estimate metric tons CO₂e by fuel type. Each fuel type has a separate emissions factor associated with it. The Fleets fuel methodology was updated for the 2011 inventory to calculate separate emissions for the alternative and the traditional fuel fractions for both biodiesel and ethanol using associated emissions factors. For example, B10 is comprised of 10% biofuel and 90% diesel, so only the 90% diesel component, which is the conventional fuel, is counted towards the inventory emissions total. Emissions from the 10% biofuel component are considered a biogenic source of emissions, and therefore are not included in the GHG inventory.

Current Employee Airline Travel Method: The LGOP encourages municipalities to report Scope 3 emissions; however, it does not contain a method for calculating emissions related to employee airline travel. The method selected for calculating emissions for airline business travel is described in Section 2.4 of EPA's Climate Leaders' Optional Emissions from Commuting, Business Travel and Product Transport, EPA430-R-08-006, dated May 2008 (available at: http://www.epa.gov/climateleadership/documents/resources/commute_travel_product.pdf). Equation 4 and the Table 4 emission factors for CO₂, CH₄ and N₂O are used for these calculations. Employee airline travel for work is calculated using data provided annually by the City Finance Department for employee work-related travel from Denver International Airport (DIA) to the travel destinations. The roundtrip mileage for each trip is determined using an online air miles calculator located at: http://www.webflyer.com/travel/mileage_calculator/. The mileage results are then compiled in a spreadsheet and totaled by City department and then entered into the GEMS database to calculate metric tons of CO₂e emissions.

Current Employee Driving for Work Method: The LGOP encourages cities to report emissions from employee business travel, but does not contain a method for these calculations. ESD

selected EPA's Method 2.1 as described in EPA's Climate Leaders' Optional Emissions from Commuting, Business Travel and Product Transport, EPA430-R-08-006, dated May 2008. Employee vehicle travel mileage that is reimbursed is compiled from data provided by the Finance department. The mileage is totaled by department, and the results are manually entered into the GEMS database. The employee driving for work mileage results only cover reported travel (primarily to/from conferences). Sometimes employees don't submit reimbursement requests for travel when they use their own vehicles, and therefore this is not included in the emissions estimate. Employee commute (driving to and from work) are also not currently estimated and included in the municipal GHG inventory.

E. Solid Waste

Current Solid Waste Method: Reporting of Scope 3 emissions, including those from solid waste generation by municipal operations, is optional under ICLEI's LGOP, however the LGOP only offers a methodology for cities that have operational control over their own landfill. Fort Collins does not manage the Larimer County landfill, but it sends its waste from municipal operations to this facility. It is important to the City to track emissions from its municipal operation's solid waste generation and to track the progress of the many City initiatives to reduce GHG emissions from waste reduction and recycling programs. Over the past 3 years the City has also made the effort to collect and analyze these solid waste data in greater detail and to use the data to drive further waste reduction efforts. In 2013, the City updated its solid waste methods and the GEMS database to incorporate ICLEI's new solid waste GHG emissions methods from the 2012 ICLEI Community Protocol. The 3 methods applicable for Fort Collins are SW.4, SW.5, and SW.6 and are described in the following paragraphs:

Method SW.4 Community-Generated Waste Sent to Landfills

Method SW.4 accounts for activity emissions that occur as a result of waste disposed by municipal operations, regardless of whether or not the receiving landfill is located inside or outside of the community boundary. Method SW.4 attributes future landfill gas generation to the inventory year in which the waste was generated and deposited. This perspective is different from previous solid waste emissions methods in that it focuses the local decision making with regard to policies that can influence the generation and fate of solid waste from municipal operations. The City is better able to focus on tracking the progress made to reduce emissions by reducing the landfilling of wastes in subsequent inventory years rather than on landfill management practices.

The calculation method consists of the following steps:

- Determine the total mass of waste entering landfills during the inventory year attributed to municipal operations. These data are obtained from the vendor account and from self-haul data reports from the Larimer County Solid Waste department.
- If data are available, determine the waste characterization by waste type for the inventory year. If the data is unavailable, Table SW.5 in the 2012 ICLEI Community Protocol has default values that can be used. The waste characterization from the 2007 Larimer County Waste Composition Study was used for the current GHG inventory.

- Use Equation SW4.1 to determine the CH₄ emissions as CO₂e associated with solid waste for City operations (p. 24, Appendix E, 2012 ICLEI Community Protocol). (Note: The Larimer County Landfill has a partial gas collection system.)

Method SW.5 Process Emissions Associated with Landfilling

In order to get a complete picture of the emissions associated with landfilling, it is important to calculate process emissions. Process emissions come from CO₂ emissions associated with powering the equipment necessary to manage the landfill. This method is required for community generated waste process emissions from landfills outside a community's boundaries. The following steps are used to calculate emissions for the annual GHG emissions inventory:

- Determine the mass of solid waste that enters the landfill in the inventory year.
- Use Equation SW.5 to calculate the landfill process emissions (p. 27, Appendix E, 2012 ICLEI Community Protocol). Note: The Larimer County landfill uses diesel powered landfill equipment.

Method SW.6 Collection and Transportation Emissions

To further complete the picture of the emissions associated with landfilling, it is important to calculate emissions from collection and transportation emissions. Collection emissions consist predominately of CO₂ emissions associated with powering the equipment necessary to collect solid waste from within the community. Transportation emissions are similar, but instead cover the transportation of waste from the community to facilities located outside of the community. The following steps were used to calculate emissions for the 2012 GHG inventory:

- Determine the mass of solid waste managed at a facility in the inventory year.
- Determine the distance traveled to the waste management facility. Average haul distance to the Larimer County Landfill was estimated at 7.5 miles.
- Use Equation SW.6 to calculate collection and transportation emissions (p. 29, Appendix E, 2012 ICLEI Community Protocol).

Vendor data (e.g., Waste Management, Inc.) is uploaded from spreadsheets to GEMS where the calculations are done, while other sources of data are manually entered (e.g., solid waste that is self-hauled to the Larimer County landfill). All previous data for years 2005 through the current GHG inventory were revised using the methodology described above. The current contract with Waste Management Inc. requires that actual weights be provided instead of volumes, so associated conversion factors are no longer required, which also reduces estimation errors. In cases where solid waste pick-up involves dumpsters, the assumption is that the dumpsters are full.

The City began tracking solid waste generated by municipal operations into 3 components beginning with the 2012 annual GHG inventory:

- Office solid waste – 47 solid waste accounts for municipal office buildings
- Industrial solid waste – includes 11 roll-offs located at municipal operations (e.g., Utilities, Transfort) and all self-haul data for solid waste taken to the landfill

- Publically-generated solid waste – includes 23 solid waste accounts at facilities serving the public (e.g., public restrooms, parks, public recreation facilities, parking garages)

This change in solid waste accounting allows the City to calculate 2 different solid waste diversion rates (office waste and industrial waste) consistent with the method used by the Colorado Department of Public Health and the Environment (CDPHE).

F. Recycling

Current Recycling Method: Reporting recycling and solid waste diversion is not required by ICLEI's LGOP, nor is it typically a requirement of a GHG Emissions Inventory. Recycling and solid waste diversion data is not included in the calculations or inventory totals for the Municipal GHG Inventory for the City of Fort Collins; however, the data is collected and reported in the GEMS database and the annual Municipal Operations Sustainability report for informational purposes. Beginning in 2010, the City began receiving recycling data in actual weights of recycled material by City facilities from the vendor, Waste Management, Inc. These data are received on a monthly basis and represent single-stream recycling. Therefore, they are not broken down by categories of recyclable materials. However, the contract requires periodic characterization of the recycled material, which is used for GHG calculations in GEMS.

The Waste Management, Inc. accounts for recycling comprise the total weights for office recycling for City operations. During 2011 and 2012 ESD began collecting data (weights or volumes and costs) for industrial material that is recycled or diverted from the landfill by City departments, including some data for past inventories from 2005 through 2010. These industrial sources of recyclable material include the following materials: scrap metal, concrete, asphalt, road base, wood mulching, electronics, and yard trimmings and are added together to provide an industrial recycling/solid waste diversion weight. The method for estimating reductions used is direct estimation of GHG reductions using the U.S. Environmental Protection Agency (EPA's) Waste Reduction Model (WARM), version 13, emissions factors. This involves collecting recycling weights and multiplying by material-specific WARM emission factors. The results are then totaled to estimate annual GHG emissions.

G. Emissions Not Reported

The following categories of emissions are not currently addressed in the City of Fort Collins Annual GHG Emissions Inventory:

- HFC, PFC, and SF6 emissions from municipal operations (e.g., refrigeration, fire suppressants, and air conditioning equipment)
- Employee travel to/from work
- Separate identification of emissions from purchased electricity for electric vehicles (the emissions are included in the purchased electricity totals)
- Process emissions from the Mulberry and Drake Water Reclamation Facilities (emissions from combustion of anaerobic digester gas, denitrification, conventional treatment, and effluent discharge). This information is currently reported in the Community GHG Emissions inventory.
- Process or fugitive emissions for Meadow Springs Ranch (biosolids land treatment facility)

- Forecasts of emissions from municipal operations
- Fertilizer application

These categories will be periodically reevaluated to determine their inclusion in future inventories. Some of these categories may be de minimis or are not required reporting under the LGOP protocol.

Emission Factors and Other Constants

A. Electricity

Current Emissions Factors: Table 11 presents the emission factors for electricity used in GEMS that were implemented in the annual inventory beginning in 2011 (including recalculations for previous inventory years). These factors are identical to the factors used to calculate electricity emissions in the community GHG inventory.

Table 11. Current Emission Factors in GEMS for Electricity		
Year	lbs. CO₂/MWh	kWh/metric tons CO₂e
2005	1,827	0.00082871
2006	1,829	0.000829621
2007	1,741	0.000789705
2008	1,699	0.000757047
2009	1,777	0.000806035
2010	1,610	0.000730414
2011	1,490	0.000675860
2012	1,672	0.000758414
2013	1,672	0.000758414
Source: PRPA, 2005-2013		

Current Conversion Factor: To convert to tons CO₂e the calculation is as follows: (MWh purchased x emissions factor)/2000 = short tons CO₂e

B. Natural Gas

Current Emission Factors for GEMS: Table 12 contains the current emission factors used to calculate CO₂, CH₄, and N₂O emissions from natural gas use for municipal operations in the GEMS database.

Type of GHG Gas	Emission Factor in GEMS
CO ₂	0.05401 metric tons CO ₂ e/dth CO ₂
CH ₄	0.000005 metric tons CO ₂ e/dth CH ₄
N ₂ O	0.0000001 metric tons CO ₂ e/dth N ₂ O
Source: ICLEI 2012 Community Protocol	

Current Conversion Factor: The following conversion factor is used for natural gas calculations:
1 DTH = 1 MMBtu

C. Water and Wastewater

Current Emissions Factors for Electricity and Natural Gas Emissions Associated with Water and Water Reclamation Treatment: Because these calculations have now been integrated into the Electricity and Natural Gas Methods described in Section V, the emission factors used are also associated with these new methods. The updated methods are now based on actual utility usage data providing a greater degree of accuracy.

D. Transportation

Current Emission Factors for GEMS: The following emission factors (Table 13) have now been implemented for all municipal inventories retroactive to 2005:

Fuel	Emission Factor	Units
Gasoline	8.78	kg CO ₂ /gal
Diesel	10.21	kg CO ₂ /gal
B100*	9.45	kg CO ₂ /gal
LPG	5.79	kg CO ₂ /gal
CNG	0.054	kg CO ₂ /gal GGE
E85	6.2045	kg CO ₂ /gal
Source: ICLE 2012 Community Protocol		
* Used to calculate various mixes of biofuels		

Current Conversion Factor: A common method of measurement is the Gasoline Gallon Equivalent (GGE). This number is arrived at by comparing the British Thermal Units (BTU) content per unit of each fuel type and then calculating the ratio. To compare diesel fuel to gasoline, the conversion is 1 gallon of diesel #2 equals 0.88 GGE.

E. Solid Waste

Current Solid Waste Emissions Factor for GEMS: The GEMS emission factors for solid waste are presented in Table 14. Since the solid waste vendor has changed their method for reporting

from cubic yards to providing actual weights in short tons, the GEMS database was updated during 2013 to accommodate the change.

Table 14. Current Solid Waste Emissions Factors			
Method Number/Name	Component	Emissions Factor	Units
SW.4 Decomposition	Mixed Municipal Solid Waste (MSW)	0.060	mt CH ₄ /wet short ton
SW.4 Decomposition	Newspaper	0.043	mt CH ₄ /wet short ton
SW.4 Decomposition	Office Paper	0.203	mt CH ₄ /wet short ton
SW.4 Decomposition	Corrugated Containers	0.120	mt CH ₄ /wet short ton
SW.4 Decomposition	Magazines/Third-Class Mail	0.049	mt CH ₄ /wet short ton
SW.4 Decomposition	Food Scraps	0.078	mt CH ₄ /wet short ton
SW.4 Decomposition	Grass	0.038	mt CH ₄ /wet short ton
SW.4 Decomposition	Leaves	0.013	mt CH ₄ /wet short ton
SW.4 Decomposition	Branches	0.062	mt CH ₄ /wet short ton
SW.4 Decomposition	Dimensional Lumber	0.062	mt CH ₄ /wet short ton
SW.4 Decomposition	Textiles	0.073	mt CH ₄ /wet short ton
SW/4 Decomposition	Construction/Demolition	0.012	mt CH ₄ /wet short ton
SW.5 Process	Diesel	0.0164	mt CO ₂ e/wet short ton
SW.6 Collection	Diesel	0.020	mt CO ₂ e/wet short ton
SW.6 Transport	Diesel	0.00014	mt CO ₂ e/wet short ton

Source: ICLEI Community Protocol, October 2012

F. Recycling

Current Recycling Conversion Factors in GEMS: The conversion factors in Table 15 are the ones currently used in GEMS for calculating reductions from recycling and waste diversion activities.

Table 15. Recycling Effective Conversion Factors in GEMS	
Cardboard (pounds)	0.001576196 metric tons CO ₂ e/pound
Aluminum (pounds)	0.009167462 metric tons CO ₂ e/pound
Plastic (pounds)	0.000898558 metric tons CO ₂ e/pound
Newsprint (pounds)	0.002111347 metric tons CO ₂ e/pound
Mixed office paper (pounds)	0.001851851 metric tons CO ₂ e/pound
Magazines (pounds)	0.001367009 metric tons CO ₂ e/pound
Commingled (pounds)	0.001829803 metric tons CO ₂ /pound
Single-stream (pounds)	3.659636 metric tons CO ₂ /pound
Source: EPA WARM V.13	

Scrap metal Emission Factors: Table 16 lists the effective conversion factors from EPA's WARM, V.13 that are used for calculating carbon reductions from recycling of various types of scrap metal.

Table 16. Scrap Metal Recycling Conversion Factors in GEMS	
Mixed metal	5.4 short tons/metric tons CO ₂ e
Aluminum	13.61 short tons/metric tons CO ₂ e
Copper	4.97 short tons/metric tons CO ₂ e
Brass	5.4 short tons/metric tons CO ₂ e
Steel	1.8 short tons/metric tons CO ₂ e
Source: EPA WARM V.13	

E-scrap Conversion Factor: The source for this conversion factor for recycling is EPA's WARM, V.13. The emission factor is 2.35 short tons CO₂e/short ton of e-scrap material. These calculations were hand calculated previously when the Baseline Tool was used.

Crushed Concrete Conversion Factor: The source for this conversion factor for recycling is EPA's WARM, V.13. The conversion factor is 0.01 short tons 1.25 inch crushed concrete per metric ton CO₂e.

Recycled Asphalt Conversion Factor: The source for this conversion factor for recycling is EPA's WARM, V.13. The emission factor is 0.08 short tons 1.25 inch asphalt per metric ton CO₂e.

Recycling Unit Conversion Factor: The unit conversion factor for pounds to short tons is 1 pound = 0.0005 short tons.

VI. Data Management

Activity Data

A. Electricity

There are 3 sources for electricity usage data for the annual municipal GHG inventory:

Data provided by Operations Services

Electricity Use Data for City Buildings

The annual kWh data are provided from the Utility Manager (UM) database software and entered into GEMS to calculate GHG emissions.

Data provided by Fort Collins Utilities, Finance Department

Electricity use data for Water and Wastewater Treatment Plants

Annual electricity use data are provided by R. DeCourcey, Utilities, for the water treatment plant on Laporte Ave. and the Southwest pump station, and by E. Switzer, Utilities, for the Water Reclamation facilities at Drake Rd. and Mulberry St.

Electricity for Streetlights

The electricity used by streetlights is determined by monthly inventory, and is not metered. This data is provided by E. Switzer, Utilities, and entered into GEMS to calculate GHG emissions.

Electricity for Traffic Signals

The electricity used by traffic signals is determined by monthly inventory, and is not metered. This data is provided by E. Switzer, Utilities, and entered into GEMS to calculate GHG emissions.

“Other” Electricity Use

This refers to all additional electricity meters for which the City of Fort Collins pays utility bills. It is calculated by subtracting the total amount of energy recorded in the Utility Manager database for City buildings from the sum of all the accounts billed to the City (Note: the Water Treatment Facility, the SW pump station, both Water Reclamation Facilities, and street lights and traffic signals are accounted for separately by the Finance department and are included in the municipal GHG emissions inventory). This total for “other” electricity is entered into the GEMS database to obtain metric tons CO₂e.

Data provided by the Natural Areas Department

Electricity Use Data for Natural Areas

The electricity used by some Natural Areas facilities is provided by Poudre Valley Rural Electric Association (PVREA). This information is provided to B. Brock, Natural Areas through billing, and a spreadsheet is compiled and provided to ESD for manual entry into GEMS.

Table 17 contains the 2013 electricity use summary data for the annual GHG inventory.

Table 17. 2013 Electricity Summary Data		
Category of electricity use	Utility Provider	kWh
City Buildings	Fort Collins Utilities	16,626,189
Water Treatment Facility, Laporte Ave.	Xcel Energy	2,969,569
SW Pump Station, 3078 S. Overland Trail	Xcel Energy	475,680
Drake Water Reclamation Facility, 3036 Environmental Dr.	Xcel Energy	8,957,200
Mulberry Water Reclamation Facility	Xcel Energy	4,128,000
Traffic Signals	Fort Collins Utilities	575,316
Street Lights	Fort Collins Utilities	8,500,793
Other Electricity	Fort Collins Utilities	2,027,639

B. Natural Gas

There are 3 sources for natural gas usage data for the annual municipal GHG inventory:

Data provided by Operations Services

Natural Gas Use for Buildings

The total decatherms used by buildings tracked in the Utility Manager database are entered into GEMS to calculate annual GHG emissions. Note that the natural gas used by the Fast Fuel maker to create compressed natural gas (CNG) for use with fleet vehicles is currently included in the total for buildings. This value must be subtracted manually to calculate separate activity use data for buildings and transportation.

Data provided by Fort Collins Utilities, Finance Department

Natural Gas for the Water and two Water Reclamation Facilities

The total decatherms (DTH) for each of the 3 facilities is provided by R. DeCoursey, Utilities. These 3 separate values are entered into GEMS to calculate GHG emissions.

Data provided by Natural Areas Department

Natural Gas Use for Natural Areas Facilities outside City Limits

A spreadsheet with utility usage data from various vendors is provided by B. Brock, Natural Areas. Xcel Energy is the natural gas provider for natural areas facilities located outside City Limits. As a result, the Natural Areas department, and not Operations Services tracks these accounts.

Table 18 contains the current natural gas usage summary data for annual municipal GHG emissions inventory.

Category of natural gas use	dth
City Buildings (except facilities listed below)	143,958
Drake Water Reclamation Facility	12,220.9
Mulberry Water Reclamation Facility	1,694.7
Laporte Water Treatment Facility	12,072.0

C. Water and Wastewater

There are GHG emissions associated with the energy used to treat and pump potable water and to treat wastewater. Previously the Climate Wise Baseline Tool was used to estimate electricity usage based on water and wastewater flows. This is no longer required because GEMS incorporates actual electricity and natural gas usage data for these 3 facilities to directly calculate GHG emissions associated with water and wastewater treatment services provided by the City of Fort Collins.

Data for process emissions associated with water and wastewater treatment are collected from all 3 water-related facilities directly and used for GHG emissions calculations for the Fort Collins Community GHG Inventory. Details can be found in the current Community GHG Emissions Inventory Quality Management Plan located at: <http://www.fcgov.com/airquality/>.

D. Transportation

There are 2 sources for transportation activity data used for the annual municipal GHG inventory:

Data provided by Fleets Department

Fleets Fuel Consumption

The Fleets department FASTER database (S. Welsch) provides transaction-level gallons (or gallon equivalents) of fuel consumed by the City vehicles (both on-road and off-road) and equipment, including in-house purchases made at City-owned pumps, and commercial purchases made off-site to fuel City-owned vehicles. This includes gasoline, biodiesel (B10), propane (LPG), compressed natural gas (CNG) and ethanol (E85) for City owned and operated vehicles and equipment. Fuel transactions purchased by Poudre Fire Authority, Poudre School District, the Northern Front Range Metropolitan Planning Organization (NFRMPO), and the Food Distribution Center has been removed from the City fuel totals, as these are not City-managed operations. The GEMS database summarizes the FASTER fuel data by month and department, and this data is available for downloading for further analysis.

Data provided by the Accounting Department

Employee Airline Travel

The data for airline trips for work taken by employees is provided by Accounting from a database that tracks all reimbursed travel. This information includes travel destinations to/from DIA. The roundtrip mileage for each trip is calculated using an online air miles

calculator, and then manually entered into GEMS to calculate total annual GHG emissions.

Employee Driving for Work

The City Accounting Department provides the total number of miles reimbursed to employees per year for both local and out-of-state ground travel (data now tracked in same database). Sometimes employees don't submit reimbursement requests for travel when they use their own vehicle, and this is not factored into the emissions estimate.

E. Solid Waste

There are 2 sources for solid waste activity data for the annual municipal GHG inventory:

Data provided by Waste Management, Inc.

Solid Waste Hauled under Current City Contract

Waste Management Inc. is the vendor that provides activity data for solid waste that is hauled under the current City contract. Their data are directly uploaded from a spreadsheet to the GEMS database. All data are now provided in weights, not volumes, based on actual measurements. During 2012/2013, it was determined that these data actually represent several categories of solid waste (e.g., office waste, industrial waste, and publically-generated waste thrown away at City facilities). Subtotals are provided in GEMS for these 3 categories of solid waste.

Data provided by the Larimer County Solid Waste Department

Solid Waste Self-Hauled to the Larimer County Landfill

The Larimer County Solid Waste department provides annual reports on the weights of trash hauled directly to the Larimer County landfill by City departments for free. This includes wet dirt, diseased trees, street swept material, and other predominantly non-organic material with a high mass. These "freebies" are included in the municipal inventory as a source of industrial solid waste and a separate waste characterization was developed during 2013 based on 9 years of self-haul data because of the unique composition of this waste.

Table 19 provides a summary of data sources and revisions for historical solid waste data for municipal operations.

Table 19. Revisions to Historical Solid Waste Activity Numbers	
Year	Revision History
2005	The Waste Management Inc. waste removal contract for 2005 cannot be located, so the method used to estimate the annual volume of solid waste from municipal operations was to use 20,650 cubic yards reported in the “City of Fort Collins 2005/2006 Climate Protection Status Report”, dated 2008 (Source: http://www.fcgov.com/climateprotection/pdf/2006-climatestatusreport.pdf?1223397946). The value of 826 short tons of waste was divided equally by 12 months (68.8333 short tons/month) and entered into the GEMS database. It is unknown if this total includes weights for Roll-Off accounts because of the manner in which the number was derived. During 2012, documentation was found that 29,180 short tons of self-haul waste were taken to the landfill, and this data has now been added to the 2005 inventory as 2,431.67 short tons industrial waste/month.
2006	22,823 CY of solid waste were reported for 2006 by the Waste Management Inc. waste removal contract. This volume includes the 10% estimate for Roll-Off accounts listed in the contract. This volume equals 911 short tons or 75.91667 tons/month of total solid waste for the City. This data was entered into the GEMS database. In addition, 22,382 short tons of self-haul waste were taken to the landfill, and this data has been added to the 2006 inventory as 1,865.17 short tons industrial waste/month.
2007	24,989 CY of solid waste were reported for 2007 in the Waste Management Inc. waste removal contract. This volume includes the 10% estimate for Roll-Off accounts listed in the contract. The resulting weight is 998 short tons or 83.1667 short tons waste/month. Additionally, there were 28,271 short tons of self-haul waste taken to the landfill, and this data has been added to the 2007 inventory as 2,355.92 short tons industrial waste/month.
2008	The method used to estimate the annual volume of solid waste from municipal operations was to use the value of 24,073 cubic yards that was hand-written on a report detailing trash by departments. The note indicates that S. Gordon and R. Russo provided analysis and agreed to this value. This volume of solid waste equals an annual total of 963 short tons of waste or 80.25 short tons/month, and it is not known if it accounts for Roll-Off accounts. During 2012, 28,045 short tons of waste that were self-hauled to the landfill were identified and added to the inventory. During 2013, this number was revised downward to 20,418 short tons of self-haul based on corrections made for over estimation of weights of animal carcasses. All data were entered into the GEMS database to calculate GHG emissions.
2009	The method used to estimate the annual volume of solid waste from municipal operations was to use the value of 20,182 cubic yards that was hand-written on a report detailing trash by departments. This volume of solid waste equals an annual total of 807 short tons of waste or 67.25 short tons/month, and it is not known if it accounts for Roll-Off accounts. During 2012, 27,348 short tons of waste that was self-hauled to the landfill were identified for 2009 and added to the inventory. . During 2013, this number was revised downward to 20,263 short tons of self-haul based on corrections made for over estimation of weights of animal carcasses. All data were entered into the GEMS database to calculate GHG emissions.
2010	Seven months of volume data were available in the Waste Management Inc. reports that were averaged for the remaining 5 months and used (along with the 7 months of actual data) to obtain a total volume of 22,400 CY for the annual total of solid waste. This volume equals 896 short tons of waste or 74.6667 short tons/month and appears to include the weights for Roll-Off accounts. During 2012, 22,316 short tons of self-hauled solid waste were identified and added to the 2010 inventory. . During 2013, this number was revised downward to 15,408 short tons of self-haul based on corrections made for over estimation of weights of animal carcasses. All data were entered into the GEMS database to calculate GHG emissions.

F. Recycling

There are 5 sources of recycling and solid waste diversion data for municipal operation:

Data provided by Waste Management, Inc.

Recycling Hauled under Current City Contract

Waste Management Inc. provides activity data for recycling of office materials that are hauled under the current City contract. These data are directly uploaded from a vendor-supplied spreadsheet to the GEMS database.

Data provided by Purchasing on Scrap Metal Recycling

Scrap Metal Recycling

The current vendor for the City is Rocky Mountain Battery. The Purchasing department compiles the data in a spreadsheet that is submitted to ESD for manual entry to the GEMS database. This data is tracked by City department and type of material.

Data provided by the City's Crushing Facility

Concrete, Asphalt, and Road Base Recycling

The City's Hoffman Mill Crushing Facility compiles data on tonnage of concrete, asphalt, and road base material that is recycled at the facility. This data includes costs, and is manually entered into GEMS.

Data provided by the Purchasing department on Electronics Recycling

Electronics Recycling

Summary data on electronics recycling is collected by the Purchasing department from the current vendor and submitted for manual entry into GEMS.

Data on Wood Mulching and Recycled Yard Trimmings provided by City Departments

Wood Mulching and Recycling of Yard Trimmings

Summary data from the Parks and Forestry departments are submitted to the WR&R program on wood that has been mulched and yard trimmings that have been recycled. This data is manually entered into GEMS to estimate carbon reductions for the annual Municipal Sustainability report.

Table 20 provides a summary of data sources and revisions for historical recycling and solid waste diversion data for municipal operations.

Table 20. Revisions to Historical Recycling and Solid Waste Diversion Activity Data	
Year	Revision History
2005	All 4 quarters of the recycling volumes have been located for the 2005 Waste-Not Recycling report, and the total annual weight was documented as 251,955 lbs. The total tonnage is 125.978 short tons or 10.498 tons/month. During 2012, the following new categories of recycling/waste diversion were added to the 2005 inventory: concrete and asphalt, wood for mulching, electronics, and yard trimmings. All data were entered into the GEMS database.
2006	The Waste-Not Recycling annual report for 2006 provides 12 months of data (by weight in pounds) for 8 categories of recycled materials. The total weight for the year was 274,156 pounds of recyclables. These numbers were converted to 137 short tons then entered into the GEMS database. During 2012, the following new categories of recycling/waste diversion were added to the 2006 inventory: concrete and asphalt and electronics. All these data were entered into the GEMS database.
2007	The Waste-Not Recycling annual report for 2007 provides 12 months of data (by weight in pounds) for 10 categories of recycled materials. The annual total was 286,618 pounds or 143 short tons or 11.942 tons/month. During 2012, the following new categories of recycling/waste diversion were added to the 2007 inventory: concrete and asphalt, scrap metal, and electronics. All these data were entered into the GEMS database.
2008	The Waste-Not Recycling annual report for 2008 provides 12 months of data (by weight in pounds) for 9 categories of recycled materials. The total estimated weight was 430,070 pounds of recyclables. The annual total in tons for this recycling was 215 short tons or 17.9196 tons/month. During 2012, the following new categories of recycling/waste diversion were added to the 2008 inventory: scrap metal, concrete and asphalt, and electronics. All data were entered into the GEMS database.
2009	The municipal contract for recycling was switched to Green Girl LLC in 2009. During 2012, documentation was located for both the Green Girl LLC and the Waste-Not Recycling contracts to calculate annual tonnage for 2009. The 2009 annual total was 328,743 pounds or 164.372 short tons (or 13.6976 tons/month). During 2012, the following new categories of recycling/waste diversion were added to the 2009 inventory: scrap metal, and concrete and asphalt. All data were entered into the GEMS database.
2010	The municipal contract for recycling included Green Girl LLC and Waste Management Inc. in 2010. All data documentation was located during 2012, and the resulting annual total was 299,915 pounds or 149.958 short tons (or 12.4965 tons/month). During 2012, the following new categories of recycling/waste diversion were added to the 2008 inventory: scrap metal, concrete and asphalt, wood for mulching, and yard trimmings. All data were entered into the GEMS database.

Normalization Factors

The electricity and natural gas data in Utility Manager database are not weather normalized¹. The LGOP requires non-weather normalized data for calculating GHG emissions for inventories.

Quality Assurance

Beginning in 2011, the data collection process is reviewed annually by ESD's Environmental Data Analyst during the annual inventory reporting process. ESD recognizes that there are potential sources for errors that are inherent to an annual inventory that encompasses a large number of facilities, departments, and volumes of separate data. For example, errors could occur when transferring data sources, converting from volumes to weights or metric units, or when calculating GHG emissions. To ensure that the data collected for the City of Fort Collins Municipal Inventory is accurate, the following measures will be taken on at least an annual basis:

- The ESD Environmental Data Analyst will contact the City of Fort Collins Real Estate Services Manager to identify whether new owned or leased facilities, where the City has operational control, have been added during the year.
- Review the list of City facilities with the Utility Manager for additions and changes in square footage (from renovations or demolitions).
- Inquiries to the Community Carbon Team (formerly the Energy Management Team) and the Municipal Operations Sustainability Team will be made to identify new emissions sources at City facilities, including new or changed utilities, emergency generators, propane sources, etc.
- The ESD Environmental Data Analyst will review Utility Manager and FASTER database queries and reports for quality assurance/quality control (QA/QC) and all activity summaries used in the annual GHG Municipal Inventory from:
 - Operations Services
 - Fort Collins Utilities
 - The Water Reclamation Plants
 - The Water Treatment Plant
 - Fleets Division
 - City Accounting department
 - City Purchasing department
 - Natural Areas department
 - Parks department
 - Forestry department
 - The Hoffman Mill Road Crushing facility
 - Larimer County Solid Waste department
 - Vendor supplied data
 - ESD Waste Reduction and Recycling Program
- The ESD Environmental Data Analyst will review all emission factors used as part of the annual inventory.
- ESD will request, to the extent possible, that data used to calculate GHG be provided in a form that allows an “actual” calculation, versus an estimate.

¹ Weather normalization is a process to mathematically adjust actual energy data so that it represents energy typically used in an average year for the same location. This accounts for weather differences from year to year that may result in abnormally high or low energy consumption. There are numerous mathematical methods that can be used to achieve this result.

- At its discretion, ESD will conduct periodic reviews of the GHG Inventory and identify and correct any areas that appear to be in error.

Data Security

Beginning 2011, information compiled for the purposes of conducting the municipal annual inventories, including activity data, emission factors, conversion factors, normalization factors, the QMP, and records of any changes to the current quantification methods will be maintained both in electronic and printed form in secure locations by the ESD Environmental Data Analyst.

Municipal Reporting Frequency

Current data reporting is conducted on an annual basis in time for an annual inventory reported in June.

Document Retention and Control Policy

Effective in 2011, records used to calculate and document the GHG Inventory, from the base year through the end of the goal period, will be maintained by ESD for a minimum of three years beyond the goal period. After the three-year period following the end of the goal period, ESD will dispose of support documents, and only the final reports will be kept.

VII. Summary of Inventory Results

Appendices B through J provide the most current results of calculations to determine GHG emissions in metric tons CO₂e for the annual inventories from 2005 through present. Table 21 is the current summary of GHG emissions for the City of Fort Collins:

Current GHG Inventory Results:

Table 21. Current Summary of Municipal Operations GHG Emissions	
Year	GHG (metric tons CO₂e)
2005	60,614
2006	58,044
2007	59,343
2008	55,298
2009	55,900
2010	51,351
2011	50,361
2012	53,559
2013	55,990

Appendix A

Table 22. City of Fort Collins Facilities		
GEMS Site ID	Facility Name	Physical Address
2	City Hall	300 LaPorte Ave.
3	300 LaPorte (Old PS)	300 LaPorte Ave.
4	Fleet Services Facility	835 Wood St.
6	Carriage House	108 Meldrum St. N
8	Northside Aztlan Community Cntr.	112 Willow St. E
9	Mulberry Pool	424 S. Sherwood
10	City Park Center	211 Bryan Ave. S and intersection of Bryan Ave. & Oak St.
11	Park Shop	413 Bryan Ave. S
12	City Park Nine Clubhouse	411 Bryan Ave. S
13	Collindale Clubhouse	1441 Horsetooth Rd. E
14	Streets	625 9th St.
16	Avery House	108 Meldrum St. N
17	Lincoln Center	417 Magnolia St. W
18	Museum	200 Mathews St.
19	Library	201 Peterson St.
20	117 N. Mason St.	117 N. Mason St.
21	Transfort Facility	6570 Portner Dr.
22	321 Maple St.	321 Maple St.
23	Downtown Restrooms	123 Oak St. E
24	Collindale Maintenance Shop	1441 Horsetooth Rd. E
26	230 LaPorte	230 LaPorte Ave.
27	Car Barn	330 Howes St. N
29	Pottery Studio	1541 Oak St. W
34	Senior Center	1200 Raintree Dr.
36	214 N. Howes	214 N. Howes St.
42	112 - 114 N. Howes St.	112 N. Howes St.
43	256 W. Mountain Ave.	256 Mountain Ave. W
44	200 W. Mountain Ave.	200 W. Mountain Ave.
45	Remington St. Parking Garage	102 Remington St.
46	Epic	1801 Riverside Ave.
47	Fleet Annex	906 Vine Dr. W
48	281 N. College	281 N. College
49	Indoor Shooting Range	2554 Midpoint Dr.
50	Southridge Clubhouse	5750 Lemay Ave. S
51	CIS - 330 SC	330 S. College
53	215 N. Mason	215 Mason St. N
56	110 N. Howes St.	110 N. Howes St.

GEMS Site ID	Facility Name	Physical Address
57	200 W. Mountain - Rental	200 W. Mountain
58	Transfort Fueling Site	835 Woods St.
59	Utilities Building A-B	700 Wood St., Bld A-B
60	Utilities Building C	700 Wood St., Bld C
61	Utilities Elec Vehicle Storage	701 Wood St.
62	Utilities Water Meter Shop - D	700 Wood St., Bld D
63	Utilities Water Vehicle Storage	835 Wood St.
65	208 N. Howes (old P Fs)	208 N. Howes
66	222 LaPorte - PV Creamery	222 LaPorte
67	425 10th Street - Romero House	425 10th St.
68	Cramer's	310 Howes St. N
69	220 N. Howes - Rickers	220 Howes St. N
70	518 N. Loomis - Warehouse	518 Loomis St. N
71	Civic Center Parking Structure	120 Mason St. N
72	City Park Pool/Bathhouse	1599 City Park Ave.
73	Fossil Creek Park Shop	5833 Lemay Ave. S
74	Grandview New Shop	1900 Grandview Ave. W
75	Grandview Office	1900 Grandview Ave. W
76	Horticulture Center	2145 Centre Ave. S
77	Traffic Ops	626 Linden St.
78	Youth Activity Center	415 Monroe Dr. E
79	212 LaPorte Ave - Abrasos	212 LaPorte Ave.
80	945 W. Prospect - Rental	945 W. Prospect
81	400 Wood Street - Rental	400 Wood St.
82	212-218 W. Mountain - Rental	212 Mountain Ave. W
83	Transportation Parking Lots	320 Howes St. N
84	Transit Center	N. Mason between LaPorte & Maple (shares trash pickup with 281 N. College Ave.
85	Lee Martinez Farm Office	600 Sherwood St. N
88	Spring Canyon Park Shop	3156 Overland Trail S
89	North-Side Aztlan Center-New	112 Willow St. E
90	Police Services - New	2221 Timberline Rd. S
91	Primrose Studio	Michaud Lane at Reservoir Ridge Natural Area
92	Haiston Oil	300 Howes St. N
96	Transfort Main Fueling Station	6570 Portner Dr.
97	Civic Center Park	201 LaPorte Ave.
98	Police Downtown Sub Station	120 Mason St. N
99	Archery Range	2825 Frontage Rd. SW
103	Crushing Facility	1380 Hoffman Mill Rd.
104	Edora Park	1420 Stuart St. E
106	Gateway Park	Hwy 14 W.

GEMS Site ID	Facility Name	Physical Address
107	Greenbriar Park	730 Willox Lane E
109	Lee Martinez Park	600 Sherwood St. N
110	Meadows Spring Ranch	6200 I-25 Access Rd
111	Mulberry WWTF	3036 Environmental Dr.
112	NIX Farmhouse	1745 Hoffman Mill Rd
113	PFA Fire Station 10	2067 Vermont Dr.
114	PFA Fire Station 12	321 Country Club Rd. E
115	PFA Fire Station 14	2109 Westchase Rd.
116	PFA Fire Station 1	505 Peterson St.
117	PFA Fire Station 2	415 Bryan Ave. St.
118	PFA Fire Station 3	2000 Mathews St.
119	PFA Fire Station 4	1945 Drake Rd. W
120	PFA Fire Station 5	4615 Hogan Dr. 12
121	PFA Fire Station 6	2511 Donella Ct.
122	PFA Fire Station 7	2817 Overland Trail N
123	PFA Fire Station 8	4104 Main St.
124	PFA Fire Station 9	Shoreline Dr.
125	PFA Training	3400 Vine Dr. W
126	Rolland Moore Park	2201 Shields St. S
127	Roselawn Cemetery	2718 Mulberry St. E
128	Southridge Golf Maintenance	5090 Lemay Ave. S
129	Spring Park	Stuart St. & Busch Ct.
130	Trailer Construction	1809 Longworth Rd.
132	Warren Park	1101 Horsetooth Rd. E
133	Mulberry WWTF	920 E. Mulberry St.
134	Water Quality Lab	4316 LaPorte Ave. W
135	Water Reclamation	3036 Environmental Dr.
136	Water Treatment Facility	4316 LaPorte Ave. W
137	Water Pollution Lab-Drake WWTF	3036 E. Drake Rd.
139	Dewatering RO - Stormwater	700 Wood St.
140	Dewatering RO - Lincoln St.	Lincoln St. near Buckingham Park
141	Fleet RO - Woods St.	830 Wood St.
142	Fossil Creek RO	5833 Lemay Ave. S
143	NIX RO	1745 Hoffman Mill Rd
144	City Park RO	411 Bryan Ave. S
145	City Park RO	411 Bryan Ave. S
146	Toilet Recycle RO	1380 Hoffman Mill Rd.
147	Spring Park RO	Stuart St. & Busch Ct.
148	Utilities RO - Stormwater	700 Wood St., Bld C
149	Wastewater RO	3036 Environmental Dr.
150	500 Nighthawk	500 block Nighthawk

GEMS Site ID	Facility Name	Physical Address
151	405 Canyon	405 Canyon
152	RR Farmhouse	3829 E. Prospect
153	Drake WWTF	3036 E. Drake Rd.
154	Discovery Museum	408 Mason St.
155	Webster House Administration	301 E. Olive St.
156	NIX Shop	1745 Hoffman Mill Rd.
157	Gateway Natural Area Office	5216 Poudre Canyon Highway
158	Bobcat Ridge Natural Area House	10184 W. County Road 32C, Loveland
159	South Transit Center	5000-5002 Fossil Blvd

Appendix C – 2006 Emissions

Revised 2006 Inventory Results:

2006 Municipal

GHG Report



Scope 1- Direct GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Fleet- Gasoline Consumption	297,233 gallons	\$0	2,609.71
Fleet- LPG Consumption	358,040 gallons	\$0	207.31
Fleet- CNG Consumption	7,881 gallons	\$0	0.43
Fleet- Diesel Consumption	1,999 gallons	\$0	20.41

	Biogenic	Conventional		*emissions from conventional fuel only
Fleet- E50	0	0 gallons	\$0	0.00*
Fleet- E85	0	0 gallons	\$0	0.00*
Fleet- B10	0	0 gallons	\$0	0.00*
Fleet- B15	0	0 gallons	\$0	0.00*
Fleet- B20	43,954	175,816 gallons	\$0	1,795.08*
<i>Transportation Subtotal</i>		<i>840,969 gallons</i>	<i>\$0</i>	<i>4,632.94</i>
Facilities Natural Gas Consumption		91,833 dTh	\$810,704	4,881.46
Water-related Natural Gas Consumption		21,740 dTh	\$0	1,155.61
<i>Natural Gas Subtotal</i>		<i>113,573 dTh</i>	<i>\$810,704</i>	<i>6,037.07</i>
Scope 1 Subtotal			\$810,704	10,670.01

Scope 2- Energy Indirect GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Facilities Electrical Consumption	16,079,088 kWh	\$413,702	13,339.68
Water-related Electrical Consumption	17,710,603 kWh	\$0	14,693.23
Streetlight Electrical Consumption	8,235,645 kWh	\$0	6,832.53
Traffic Signal Electrical Consumption	910,628 kWh	\$0	755.48
"Other" Electrical Consumption	2,586,487 kWh	\$0	2,145.82
Scope 2 Subtotal	45,522,451 kWh	\$413,702	37,766.75

Scope 3- Other Indirect GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Travel in Personal Vehicle (Reimbursed)	137,668 miles	\$61,719	68.29
Air Travel (Reimbursed)	miles	\$0	
Office Waste from Municipal Facilities	911.00 tons	-	656.00
Industrial Waste from Municipal Facilities	22,382.00 tons	-	8,883.42
Public Waste	0.00 tons	-	0.00
Scope 3 Subtotal		\$61,719	9,607.71

Total Metric Tons of CO2e: 58,044.47

Appendix F – 2009 Emissions

Revised 2009 Inventory Results:

2009 Municipal				
<i>GHG Report</i>				
Scope 1- Direct GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Fleet- Gasoline Consumption	245,514	gallons	\$0	2,155.61
Fleet- LPG Consumption	82,780	gallons	\$0	47.93
Fleet- CNG Consumption	38,823	gallons	\$0	2.10
Fleet- Diesel Consumption	1,129	gallons	\$0	11.53
	Biogenic	Conventional	<i>*emissions from conventional fuel only</i>	
Fleet- E50	0	0	\$0	0.00 *
Fleet- E85	54,320	9,586	\$0	84.16 *
Fleet- B10	0	0	\$0	0.00 *
Fleet- B15	0	0	\$0	0.00 *
Fleet- B20	46,879	187,518	\$0	1,914.55 *
<i>Transportation Subtotal</i>		<i>565,350 gallons</i>	<i>\$0</i>	<i>4,215.88</i>
Facilities Natural Gas Consumption		103,507	dTh	\$615,590
Water-related Natural Gas Consumption		26,073	dTh	\$0
<i>Natural Gas Subtotal</i>		<i>129,580 dTh</i>	<i>\$615,590</i>	<i>6,887.95</i>
Scope 1 Subtotal			\$615,590	11,103.83
Scope 2- Energy Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Facilities Electrical Consumption	16,177,340	kWh	\$441,781	13,039.62
Water-related Electrical Consumption	15,936,950	kWh	\$533,657	12,845.85
Streetlight Electrical Consumption	8,535,299	kWh	\$0	6,879.81
Traffic Signal Electrical Consumption	621,057	kWh	\$28,553	500.60
"Other" Electrical Consumption	2,163,549	kWh	\$701,957	1,743.91
Scope 2 Subtotal			\$1,705,948	35,009.79
Scope 3- Other Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Travel in Personal Vehicle (Reimbursed)	157,599	miles	\$86,825	78.18
Air Travel (Reimbursed)	222,722	miles	\$37,266	609.93
Office Waste from Municipal Facilities	807.00	tons	-	581.11
Industrial Waste from Municipal Facilities	21,458.02	tons	-	8,516.69
Public Waste	0.00	tons	-	0.00
Scope 3 Subtotal			\$124,091	9,785.91
Total Metric Tons of CO2e:				55,899.52

Appendix G– 2010 Emissions

Revised 2010 Inventory Results:

2010 Municipal				
<i>GHG Report</i>				
Scope 1- Direct GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Fleet- Gasoline Consumption	232,636	gallons	\$0	2,042.54
Fleet- LPG Consumption	56,980	gallons	\$0	32.99
Fleet- CNG Consumption	98,513	gallons	\$0	5.32
Fleet- Diesel Consumption	1,694	gallons	\$0	17.30
	Biogenic	Conventional	<i>*emissions from conventional fuel only</i>	
Fleet- E50	0	0	\$0	0.00 *
Fleet- E85	49,514	8,738	\$0	76.72 *
Fleet- B10	0	0	\$0	0.00 *
Fleet- B15	0	0	\$0	0.00 *
Fleet- B20	41,151	164,606	\$0	1,680.62 *
<i>Transportation Subtotal</i>		<i>563,167</i>	<i>\$0</i>	<i>3,855.49</i>
Facilities Natural Gas Consumption		114,953	dTh	\$651,674
Water-related Natural Gas Consumption		23,783	dTh	\$0
<i>Natural Gas Subtotal</i>		<i>138,736</i>	<i>dTh</i>	<i>\$651,674</i>
Scope 1 Subtotal			\$651,674	11,230.12
Scope 2- Energy Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Facilities Electrical Consumption	15,350,191	kWh	\$960,395	11,210.11
Water-related Electrical Consumption	17,422,062	kWh	\$584,258	12,723.18
Streetlight Electrical Consumption	8,526,559	kWh	\$0	6,226.87
Traffic Signal Electrical Consumption	610,067	kWh	\$28,432	445.53
"Other" Electrical Consumption	2,666,546	kWh	\$220,673	1,947.35
Scope 2 Subtotal	44,575,425	kWh	\$1,793,759	32,553.03
Scope 3- Other Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Travel in Personal Vehicle (Reimbursed)	138,728	miles	\$68,123	68.82
Air Travel (Reimbursed)	358,331	miles	\$99,938	981.30
Office Waste from Municipal Facilities	896.00	tons	-	589.15
Industrial Waste from Municipal Facilities	21,337.32	tons	-	5,928.15
Public Waste	0.00	tons	-	0.00
Scope 3 Subtotal			\$168,061	7,567.41
Total Metric Tons of CO2e:				51,350.57

Appendix H – 2011 Emissions

Revised 2011 Inventory Results:

2011 Municipal					
<i>GHG Report</i>					
Scope 1- Direct GHG Emissions					
GHG Source	Quantity Used		Cost	MT of CO2e	
Fleet- Gasoline Consumption	246,858	gallons	\$0	2,167.41	
Fleet- LPG Consumption	55,740	gallons	\$0	32.27	
Fleet- CNG Consumption	110,972	gallons	\$0	5.99	
Fleet- Diesel Consumption	1,902	gallons	\$0	19.42	
	<i>Biogenic</i>	<i>Conventional</i>	<i>*emissions from conventional fuel only</i>		
Fleet- E50	0	0	\$0	0.00*	
Fleet- E85	40,270	7,106	\$0	62.39*	
Fleet- B10	21,281	191,525	\$0	1,955.47*	
Fleet- B15	0	0	\$0	0.00*	
Fleet- B20	0	0	\$0	0.00*	
<i>Transportation Subtotal</i>		<i>614,103</i>	<i>gallons</i>	<i>\$0</i>	<i>4,242.95</i>
Facilities Natural Gas Consumption		121,038	dTh	\$613,654	6,433.88
Water-related Natural Gas Consumption		24,917	dTh	\$0	1,324.50
<i>Natural Gas Subtotal</i>		<i>145,955</i>	<i>dTh</i>	<i>\$613,654</i>	<i>7,758.39</i>
Scope 1 Subtotal			\$613,654	12,001.34	
Scope 2- Energy Indirect GHG Emissions					
GHG Source	Quantity Used		Cost	MT of CO2e	
Facilities Electrical Consumption	15,703,133	kWh	\$546,669	10,613.12	
Water-related Electrical Consumption	16,600,546	kWh	\$656,358	11,219.65	
Streetlight Electrical Consumption	8,532,694	kWh	\$0	5,766.91	
Traffic Signal Electrical Consumption	576,847	kWh	\$32,606	389.87	
"Other" Electrical Consumption	1,893,785	kWh	\$696,992	1,279.93	
Scope 2 Subtotal		43,307,005	kWh	\$1,932,625	29,269.47
Scope 3- Other Indirect GHG Emissions					
GHG Source	Quantity Used		Cost	MT of CO2e	
Travel in Personal Vehicle (Reimbursed)	100,591	miles	\$53,367	49.90	
Air Travel (Reimbursed)	352,348	miles	\$54,902	964.92	
Office Waste from Municipal Facilities	657.31	tons	-	734.06	
Industrial Waste from Municipal Facilities	25,819.49	tons	-	7,173.43	
Public Waste	257.66	tons	-	168.27	
Scope 3 Subtotal			\$108,269	9,090.57	
Total Metric Tons of CO2e:				50,361.38	

Appendix I – 2012 Emissions

Revised 2012 Inventory Results:

2012 Municipal				
<i>GHG Report</i>				
Scope 1- Direct GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Fleet- Gasoline Consumption	276,853	gallons	\$0	2,430.77
Fleet- LPG Consumption	57,770	gallons	\$0	33.45
Fleet- CNG Consumption	158,975	gallons	\$0	8.58
Fleet- Diesel Consumption	1,217	gallons	\$0	12.43
	Biogenic	Conventional	<i>*emissions from conventional fuel only</i>	
Fleet- E50	0	0	\$0	0.00*
Fleet- E85	31,544	5,566	\$0	48.87*
Fleet- B10	0	0	\$0	0.00*
Fleet- B15	0	0	\$0	0.00*
Fleet- B20	36,900	147,601	\$0	1,507.01*
<i>Transportation Subtotal</i>		<i>647,982 gallons</i>	<i>\$0</i>	<i>4,041.11</i>
Facilities Natural Gas Consumption		118,439	dTh	\$509,428
Water-related Natural Gas Consumption		18,602	dTh	\$89,796
<i>Natural Gas Subtotal</i>		<i>137,041 dTh</i>	<i>\$599,223</i>	<i>7,284.55</i>
Scope 1 Subtotal			\$599,223	11,325.66
Scope 2- Energy Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Facilities Electrical Consumption	16,060,284	kWh	\$713,321	12,180.34
Water-related Electrical Consumption	16,030,215	kWh	\$720,036	12,157.54
Streetlight Electrical Consumption	8,526,396	kWh	\$0	6,466.54
Traffic Signal Electrical Consumption	575,314	kWh	\$36,121	436.33
"Other" Electrical Consumption	2,515,853	kWh	\$1,358,253	1,908.06
Scope 2 Subtotal		43,708,062 kWh	\$2,827,732	33,148.81
Scope 3- Other Indirect GHG Emissions				
GHG Source	Quantity Used		Cost	MT of CO2e
Travel in Personal Vehicle (Reimbursed)	155,978	miles	\$86,564	77.37
Air Travel (Reimbursed)	234,137	miles	\$81,578	641.19
Office Waste from Municipal Facilities	682.86	tons	-	762.60
Industrial Waste from Municipal Facilities	26,763.80	tons	-	7,435.79
Public Waste	256.85	tons	-	167.74
Scope 3 Subtotal			\$168,143	9,084.69
Total Metric Tons of CO2e:				53,559.15

Appendix J – 2013 Emissions

2013 Inventory Results:

2013 Municipal

GHG Report



Scope 1- Direct GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Fleet- Gasoline Consumption	258,250 gallons	\$799,030	2,267.43
Fleet- LPG Consumption	3,914 gallons	\$6,372	22.66
Fleet- CNG Consumption	144,518 gallons	\$325,999	7.80
Fleet- Diesel Consumption	322 gallons	\$1,055	3.29

	Biogenic	Conventional	*emissions from conventional fuel only	
Fleet- E50	0	0 gallons	\$0	0.00*
Fleet- E85	16,402	2,894 gallons	\$57,571	25.41*
Fleet- B10	16,083	144,750 gallons	\$524,971	1,477.90*
Fleet- B15	0	0 gallons	\$0	0.00*
Fleet- B20	0	0 gallons	\$0	0.00*
<i>Transportation Subtotal</i>		<i>554,648 gallons</i>	<i>\$1,714,998</i>	<i>3,804.49</i>
Facilities Natural Gas Consumption		143,958 dTh	\$663,688	7,652.22
Water-related Natural Gas Consumption		25,988 dTh	\$162,121	1,381.40
<i>Natural Gas Subtotal</i>		<i>169,945 dTh</i>	<i>\$825,810</i>	<i>9,033.62</i>
Scope 1 Subtotal			\$2,540,808	12,838.11

Scope 2- Energy Indirect GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Facilities Electrical Consumption	16,626,189 kWh	\$778,644	12,609.53
Water-related Electrical Consumption	16,530,449 kWh	\$880,744	12,536.92
Streetlight Electrical Consumption	8,500,793 kWh	\$0	6,447.12
Traffic Signal Electrical Consumption	575,316 kWh	\$37,698	436.33
"Other" Electrical Consumption	2,027,639 kWh	\$692,210	1,537.79
Scope 2 Subtotal	44,260,386 kWh	\$2,389,297	33,567.70

Scope 3- Other Indirect GHG Emissions

GHG Source	Quantity Used	Cost	MT of CO2e
Travel in Personal Vehicle (Reimbursed)	147,013 miles	\$0	72.92
Air Travel (Reimbursed)	358,936 miles	\$0	982.96
Office Waste from Municipal Facilities	717.19 tons	-	800.94
Industrial Waste from Municipal Facilities	13,451.64 tons	-	7,538.61
Public Waste	289.64 tons	-	189.15
Scope 3 Subtotal		\$0	9,584.58
Total Metric Tons of CO2e:			55,990.38

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