THE CITY OF WILDWOOD, MISSOURI 2010 GREENHOUSE GAS EMISSIONS INVENTORY

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WILDWOOD
www.cityofwildwood.com

Missouri Gateway CHAPTER

Credits and Acknowledgements

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This inventory would have been impossible without the cooperation and support of numerous organizations and their representatives. These organizations include Ameren Missouri, East-West Gateway Council of Governments, ICLEI- Local Governments for Sustainability, Laclede Gas Company, Meridian Waste Services, Metropolitan St. Louis Sewer District, Missouri American Water, and the St. Louis County Police Department. I would like to express my gratitude to these organizations and their representatives for the timely support they provided.

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I am honored to have had the opportunity to work with all of the parties mentioned above, and am grateful for all of their support and assistance.

Sincerely,

Johanna Ofner
Climate Action Intern
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Executive Summary

Since its incorporation, the City of Wildwood, Missouri has demonstrated a commitment to environmental stewardship. With this greenhouse gas (GHG) inventory, the City reaffirms that commitment. As a local government in the St. Louis Metropolitan Region, the City of Wildwood has an opportunity to contribute to regional efforts to reduce greenhouse gas emissions, conserving resources and saving money in the process.

This inventory is composed of two parts: first, it quantifies GHG emissions associated with the City of Wildwood as a whole; second, it breaks out emissions associated with the City's local government operations.

Community Inventory

Residential electricity and natural gas usage (62%) is the source of over half of the City's GHG emissions. The next largest source is transportation (25%), followed by commercial electricity and natural gas usage (21%). GHG emissions associated with the decomposition of solid waste (1%), the treatment and delivery of drinking water (0.34%), the treatment of wastewater (0.29%), and the electricity and natural gas used by the industrial (0.02%) and street and highway sectors (less than 0.00%) are significantly smaller.

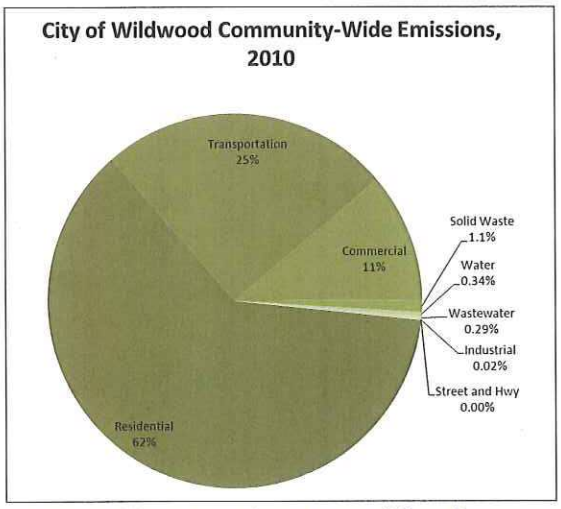

Figure 1: City of Wildwood Community-Wide Emissions, 2010

Local Government Inventory

In total, the GHG emissions from the City of Wildwood's local government make up less than 1% of the community inventory total. However, this need not deter the City from pursuing energy conservation strategies; many municipalities realize significant cost savings from reducing energy consumption.

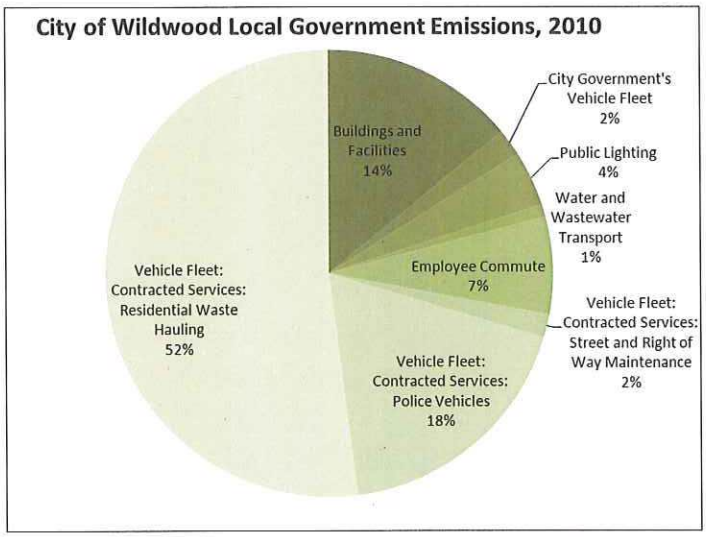

Figure 2: City of Wildwood Local Government Emissions, 2010

The majority of the City of Wildwood's greenhouse gas emissions are the result of contracted services (74%). The City of Wildwood contracts to provide street and right-of-way maintenance, residential waste and recycling services, and police services to the residents of Wildwood. The City is indirectly responsible for these emissions; it has limited influence over the contractors' GHG emissions-generating activities. Future contract

negotiations will be key to resource conservation and the associated cost savings and reduced greenhouse gas emissions.

The electricity and natural gas used to power, heat, and cool the City of Wildwood's buildings was responsible for 14% of local government GHG emissions. When this inventory was conducted in the fall of 2012, the City of Wildwood occupied two leased facilities: Wildwood City Hall and the Wildwood Precinct Station. Construction of a new Wildwood City Hall will be complete in early 2013. This new facility will house city business offices, meeting rooms, and the Wildwood Precinct station. Electricity, water, and natural gas consumption will likely change as the local government moves from leased facilities into the new City Hall, altering the corresponding greenhouse gas emissions levels as well.

Understanding Greenhouse Gas Emissions

Understanding the relative size of a greenhouse gas emissions inventory can be difficult. The *Conclusion* section of this report compares the City of Wildwood's community and local government inventories with inventories completed by other municipalities in the St. Louis Region: the Cities of Richmond Heights, Clayton, and Creve Coeur.

Emissions from the City of Wildwood were estimated to be less than those of Clayton and Creve Coeur but larger than those of Richmond Heights. Of the four, the City of Wildwood has the largest area and the largest population; the City has the lowest emissions by far when emissions per person or emissions per square mile are considered. These relatively low emissions levels seem to be related to lower levels of electricity and natural gas consumption in the commercial and industrial sectors.

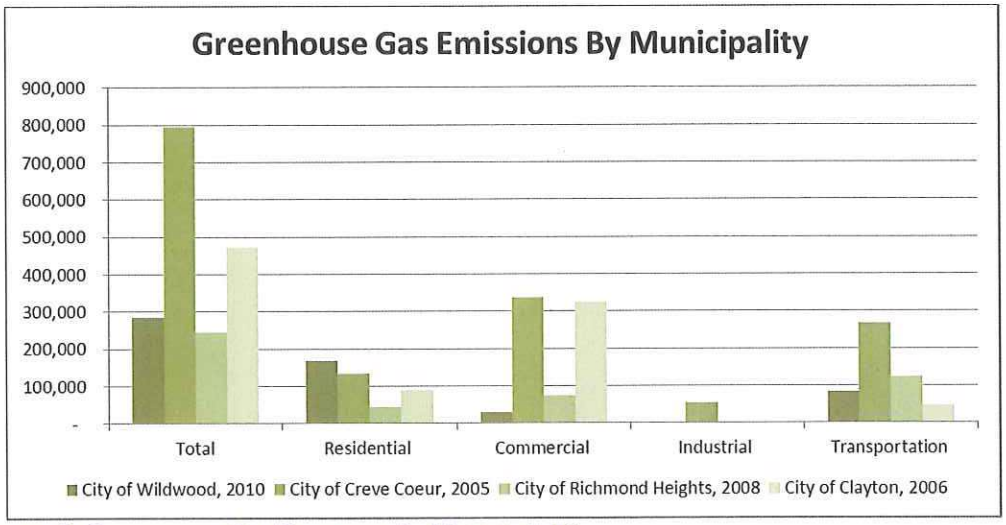

Figure 3: Greenhouse Gas Emissions By Municipality

Conclusions

This inventory provides insights into the sectors that are most likely to yield opportunities for energy conservation, cost savings, and emissions reduction. Any emissions reductions pursued by the City of Wildwood will not only conserve resources and potentially reduce costs, they will contribute to the efforts of other regional municipalities. The combined efforts of local government throughout the St. Louis Region have the potential to create a significant positive environmental impact.

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THE CITY OF WILDWOOD: PLANNING TOMORROW TODAY

The City of Wildwood occupies 68 square miles in western St. Louis County. The City is bordered on the west by the Franklin County Line; on the south by Interstate 44, the City of Eureka, and the Meramec River; and on the east and north by the Cities of Ellisville, Clarkson Valley and Chesterfield.

The incorporation of the City was the culmination of a grassroots effort to halt development practices that were causing environmental degradation. Since its incorporation, the City of Wildwood has demonstrated a commitment to environmental stewardship, addressed existing environmental damage, and established regulations that prevent similar damage in the future.

For instance, Wildwood was one of the first cities in the St. Louis Metropolitan Region to adopt a tree preservation ordinance; the only city in Missouri to employ a Natural Resource Protection Standards requirement; one of the leaders among communities in St. Louis County to accept and apply the new Metropolitan St. Louis Sewer District's stormwater standards in 1997; and the only jurisdiction to create a Master Plan linking them all together.

This greenhouse gas (GHG) emissions inventory signifies that Wildwood is continuing its commitment to environmental stewardship. The City of Wildwood has an opportunity to conserve energy, fuel and resources, cutting costs and reducing GHG emissions in the process. As a municipality in the St. Louis Metropolitan Region, any actions taken will contribute to regional environmental efforts.

CLIMATE CHANGE AND ITS IMPACTS

In its report, *America's Climate Choices*, the National Research Council states that "Climate change is occurring, is very likely caused by human activities, and poses significant risks for a broad range of human and natural systems."[1] The scientific community agrees: climate change is occurring and is likely caused by human activity.

The impacts of global climate change will be numerous. The U.S. Global Change Research Program's (USGCRP) report "Global Climate Change Impacts in the United States" outlines the impacts that are anticipated throughout the nation. In the Midwest, average annual temperatures have already increased over the last several decades, with more frequent heat waves and fewer cold periods. Over the coming decades, the Midwest will likely begin to experience milder, wetter winters, and hotter summers with longer dry periods.[2]

These changes will have a marked impact on public health. Longer, hotter summers increase the risk of heat-related deaths. Mosquitos and ticks, both vectors for disease, will survive milder winters in larger numbers, causing their populations to increase. Some areas in the St. Louis Region already do not meet national standards for

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[1] Committee on America's Climate Choices, National Research Council, *America's Climate Choices* (Washington, DC: The National Academies Press, 2011), 1

ground-level ozone, a pollutant that can harm lung tissue when inhaled. Longer, hotter summers are likely to increase ozone formation, leading to more health issues such as asthma, especially in children or the elderly.[3]

In addition to public health threats, climate change threatens the stability of the Midwest's water and wastewater systems. Increased intensity of rain events makes flooding more likely and would strain drainage systems. Longer periods between rain events could lead to drought or water shortages.[2]

With immediate action, the risks associated with the impacts of climate change can be reduced. However, even with immediate action, some of the impacts of climate change are unavoidable; carbon dioxide, a greenhouse gas, can remain in the atmosphere for a century. Reducing greenhouse gas emissions is necessary to mitigate climate change, but it is also prudent for communities to begin to plan for the coming impacts of climate change[4].

Sustainability in the St. Louis Metropolitan Area

With the completion of this greenhouse gas (GHG) emissions inventory, Wildwood joins municipalities throughout the St Louis Metropolitan Region in a movement to quantify GHG emissions.

In 2009, FOCUS St. Louis published *The Environmental Sustainability Roadmap: A Toolkit for Local Governments*, a report meant to give communities in the St. Louis Region tools to measure their progress toward sustainability. A citizen task force convened by FOCUS St. Louis identified sustainability standards and best practices for local governments, including the Roadmap pictured at the right.

FOCUS St. Louis Roadmap

1. Commit to Action
2. Assess the Situation
3. Make Plans
4. Implement
5. Measure and Celebrate Success

The City of Wildwood has already demonstrated its environmental leadership. This report marks the City of Wildwood's continued commitment to protecting natural resources, and contributes toward step two of FOCUS's five step roadmap. This stage, "assessing the situation", begins with the inventory of greenhouse gas emissions in order to establish a baseline and will inform step three, "make plans" or the identification of potential actions to reduce greenhouse gas emissions, conserve resources, and save money. The two-part internship responsible for this report is meant to step a local government through "assess[ing] the situation" and "making plans."

With this report, the City of Wildwood joins the numerous municipalities in the St. Louis region quantifying greenhouse gas emissions: the City of Richmond Heights, the City of Clayton, the City of Creve Coeur, the City of Maplewood, and the City of St. Louis, and St. Louis County. The combined efforts of local government throughout the Region have the potential to create a large positive environmental impact.

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[3] USGCRP, *Global Climate Change Impacts in the United States* (New York: Cambridge University Press, 2009), 117-122

[4] "EPA Climate Change Basics," Environmental Protection Agency, last modified June 14, 2012, accessed November 26, 2012, http://www.epa.gov/climatechange/basics/

Inventory Methodology

Inventory Protocols

This GHG emissions inventory was completed following the protocols established by ICLEI--Local Governments for Sustainability[5]. These protocols are the *de facto* national standard, having been used to conduct several hundred GHG inventories nationwide, including every local GHG inventory in the State of Missouri. Their use ensures that the City of Wildwood conducts its inventory using nationally accepted standards, and that results can be compared to other municipalities in the St. Louis region and throughout the country. Their use does not imply an endorsement by the City of Wildwood of ICLEI or any other organization.

Quantifying Greenhouse Gas Emissions

Establishing a Baseline Year

Baseline GHG inventories are used to benchmark ongoing GHG emissions measurement, create projections of future GHG emissions levels, and strategize climate change mitigation efforts. This inventory quantifies the emissions created by the community and local government of Wildwood, Missouri during the 2010 calendar year and will serve as a baseline for any ongoing GHG emissions measurement. The year 2010 was chosen as the baseline year because it is the earliest year for which greenhouse gas emissions could be comprehensively inventoried.

Establishing Boundaries

Community Geographical Boundary

This inventory quantifies GHG emissions created within the City of Wildwood's geographical boundary in a community-wide GHG inventory. It includes all available data concerning emissions from Wildwood's industrial, commercial, governmental, and residential sectors and includes emissions that result from transportation, electricity use, natural gas consumption, solid waste, wastewater treatment, and water use.

Figure 4: Community and Government Emissions Inventories

Governmental Organization Boundary

Emissions created by the City of Wildwood's local government are included in the community inventory, and receive further definition in a local government-specific inventory. This detailed inventory of the GHG emissions that result from local government operations will allow the City to better understand the most effective approaches to conserving energy, saving money, and reducing emissions. This inventory includes all available data on emissions from the City of Wildwood's facilities, vehicle fleet, employee commute, and contracted services.

[5] Further information about ICLEI is available on their website: www.icleiusa.org. Use of ICLEI protocols does not imply an endorsement by the City of Wildwood of ICLEI.

GHG Emission Types

This GHG inventory asseses the emissions of the six greenhouse gases (GHGs) that were regulated by the Kyoto Protocol. The heat trapping effects of these six greenhouse gases vary greatly. For example, 1 metric ton of methane (1 mt CH_4) traps 21 times more heat than 1 metric ton of carbon dioxide (1 mt CO_2). In order to sum and compare emissions of different greenhouse gases we convert them to a common unit: metric tons of carbon dioxide equivalent (mt CO_2e). All GHG emissions in this report are measured in mt CO_2e.

To put GHG emissions into context, it is helpful to understand how large a metric ton of carbon dioxide equivalent truly is. The Environmental Protection Agency's (EPA) Greenhouse Gas Equivalencies Calculator[6] provided the approximations in Table 1.

Table 1: Greenhouse Gas Equivalencies

1 mt CO_2e is equal to	The GHG emissions from an average vehicle for 73 days
	The CO_2 emissions from the consumption of 112 gallons of gasoline
	The CO_2 emissions from the electricity use of an average home from 55 days
	The CO_2 emissions from 42 propane cylinders used for home barbeques
	The carbon sequestered annually by 348 square feet of forest preserved from deforestation

[6] "Greenhouse Gas Equivalencies Calculator" Environmental Protection Agency, accessed December 15th, 2012, http://www.epa.gov/cleanenergy/energy-resources/calculator.html

COMMUNITY-WIDE GHG EMISSIONS INVENTORY: 2010

THE WILDWOOD COMMUNITY

The City of Wildwood occupies 68 square miles in western St. Louis County and is bordered on the west by the Franklin County Line; on the south by Interstate 44, the City of Eureka, and the Meramec River; and on the east and north by the Cities of Ellisville, Clarkson Valley and Chesterfield. The City is a point of transition between the densely developed surrounding municipalities of St. Louis County and the rural nature of neighboring Franklin County. A map of the City of Wildwood is included on page 4142, in Appendix C: Community Inventory Calculation Details.

The City is largely residential, home to 35,517 residents in 2010[7], with commercial areas concentrated along State Route 100. While most of the city is zoned as suburban or non-urban, the City's Town Center is intended for high density residential and commercial development and follows the principles of New Urbanism. It houses both the current City Hall and the soon to be opened New City Hall, a hotel, shops, restaurants, a movie theater, and a community garden.

State Route 109 forms a de facto boundary between the east and west sides of the city, with State Route 100 dividing the city into northern and southern areas. Much of the land east of State Route 109 was developed by St. Louis County before the city was incorporated; it is more densely developed and follows a suburban model. The area west of State Route 109 has a much lower density and is considered non-urban both in current building patterns and plans for future land use. The western half of the city is not served by Laclede Gas, the Metropolitan St. Louis Sewer District (MSD), or by Missouri American Water; the majority of these homes depend on package plants (small, localized wastewater treatment plants) or septic systems to treat wastewater, wells for drinking water, and electricity for heat.

TOTAL WILDWOOD COMMUNITY EMISSIONS: 2010

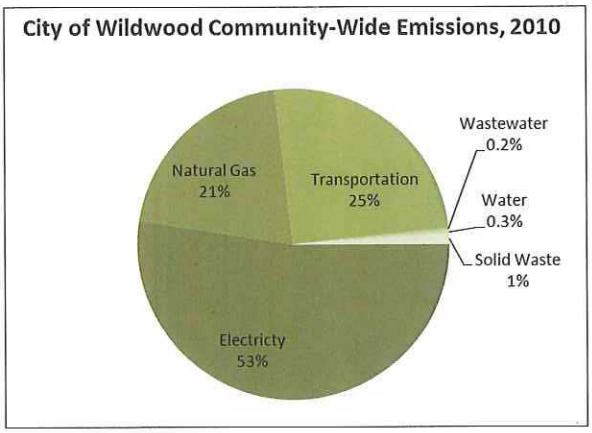

FIGURE 5: CITY OF WILDWOOD COMMUNITY-WIDE EMISSIONS, 2010

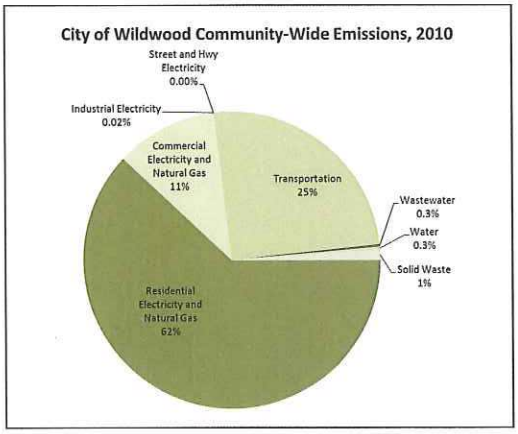

FIGURE 6: CITY OF WILDWOOD COMMUNITY-WIDE EMISSIONS, 2010

[7] US Census Bureau, *Profile of General Population and Housing Characteristics: 2010, City of Wildwood, Missouri* (Washington, DC, 2010).

TABLE 2: CITY OF WILDWOOD COMMUNITY-WIDE EMISSIONS INVENTORY, 2010

Emissions Category	Total Emissions (mt CO_2e)
Built Environment	
Natural Gas Use	55,678
Electricity Use	141,156
Transportation	
Passenger Vehicles	52,074
Freight Vehicles	15,688
Solid Waste	
Disposal of community-generated solid waste	2,897
Water and Wastewater	
Use of energy associated with use of potable water by the community	909
Process Emissions from operation of package plants within Wildwood	0.23
Process Emissions from MSD treatment of wastewater generated in Wildwood	18
Septic Systems	606
Total Emissions:	**269,026**

Calculation methods and detailed notes are outlined in *Appendix C: Community Inventory Calculation Details.*

THE BUILT ENVIRONMENT: EMISSIONS FROM ELECTRICITY AND NATURAL GAS

The built environment is comprised of all the human-made surroundings that provide spaces for living and working. This category includes emissions from the residential, commercial, industrial and street and highway consumption of electricity and natural gas. Emissions from the natural gas and electricity used in the built environment constitute 74% of the community's total emissions.

Residential electricity and natural gas consumption is responsible for the majority (62%) of the City of Wildwood's total emissions. Commercial emissions (11%) are a smaller portion of the community inventory, with industrial (0.02%) and street and highway emissions (less than 0.00%) making up much less significant portions.

TABLE 3: COMMUNITY-WIDE EMISSIONS FROM ELECTRICITY AND NATURAL GAS

	Electricity Consumption (kWh)	Emissions from Electricity Consumption (mt CO_2e)	Natural Gas Consumption (Therms)	Emissions from Natural Gas Consumption (mt CO_2e)	Total Emissions, Electricity and Natural Gas (mt CO_2e)
Residential	252,859,409	115,398	9,672,683	51,416	166,814
Commercial	56,277,352	25,684	801,733	4,262	29,946
Industrial	145,812	67	-	-	67
Street and Highway	15,866	7	-	-	7
Total	**309,298,439**	**141,156**	**10,474,416**	**55,678**	**196,834**

Within the built environment, emissions from electricity use are much higher than those from natural gas. There are several potential reasons for the higher emissions levels from electricity. Wildwood's electricity is created by combusting coal, a process that emits more GHG emissions than natural gas per unit energy. While natural gas is commonly used for cooking, heating water and home heat, electricity is used for all of those purposes and several others: air conditioning, lighting, electronics and office equipment. This is especially true in the western half of the city; as mentioned previously, the Laclede Gas Company's service extends to roughly State Route 109, leaving the majority of residents in western side of the City to heat their homes, heat water, and cook with electricity.

According to the 2010 Census, electricity and natural gas are used to heat 99% of the homes in St. Louis County.[8] A small number of homes use propane or wood, but no data was available to estimate those emissions.

TRANSPORTATION

PASSENGER AND FREIGHT VEHICLES

Emissions from transportation comprise a significant portion (25%) of the emissions from the City of Wildwood.

To estimate these emissions, East-West Gateway Council of Governments, the St. Louis Region's Metropolitan Planning Organization, provided a total of daily vehicle miles traveled (VMT) within the City of Wildwood. This data was combined with the typical mix of vehicle types on the road and average fuel efficiencies to estimate emissions.

TABLE 4: EMISSIONS FROM COMMUNITY-WIDE TRANSPORTATION, 2010

Annual Vehicle Miles Traveled	141,880,975 miles
Vehicle Type	**Emissions (mt CO_2e)**
E10[9] Passenger Cars	29,476
E10[10] Light Trucks	21,556
Diesel Passenger Cars	250
Diesel Light Trucks	792
Diesel Heavy Trucks	15,688
Total (mt CO_2e)	**67,762**

Missouri's Renewable Fuel Standard Act became effective in 2008 and requires that all gasoline sold in the state must contain 10% ethanol[10], with some exceptions. For the purpose of this inventory, it was assumed that all gasoline consumed by vehicles driving within the City of Wildwood contained 10% ethanol. CO_2 emissions from ethanol are considered biogenic and are not included in emissions totals. More information about the calculation of emissions from biofuels is included in the *Transportation* section of *Appendix C: Community Inventory Calculation Details*.

WASTEWATER

The Metropolitan St Louis Sewer District's (MSD) service extends to properties on the eastern side of the City, with the boundary line roughly following State Route 109. MSD provided wastewater services to an estimated 8,225 residences and 201 non-residential properties in 2010[11]. The rest of the City's properties are served by septic tanks and package plants- small, localized wastewater treatment systems. In 2010, an estimated 2,271 residences were served by septic systems and 234 residences were served by package plants[12].

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[8] US Census Bureau, American Factfinder, *St. Louis County Selected Housing Characteristics 2010: Home Heating Fuel*, (Washington, DC, 2010).

[9] Biofuel mixes that contains 10% ethanol and 90% gasoline are referred to as E10.

[10] "Missouri Renewable Fuel Standard Act," Missouri Department of Agriculture, accessed October 25th, 2012, http://mda.mo.gov/weights/fuel/renewablefuelstandard.php

[11] Data on properties served, and emissions estimation assistance provided by MSD

[12] Estimates of properties served by septic tanks and package plants provided by City planner Terri Gaston.

Wastewater is rich in organic matter and contains high levels of carbon and nitrogen. As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emissions of two greenhouse gases: methane (CH_4) and nitrous oxide (N_2O). MSD's wastewater treatment plants and the privately managed package plants in the City create nitrous oxide (N_2O), while septic tanks' anaerobic conditions produce methane (CH_4)

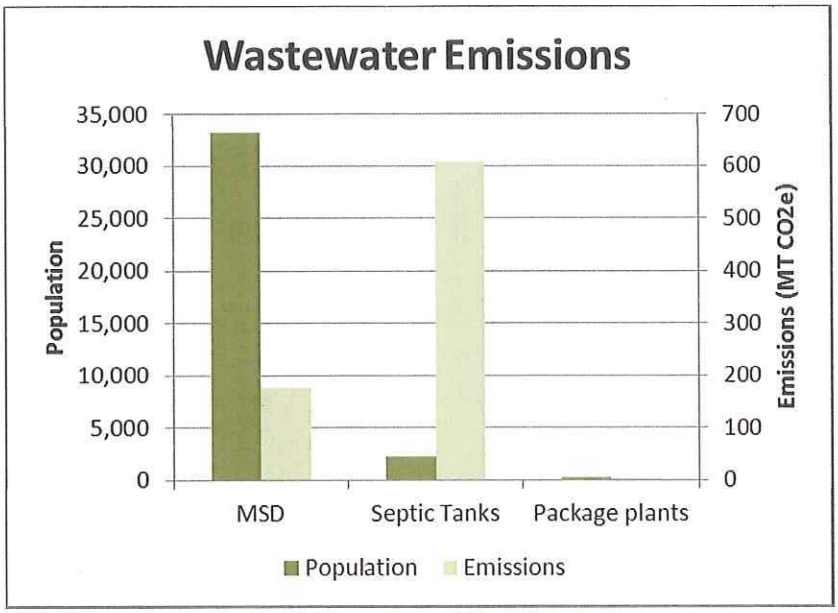

FIGURE 7: COMMUNITY-WIDE EMISSIONS FROM WASTEWATER TREATMENT, 2010

As shown in *Figure 7*~~*Figure 7*~~, the GHG emissions from septic tanks are significantly higher than the emissions from MSD's wastewater treatment, despite the fact that a smaller population is served by septic systems. As described in the City of Wildwood's Master Plan, septic systems pose other environmental risks; poor siting and improper use can affect both surface and ground water quality. Many residents west of State Route 109 are also on well water; improperly functioning septic systems risk potential contamination of drinking water.

TABLE 5: EMISSIONS FROM WASTEWATER TREATMENT, 2010

Wastewater Treatment Method	Population	Emissions (mt CO_2e)
MSD Wastewater Treatment	33,207	176.7
Septic Tank	2,271	606.3
Package Plant	234	0.23
Total		783.3

WATER CONSUMPTION

Similar to MSD, Missouri American Water serves only a portion of the Wildwood community. With 8,754 active accounts in the City of Wildwood, Missouri American Water provides potable water to an estimated 25,737 people[13]. The average daily consumption is 90 gallons per person per day. Based on this average, the residents of Wildwood served by Missouri American Water consumed an estimated 845,452,566 gallons of water in 2010.

TABLE 6: EMISSIONS FROM THE CONVEYANCE, TREATMENT AND DISTRIBUTION OF POTABLE WATER, 2010

Stage	mt CO_2e
Water Conveyance and Treatment	803
Water Distribution	106
Total	**909**

[13] Number of accounts, estimated population served, and average daily consumption was provided by Missouri American Water. Total community-wide water consumption data was not available.

GHG emissions from Wildwood residents' water consumption are estimated based on the energy intensity of each stage of the process. These stages include conveying the water from the source to the treatment facility, treating the water, and distributing the water to the end user.

According to energy intensities provided by Missouri American Water, the conveyance, treatment and distribution of potable water was responsible for 909 mt CO_2e in 2010. This constitutes 0.3% of the total emissions for the City in 2010.

The remainder of the City is served by well water; the only GHG emissions resulting from the consumption of well water are those associated with the energy used to pump water out of the well. Electricity used for this purpose is included in the community-wide electricity consumption totals provided by Ameren Missouri. No data was available to estimate the emissions from water pumps powered by propane or other stationary fuels; those GHG emissions are not included in this inventory.

Solid Waste

GHG emissions result from the management and decomposition of solid waste, including the combustion of fuel to transport and process waste, the combustion of solid waste in incinerators or waste-to-energy facilities, and the decomposition of biologic solid waste in landfills. There are no landfills or waste-to-energy facilities located within the City of Wildwood. This inventory quantifies the emissions associated with the decomposition of waste produced by the Wildwood community and landfilled elsewhere.

Residential waste is collected by the Meridian Waste Services under a City contract and sent to the Champs Sanitary Landfill. Unfortunately no data regarding commercial waste volumes was available. This is a significant source of emissions and strategies should be developed to include it in future inventories.

Meridian Waste Services' records indicated that 10,218 tons of trash, 3,636 yards of yard waste, and 3,661 tons of recycling were collected from Wildwood residents in 2010, using a total of 72,576 gallons of diesel fuel. Wildwood's diversion rate (the amount of material diverted from the landfill into recycling streams) is 36%. The emissions associated with the disposal of solid waste totaled 2,897 mt CO_2e, 1% of the city's total emissions. The emissions associated with the use of diesel fuel to haul residential waste totaled 752 mt CO_2e; these emissions are included in the community transportation totals.

Sources Not Included

Freight Rail

St. Louis is the nation's third largest rail hub, and Missouri is home to 19 railroads operating on nearly 4,400 miles of track. Approximately three miles of the Missouri Central Railroad Company's rail line passes through the City, with two more lines running just outside the City's Southern border: the Burlington Northern Santa Fe rail line, and a line managed by Union Pacific.

Given the St. Louis region's status as a hub for rail traffic, the emissions associated with rail freight would ideally be included in this greenhouse gas emissions inventory. However, the data needed to calculate emissions following ICLEI's new community protocol, specifically the tons of freight moved, was unavailable.

Local Government GHG Emissions Inventory: 2010

The City of Wildwood's Local Government

In total, the emissions from the City of Wildwood's local government make up less than 1% of the community of Wildwood's emissions total. However, this need not deter the city from pursuing cost-cutting energy and resource conservation strategies. Despite the small relative size of many local government's emissions, municipalities have the opportunity to conserve energy and resources, saving money and reducing emissions in the process.

Evaluating Local Government Emissions

Greenhouse Gas Emissions by Scope

For local government GHG emissions inventories, emission sources are categorized as direct emissions - Scope One- or indirect emissions- Scope Two or Scope Three. This categorization is done mainly to prevent double counting.

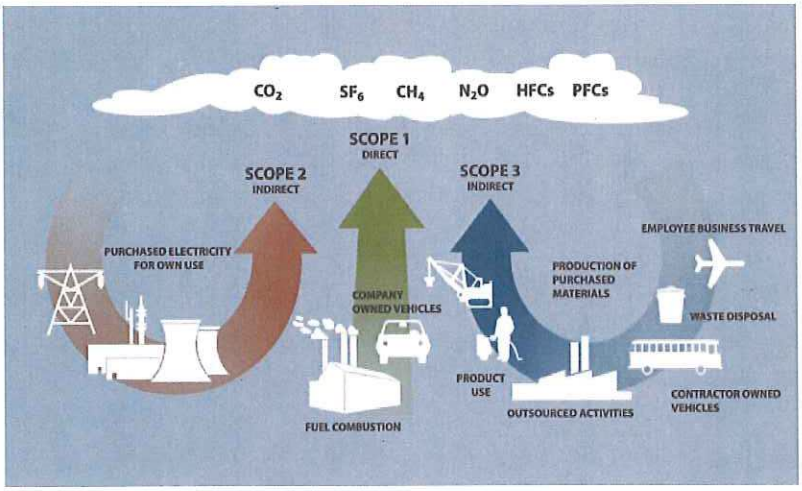

Figure 8: Greenhouse Gas Emissions Scopes[14]

Any physical process that releases GHG emissions into the atmosphere is considered direct emissions. These emissions are included in the local government inventory if the source is within the City of Wildwood's local government organizational boundaries or if it is owned or controlled by the City. For example, direct emissions from the local government include the emissions that result from the combustion of natural gas in the City Hall furnace, or the combustion of fuel in a vehicle owned by the City.

Indirect emissions (Scopes Two and Three) occur at sources owned or controlled by other entities but are the result of activities that occur within the organizational boundary of the City's local government. Scope Two includes the emissions associated with the consumption of purchased electricity, steam, or heating and cooling. For example, the emissions associated with combustion of coal to produce the electricity consumed in Wildwood City Hall are included in the local government inventory, even though the combustion is conducted by another entity.

[14] World Resources Institute and The World Business Council for Sustainable Development. *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.* (WRI and WBCSB, 2004), 26.

Scope Three includes all other indirect emissions not included in Scope Two, such as emissions from contracted services, and emissions from waste disposal.

The City of Wildwood contracts with others to provide street and right-of-way maintenance, residential solid waste collection, and police services. All emissions that result from contracted services are categorized as Scope Three emissions. So while Scopes One and Two are often the larger portions of the local government inventory, in the City of Wildwood's case they make up only 21% of the local government inventory.

Including all scopes, the City's local government emitted approximately 1,426 mt CO_2e in 2010. Calculation details are included in *Appendix D: Local Government Inventory Calculation Details*.

Greenhouse Gas Emissions by Sector

Understanding emissions from various sectors of city government operations can be useful for policy-making, GHG emissions reduction planning, and climate action planning. This inventory evaluates local government GHG emissions by the following sectors:

- Buildings and Facilities
- City Government Vehicle Fleet
- Public Lighting
- Water and Wastewater Transport
- Contracted Services:
    - Vehicle Fleet: Street and Right-of-way Maintenance
    - Vehicle Fleet: Police Operations
    - Vehicle Fleet: Residential Waste Hauling
- Employee Commute

TABLE 7: TOTAL LOCAL GOVERNMENT EMISSIONS BY SECTOR, 2010

	mt CO_2e
Sectors (Scope 1 and 2)	
Buildings and Facilities	201
City Government's Vehicle Fleet	28
Public Lighting	57
Water Use	13
Total	**299**
Sectors (Scope 3)	
Contracted Services	
Vehicle Fleet: Street and Right-of-way Maintenance	24
Vehicle Fleet: Police Operations	261
Vehicle Fleet: Residential Waste Hauling	742
Employee Commute	100
Total	**1,127**
Total (Scopes 1, 2, and 3)	**1,426**

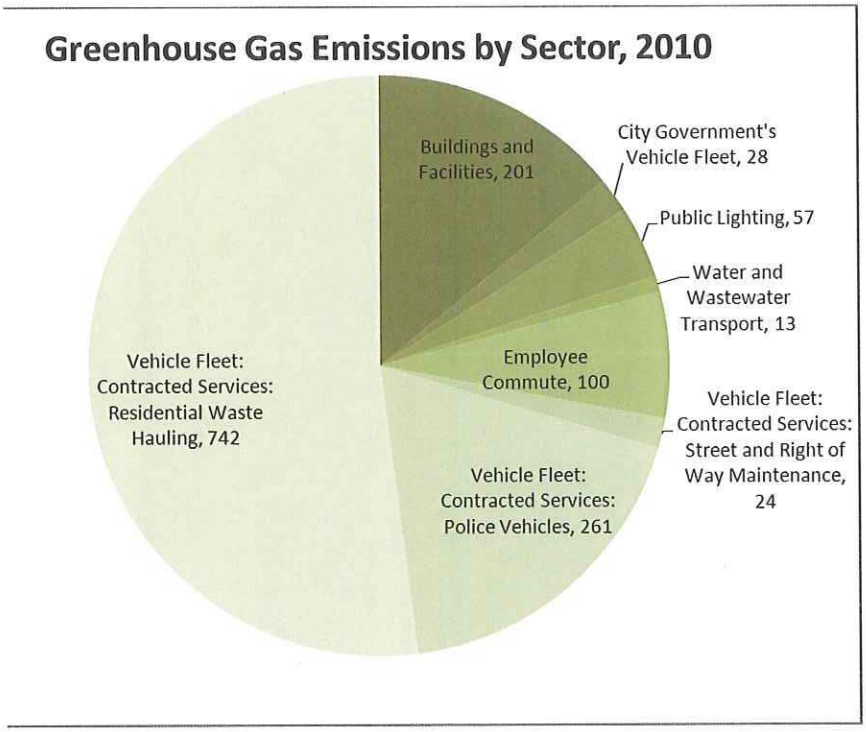

FIGURE 9: 2010 LOCAL GOVERNMENT GHG EMISSIONS BY SECTOR, MT CO_2E

Buildings and Facilities

Electricity and natural gas used to power, heat, and cool the City of Wildwood's buildings was responsible for 201 mt CO_2e in 2010. This sector comprised 14% of local government GHG emissions.

At the time of writing, the City of Wildwood occupied two leased facilities: Wildwood City Hall and the Wildwood Precinct Station. The city is also responsible for managing several additional facilities; two park facilities, Old Pond School Park and Anniversary Park, consumed electricity in 2010 and are included in this inventory. In addition, a fountain in Town Center consumed electricity in 2010. Electricity consumption from Wildwood City Hall made up over half of this sector; electricity consumption from the Wildwood Precinct station was the next largest source of greenhouse gas emissions. It is worth noting that no natural gas consumption data was available for the Police Substation.

Construction of a new Wildwood City Hall building will be complete in early 2013. This new facility will house all city business offices and meeting rooms and includes space for the Wildwood Precinct of the St. Louis County Police Department. The design team is targeting LEED silver or gold level certification for this facility. The consolidation of leased office spaces into the new Wildwood City Hall building will change the emissions associated with the City's buildings and facilities. Though this space is larger, it was designed following LEED principles. More data collection and analysis is necessary before the effect of the move can be understood.

It is unusual for buildings and facilities to comprise such a relatively small portion of the local government inventory (14%). In contrast to other municipalities discussed in the *Putting Emissions in Context* section, the City of Wildwood does not operate a recreational facility and it occupied two relatively small leased offices in 2010.

Table 8: 2010 Local Government Building and Facility Emissions

Emissions by Building or Facility	Electricity Consumption (kWh)	Emissions from Electricity Consumption (mt CO_2e)	Natural Gas Consumption (Therms)	Emissions from Natural Gas Consumption (mt CO_2e)	Total Emissions (mtCO_2e)
City Hall	266,830	122	1,447	7.7	129.7
Police Substation	89,538	40.9	0	0	40.9
Old Pond School Park	31,537	14.3	0	0	14.3
Town Center Fountain	29,957	14	0	0	14
Anniversary Park	4,767	2.2	0	0	2.2
Total	**422,629**	**193.4**	**1,447**	**7.7**	201.1

Electricity and natural gas use varies greatly between seasons. Two factors, heating degree days and cooling degree days, allow us to compare energy use from year to year or season to season despite differences in weather patterns. A heating degree day is a measurement of how many degrees and for how long the outside air temperature is *below* 65˚F (in this case); a cooling degree day is a similar measurement of how many degrees and how long the outside air is *above* 65˚F.

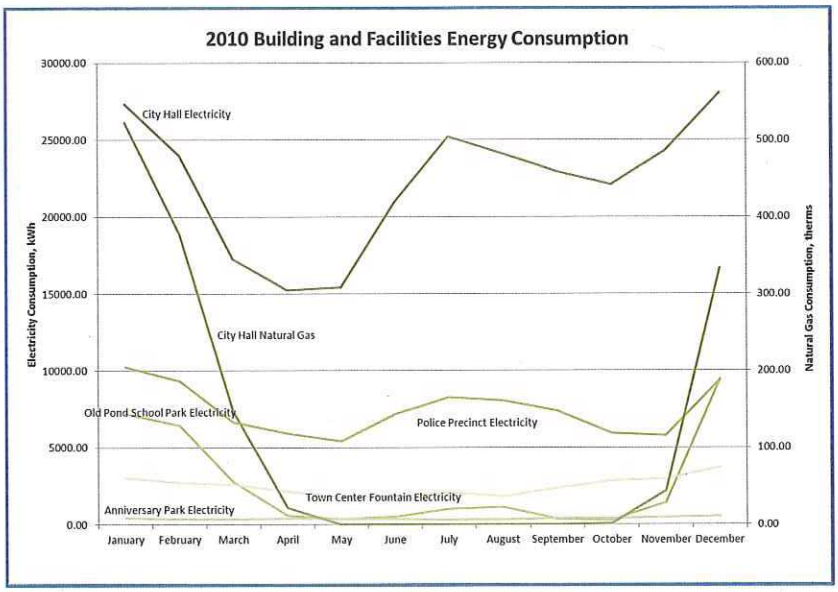

FIGURE 10: 2010 LOCAL GOVERNMENT BUILDINGS AND FACILITIES ENERGY CONSUMPTION

The heating and cooling degree days for St. Louis are from the National Oceanic and Atmospheric Administration (NOAA). *Figure 11~~Figure 11~~* shows the electricity consumption of the City's three largest facilities compared with the heating and cooling degree days in 2010.

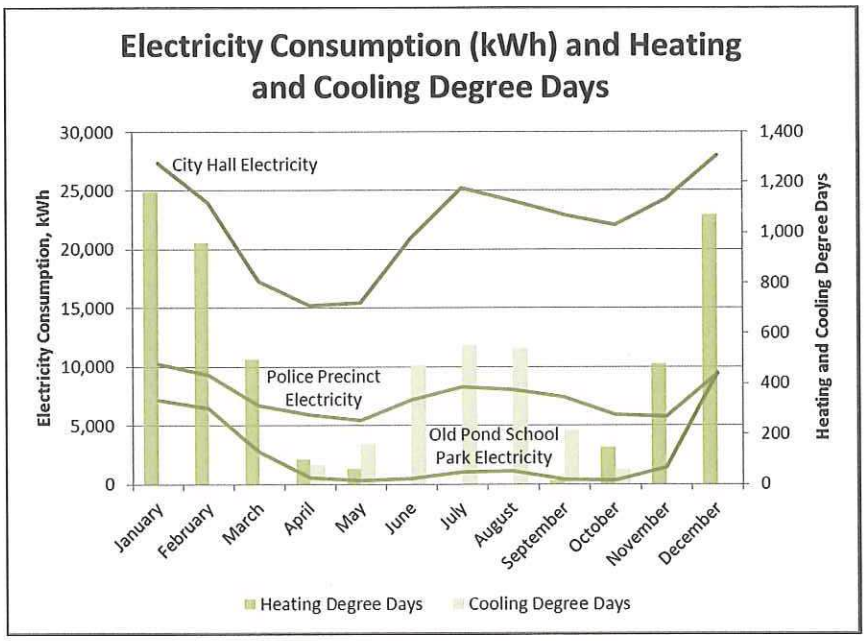

FIGURE 11: CITY OF WILDWOOD ELECTRICITY CONSUMPTION (KWH) AND HEATING AND COOLING DEGREE DAYS, 2010

Emissions from the facilities and buildings operated by the City of Wildwood will change greatly when the New City Hall building is completed in early 2013. Ongoing emissions tracking is advisable, and comparing electricity and natural gas consumption per heating and cooling degree days is a useful way to normalize energy consumption based upon weather patterns.

STREET LIGHTS, TRAFFIC LIGHTS AND PARK LIGHTING

The emissions created by electricity consumed to power streetlights, traffic lights, and park lighting under the City of Wildwood's control are included in this sector. This estimate does not include streetlights on private roadways or street and traffic lights operated by the State of Missouri on its roadways.

An estimated 57 mt CO_2e were emitted in 2010 as a result of street, traffic and park lights under the City of Wildwood's operational control; at 4% of the total emissions for the City of Wildwood local government, this is not a large emissions sector.

Water and Wastewater Transport

The City of Wildwood does not operate any water or wastewater transport facilities. As described in the community GHG inventory, these services are provided by Missouri American Water and the Metropolitan St. Louis Service District respectively. The 13 mt CO_2e of GHG emissions included in this sector are associated with the 1,677,000 gallons of water consumed by Wildwood City Hall in 2010. This sector constitutes 1% of the city's total emissions, and much like electricity and natural gas usage, this sector will be affected when city operations move from the current location to the new city hall.

Vehicle Fleet

The City of Wildwood's vehicle fleet includes seven vehicles and is used for a variety of purposes, such as code enforcement, site inspections, and organization of city sponsored events. Currently fuel use data is available but vehicle mileage is not being tracked. Should the City of Wildwood wish to reduce fuel consumption and corresponding fuel costs and GHG emissions, tracking the mileage of city-owned vehicles could provide the city with a useful metric.

Missouri's Renewable Fuel Standard Act became effective in 2008 and requires that all gasoline sold in Missouri must contain 10% ethanol, with some exceptions.[15] For the purpose of this inventory, it is assumed that all gasoline consumed by the City of Wildwood's vehicle fleet consisted of 10% ethanol. More information about the calculation of greenhouse gas emissions from biofuels is included in the *Transportation* section of *Appendix C: Community Inventory Calculation Details.*

Table 9: Emissions from City-owned Vehicle Fleet

Source	Fuel Consumption (gallons)	GHG Emissions (mt CO_2e)
Gasoline	3,114	27.5
Ethanol	346	0.1

Employee Commute

This sector includes the emissions created by the combustion of fuel in government employee's vehicles as they commute to and from work. Employee commuting emissions are included in Scope 3, as they are outside the local government's control.

City of Wildwood emissions from employee commuting totaled 100 mt CO_2e in 2010, making up 7.2% of government emissions. Eighteen City Hall employees were surveyed; each reported their preferred method of commuting, the distance of their daily commute, and the make and model of their vehicle.

[15] "Missouri Renewable Fuel Standard Act," Missouri Department of Agriculture, accessed October 25th, 2012, http://mda.mo.gov/weights/fuel/renewablefuelstandard.php

City employees commute an average of 14.3 miles one way each day. Yearly, their annual round-trip commuting mileage totals an estimated 118,496 miles. The City has an extensive network of pedestrian and biking trails and the new City Hall building design includes locker rooms; several employees stated that they hope to use alternative forms of commuting more often when changing and locker facilities are readily available.

As described in earlier sections, the Renewable Fuel Standards Act requires that all gasoline sold in the state of Missouri contain 10% ethanol. This inventory assumed that all gasoline consumed by employees commuting to work complied with this fuel standard.

TABLE 10: EMPLOYEE COMMUTE MILEAGE

One Way Commute Distance (miles)	Number of Employees	Estimated Annual Miles of Group
0-5	8	10,810
6-10	2	5,520
11-15	1	5,980
16-20	1	9,200
21-25	0	0
26-30	4	51,106
31-35	1	14,720
36-40	0	0
41-45	0	0
46-50	1	21,160
Total	18	118,496

CONTRACTED SERVICES

The majority of the City of Wildwood's emissions are the result of contracted services: 1027 mt CO_2e or 74%. The City of Wildwood contracts to provide street and right-of-way maintenance, residential waste and recycling services, and police services to the residents of Wildwood. Since contracted services are such a significant source of The City's greenhouse gas emissions, future contract negotiation will be the key to reducing fuel consumption, fuel costs, and the associated greenhouse gas emissions.

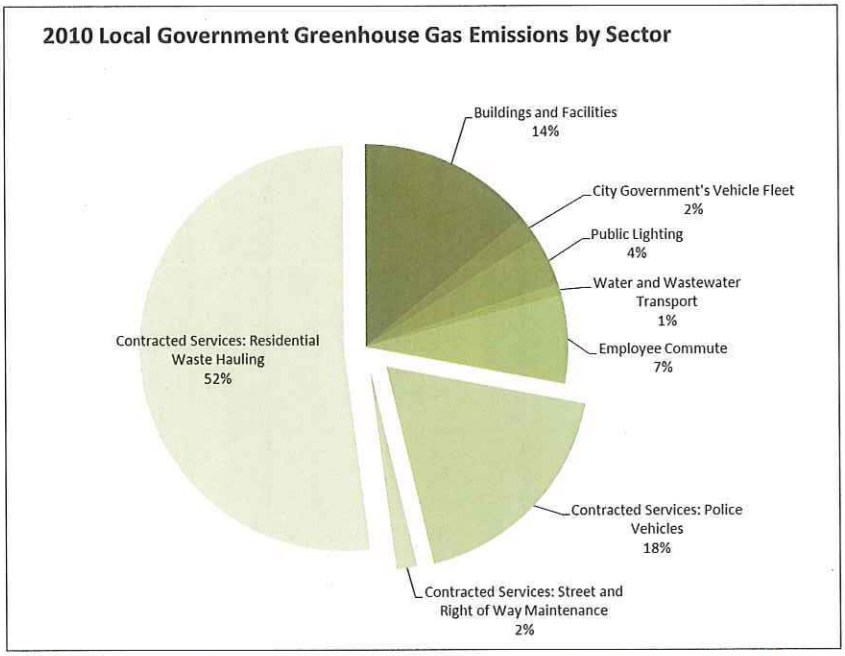

FIGURE 12: 2010 LOCAL GOVERNMENT GREENHOUSE GAS EMISSIONS BY SECTOR

STREET AND RIGHT-OF-WAY MAINTENANCE

Approximately 24 mt CO_2e were emitted in 2010 from street and right-of-way maintenance. Work completed in this category includes road salting, snow plowing, street repair and median maintenance. While mileage associated with road salting is currently being tracked, mileage and fuel consumption associated with other street and right-

of-way maintenance is currently not being recorded. When this data was unavailable, travel was estimated based on the contractor's starting location and the location of work completed each day.

Residential Waste and Recycling Services

The City of Wildwood contracts with Meridian Waste Services to collect trash, recycling, and yard waste from City residents who elect to sign up for these services. Meridian reports waste tonnage and fuel consumption to the city each month. The local government portion of this inventory includes the emissions associated with the combustion of fuel in the vehicles used to collect solid waste; emissions from the decomposition of solid waste are included in the community inventory.

It is unusual for municipalities to be able to include the emissions associated with waste hauling in their greenhouse gas inventory. Fortunately for the City of Wildwood and this greenhouse gas inventory, Meridian Waste Services keeps detailed records of monthly fuel consumption totals.

Of all local government GHG emissions categories, the residential waste-hauling category is the largest; at 742 mt CO_2e, it comprises 53% of the city's total emissions. This is likely because of several factors: at 68 square miles, the City of Wildwood is one of the largest municipalities in the state. Meridian collects recycling, trash, and yard waste weekly in separate vehicles; the amount of fuel consumed during waste collection reflects these facts.

Additionally, Waste and Recycling Services appear to be such a large portion of the inventory because the building and facilities sector, normally the largest sector in a municipal greenhouse gas inventory, is relatively small. As a result, the emissions associated with other categories may appear larger in comparison.

Wildwood Police Precinct

The City of Wildwood contracts with St. Louis County to provide police services to its residents. Estimated GHG emissions from Wildwood Precinct's officers' vehicles in 2010 totaled 261 mt CO_2e, or 19% of the City of Wildwood's local government GHG emissions total. Police driving styles and conditions are inherently different from those of typical drivers; not only are their vehicles heavier because of added equipment, officers often idle or travel at fast speeds in order to successfully complete their work. These factors increase fuel consumption and in doing so, increase the associated emissions.

Sources Not Included

Because of limitations of data availability, some sectors were omitted from this inventory. The solid waste produced by city government facilities is not currently tracked or recorded. In addition, it was not possible to inventory refrigerants in city facilities and vehicles. Though the total amount of escaped refrigerants is likely small, refrigerants are extremely powerful greenhouse gases, and therefore are important. Measuring these two emissions sources would be the first step towards managing and reducing their impact. In the future, especially once the city moves into the New City Hall facility, it is recommended that the tonnage of solid waste produced by the local government and the types and amounts of refrigerants currently being used in city vehicles and city HVAC equipment be tracked.

CONCLUSION

PUTTING EMISSIONS IN CONTEXT

In order to understand the relative size and significance of the City of Wildwood's 2010 greenhouse gas emissions, it is helpful to compare the results of this inventory with the GHG emissions inventories of other municipalities in the St. Louis Metropolitan Region. Several local governments of comparable size have completed greenhouse gas emission inventories, including the cities of Richmond Heights[16], Clayton[17], and Creve Coeur[18].

While all of these cities are located within the St. Louis Metropolitan Region, differences in population, density, and size create significant differences in greenhouse gas emissions levels. Also, each inventory varies in the data available and inventory year, so it is misleading to focus on very small differences in data.

TABLE 11: COMMUNITY-WIDE GREENHOUSE GAS EMISSIONS, MUNICIPALITIES IN THE ST. LOUIS REGION

Municipality	Inventory Year	Population in Inventory Year	City Area (square miles)	Total Community Emissions (mt CO_2e)	Emissions per square mile (mt CO_2e)	Emissions per capita (mt CO_2e)
City of Wildwood	2010	35,517	68	284,268	4,180	8
Creve Coeur	2005	16,920	10.1	794,963	78,709	47
Richmond Heights	2008	8,600	2.3	243,621	105,922	28
Clayton	2006	15,935	2.5	472,466	188,986	30

In addition to contrasting total emissions levels, it is helpful to consider two additional metrics: emissions per capita and emissions per square mile. In comparison to Creve Coeur, Richmond Heights, and Clayton, Wildwood's per capita emissions and emissions per square mile are significantly lower. To understand this difference it is helpful to examine the emissions by sector.

TABLE 12: COMMUNITY-WIDE GREENHOUSE GAS EMISSIONS BY SECTOR, MUNICIPALITIES IN THE ST. LOUIS REGION

Municipality	Inventory Year	Emissions from Electricity and Natural Gas (mt CO_2e)			Emissions from Transportation (mt CO_2e)	Emissions from Solid Waste (mt CO_2e)	Emissions from Water and Wastewater (mt CO_2e)
		Residential	Commercial	Industrial			
City of Wildwood	2010	166,814	29,945	67	82,739	2,897	1,692
Creve Coeur	2005	132,320	366,012	54,299	268,089	2,686	1,558
Richmond Heights	2008	44,855	74,688	127	123,150	801	Not Included
Clayton	2006	87,500	323,529	Not Included	46,064	4,124	Not included

[16] Robinson, Teresa, *2008 Community-Wide & Local Government Operations Greenhouse Gas Emissions Inventory* (St. Louis, MO: City of Richmond Heights, 2011).

[17] City of Clayton, MO, Greenhouse Gas Emissions Inventory Report (St. Louis, MO: City of Clayton)

[18] Kellum, Spencer, *City of Creve Coeur, Missouri Baseline Greenhouse Gas Emissions Inventory for 2005* (St. Louis, MO: City of Creve Coeur, 2008).

While the City of Wildwood has the largest levels of GHG emissions from residential electricity and natural gas consumption, it produced significantly smaller amounts of commercial, industrial, and transportation emissions. Higher levels of electricity and natural gas consumption by commercial and industrial properties in Creve Coeur, Richmond Heights and Clayton seem to be the reason the City of Wildwood's GHG emissions totals are lower by comparison.

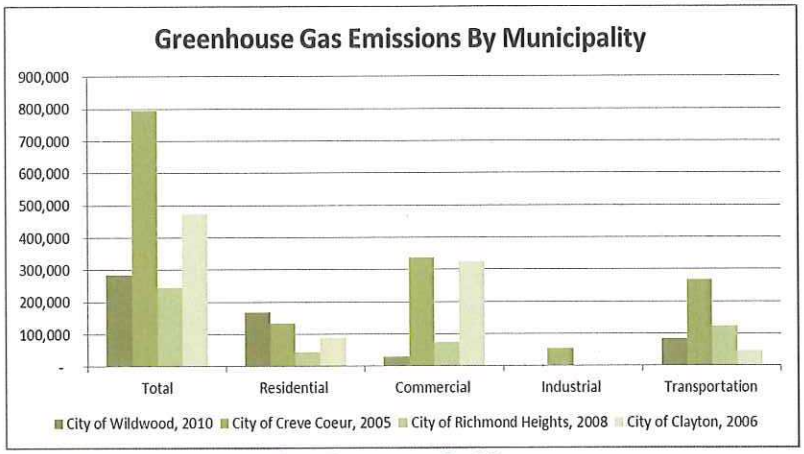

FIGURE 13: GREENHOUSE GAS EMISSIONS BY MUNICIPALITY

A 2005 report by the Missouri Economic Research and Information Center[19] identified daytime changes in population as residents commute to other cities for employment. An estimated 35.3% of Wildwood's population left the city for employment in 2005. In contrast, Clayton's population increased by 25.1%, Richmond Height's by 13.9%, and Creve Coeur's by 23.5%. While this information is now out of date, it does shed some light on the differences in GHG emissions. This study implies that in 2005, Clayton, Richmond Heights, and Creve Coeur all had more commercial and industrial development, leading to more commercial and industrial energy consumption.

GHG emissions from transportation can also be explained by examining changes in daytime population. The City of Creve Coeur has the largest transportation total; Creve Coeur's greenhouse gas emissions inventory attributed these emissions to the estimated 33,000 people commuting into the City for employment[20].

TABLE 13: LOCAL GOVERNMENT OPERATIONS GREENHOUSE GAS EMISSIONS, MUNICIPALITIES IN THE ST. LOUIS REGION

Municipality	Inventory Year	Local Government Emissions (mt CO_2e)							
		Buildings and Facilities	Streetlights and Traffic Signals	Vehicle Fleet	Employee Commute	Refrigerants	Water	Contracted Services	Total Local Government Emissions
City of Wildwood	2010	201	57	28	100		13	1027	**1,426**
Creve Coeur	2005	2,431	353	587	556		45		**3,973**
Richmond Heights	2008	2,340[21]	492	359	628	37			**3,857**
Clayton[22]	2006	4,670	338	450	169				**5,627**

Cells in gray were not included in that municipality's inventory.

[19] Missouri Economic Research and Information Center, *Daytime Population Changes in Missouri Counties and Selected Cities* (Jefferson City, Missouri, 2005)

[20] Kellum, Spencer, *City of Creve Coeur, Missouri Baseline Greenhouse Gas Emissions Inventory for 200*5 (St. Louis, MO: City of Creve Coeur, 2008), page 12

[21] Two categories from the Richmond Heights Inventory were combined to facilitate comparison between municipalities: "Building and Facilities" and "Non-Fleet Fuel".

[22] Total emissions and percentage of emissions associated with each sector were used to calculate the City of Clayton's emissions in *Table 13*.

When local government GHG emissions are compared, it is apparent that the City of Wildwood's inventory is significantly lower than the municipalities included in *Table 13~~Table 13~~*. The largest difference is visible in the Buildings and Facilities sector, where the City of Wildwood (in 2010) was associated with less than 10% of the emissions from Creve Coeur's, Richmond Heights' or Clayton's.

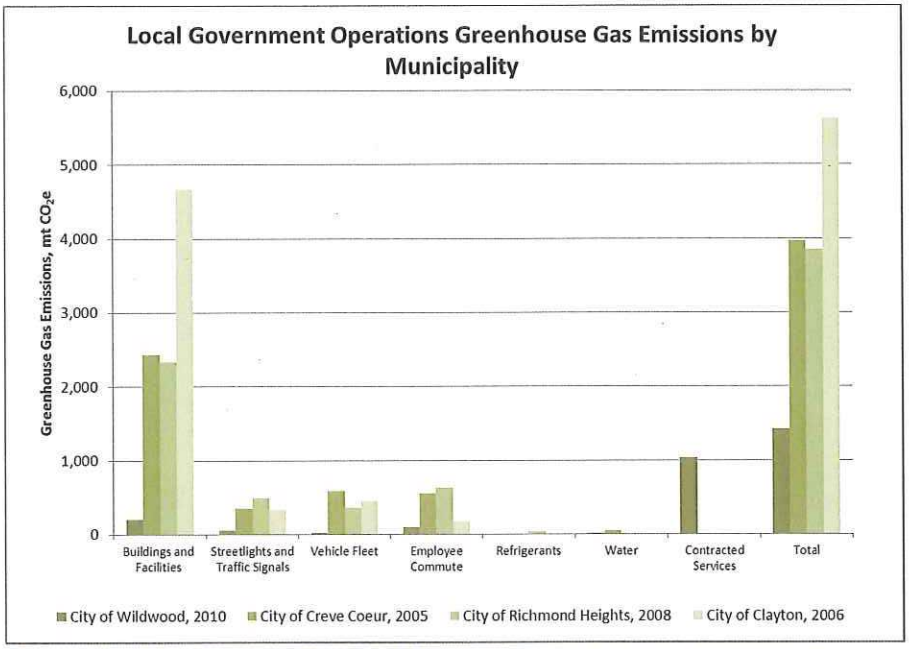

FIGURE 14: LOCAL GOVERNMENT OPERATIONS GREENHOUSE GAS EMISSIONS BY MUNICIPALITY

The lack of any large recreational facility operated by the City of Wildwood may be the cause of its lower building and facility emissions. Creve Coeur, Richmond Heights, and Clayton all operate several facilities, including recreational facilities. 38% of Creve Coeur's emissions are the result of its ice arena, and approximately half of Richmond Height's electricity and natural gas consumption are the result of The Heights, its recreation center. The City of Clayton's inventory contains limited information about the buildings in operation at the time of its 2006 inventory, but it currently operates a recreational facility and an aquatic center.

Another likely reason for The City of Wildwood's lower emissions totals is the City's use of contracted services. While the City of Wildwood contracts with others to provide street and right-of-way maintenance, police services, and waste hauling, other municipalities perform these services in-house. Residents of the City of Wildwood are served by three independent fire protection districts; the associated emissions are not included in the City's local government inventory because they are outside of the City's operational control[23]. Performing these services in-house likely contributes to other municipalities' higher buildings and facilities emissions, vehicle fleet emissions, and employee commute emissions.

FUTURE OPPORTUNITIES: COST SAVINGS

This inventory can be used in the future to explore opportunities for cost savings from resource conservation, both for the City of Wildwood's residents and for its local government. The largest portions of both the community and local government inventories are likely to yield opportunities for cost savings. 74% of the City of Wildwood's community emissions results from the consumption of electricity (53%) and natural gas (21%). Since the majority of Wildwood's electricity and natural gas GHG emissions are from the residential sector, residential conservation strategies have the potential to save City residents money, conserve resources, and reduce GHG emissions.

[23] Emissions from fire protection districts *are* included in the community-wide totals.

The largest portion of the City's local government inventory is contracted services; future contract negotiations will be the key to reducing the GHG emissions and costs associated with these activities. The electricity and natural gas consumed by City facilities are responsible for the next largest portion of the local government inventory. Similar to the community inventory, this sector may contain many opportunities for energy conservation and cost savings.

Any emissions reductions pursued by the City of Wildwood will not only conserve resources and potentially reduce costs, they will contribute to the efforts of other municipalities throughout the St. Louis Region. With this report, the City has reaffirmed its commitment to environmental stewardship and laid the groundwork for future resource conservation, cost savings, and greenhouse gas emissions reduction.

Appendix A: List of Acronyms And Abbreviations

CAP	criteria air pollutant
CO_2	Carbon Dioxide
CH_4	Methane
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
kWh	kilowatt hour
mt CO_2e	metric tons of Carbon Dioxide equivalent
MSD	Metropolitan St. Louis Sewer District
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
N_20	Nitrous Oxide
PFC	Perfluorocarbon
SF_6	Sulfur Hexafluoride
USGCRP	U.S. Global Change Research Program
VMT	Vehicle Miles Traveled
WWTP	Wastewater Treatment Plant

APPENDIX B: COMMUNITY GHG EMISSIONS INVENTORY SUMMARY TABLE

ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions requires this Community GHG Emissions Inventory Summary Table. It includes all potential sources of GHG emissions, identifies the sources included in this inventory, the methods used to estimate emissions and the total estimated emissions. It also identifies all emissions sources excluded from this inventory and the reasons for excluding each.

Legend	
Reporting Frameworks	
SI	Local Government Significant Influence
CA	Community-Wide Activities
Reasons for Excluding	
IE	Included Elsewhere
NE	Not Estimated
NA	Not Applicable
NO	Not Occurring

Community-wide GHG Emissions Inventory ***Scoping and Reporting Tool*** Emissions Type		Source or Activity?	FINAL REPORTING - INCLUDED / EXCLUDED					FINAL REPORTING DATA		
			Required Activities	Included, under possible reporting frameworks: SI	Included, under possible reporting frameworks: CA	Excluded (IE, NA, NO, or NE)	Explanatory Notes	Emissions ($MTCO_2e$)	Acct Method Used	Acct Method Notes
Built Environment										
Use of fuel in residential and commercial stationary combustion equipment		Source AND Activity	•		•		Data from Laclede Gas Company	55,678	BE.1.1	
Industrial stationary combustion sources		Source				NO				
Electricity	Power generation in the community	Source				NO				
	Use of electricity by the community	Activity	•		•		Data provided by Ameren Missouri	141,156	BE.2.2	
District Heating/ Cooling	District heating/cooling facilities in the community	Source				NE				
	Use of district heating/cooling by the community	Activity				NE				
Industrial process emissions in the community		Source				NE				
Refrigerant leakage in the community		Source				NE	No Refrigerant data available			
Transportation and Other Mobile Sources										
On-road Passenger Vehicles	On-road passenger vehicles operating within the community boundary	Source	• or		•		Total VMT within City of Wildwood provided by EW Gateway	52,074	TR.1.B.1	Gallons of Ethanol Estimated, process described in Appendix C
	On-road passenger vehicle travel associated with community land uses (demand based allocation)	Activity	•			NE	data unavailable			
On-road Freight Vehicles	On-road freight and service vehicles operating within the community boundary	Source			•		Total VMT within City of Wildwood provided by EW Gateway	15,688	TR.1.B.1	used TR.1.B.1 with fuel efficiencies and emissions factors from Tables TR.2.1 and TR.2.2
	On-road freight and service vehicle travel associated with community land uses	Activity				NE	data unavailable			
On-road transit vehicles operating within the community boundary		Source				IE	Included in VMT totals provided by EW Gateway			
Transit Rail	Transit rail vehicles operating within the community boundary	Source				NE	data unavailable			
	Use of transit rail travel by the community	Activity				NE	data unavailable			
Inter-city passenger rail vehicles operating within the community boundary		Source				NO	no inter-city passenger rail present			
Freight rail vehicles operating within the community boundary		Source				NE	data unavailable			

Community-wide GHG Emissions Inventory ***Scoping and Reporting Tool***		Source or Activity?	FINAL REPORTING - INCLUDED / EXCLUDED					FINAL REPORTING DATA		
			Required Activities	Included, under possible reporting frameworks:		Excluded (IE, NA, NO, or NE)	Explanatory Notes	Emissions ($MTCO_2e$)	Acct Method Used	Acct Method Notes
Emissions Type				SI	CA					
Marine	Marine vessels operating within the community boundary	Source				NO	no marine vessels present			
	Use of ferries by the community	Activity				NO	no ferries present			
Off-road surface vehicles and other mobile equipment operating within the community boundary		Source				NE	data unavailable			
Use of air travel by the community		Activity				NE	data unavailable			
Solid Waste										
Solid Waste	Operation of solid waste disposal facilities in the community	Source				NO	There are no solid waste facilities in Wildwood			
	Generation and disposal of solid waste by the community	Activity	•		•		Commercial waste volumes unavailable, data reflects residential volumes only	2,897	SW.4.1	
Water and Wastewater										
Potable Water - Energy Use	Operation of water delivery facilities in the community	Source				NE				
	Use of energy associated with use of potable water by the community	Activity	•		•			909	WW.14.1	Used BE.2.2 to calculate emissions
Use of energy associated with generation of wastewater by the community		Activity	•							
Centralized Wastewater Systems - Process Emissions	Process emissions from operation of wastewater treatment facilities located in the community	Source			•		Emissions from Package Plants	0.23	WW.10 (=WW.8)	
	Process emissions associated with generation of wastewater by the community	Activity			•		Emissions from MSD	18	WW.Central Treatment Final Data sheet from ICLEI Local Gov. Master Workbook used to estimate emissiosn	
Use of septic systems in the community		Source AND activity			•		Emissions from Septic	606	WW.11 (alt)	
Agriculture										
Domesticated animal production		Source				NE				
Manure decomposition and treatment		Source				NE				
Upstream Impacts of Community-Wide Activities										
Upstream impacts of fuels used in stationary applications by the community		Activity				NE				
Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community		Activity				NE				
Upstream impacts of fuels used for transportation in trips associated with the community		Activity				NE				
Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary		Activity				NE				
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community		Activity				NE				
Independent Consumption-Based Acccounting										
Household Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)		Activity				NE	no data available			
Government Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)		Activity				NE	no data available			
Life cycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)		Activity				NE	no data available			

Appendix C: Community Inventory Calculation Details

Methods, Tables and Equations referenced in the source column of the following calculation details are all drawn from ICLEI's *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*, Version 1.0, October 2012.

Electricity

Table C. 1: 2010 Community-Wide Electricity Usage

Data source: Ameren UE		
Sector	**2010 Electricity Usage (kWh)**	**2010 Electricity Usage (MWh)**
Residential	252,859,409	252,859.4
Commercial	56,277,352	56,277.4
Industrial	145,812	145.8
Street and Hwy	15,866	15.9
Total	**309,298,439**	**309,298.4**

Table C. 2: Emissions Calculation: Community-Wide Electricity Usage

Method	**BE.2.1: Calculating Electricity GHG Emissions Using Separate CO_2, N_2O, and CH_4 Emissions Factors, *U.S. Community Protocol***	
Step One		
$$Annual\ Emissions_{GHG} = \frac{electricity\ usage}{2204.6} \times Ef_{GHG}$$		
Term	**Definition**	**Source**
Annual Emissions$_{GHG}$	Metric tons of emissions of specified greenhouse gas	Result of equation
Electricity Usage	Community's annual electricity usage (MWh)	Ameren Missouri
Ef_{GHG}	Emissions factor of specified GHG (lb/MWh)	Table GWP.1[24]
2204.6	Conversion factor to convert from pounds to metric tons	Equation BE.2.1
Step Two		
$$Total\ Annual\ Emissions = \sum_{GHG}(Annual\ Emissions_{GHG} \times GWP_{GHG})$$		
Term	**Definition**	**Source**
Total Annual Emissions	Total emissions from all greenhouse gases (mt CO_2e)	Result of equation
Annual Emissions$_{GHG}$	Result of first equation	Result of equation
GWP_{GHG}	Global Warming Potential of specified greenhouse gas	Table GWP.1[24]

Table C. 3: 2010 Emissions from Community-Wide Electricity Usage By Greenhouse Gas

Greenhouse Gas	**Emissions Factor, Ef_{GHG} (lb/MWh)**	**Annual Emissions (metric tons)**	**Global Warming Potential (GWP)**	**Annual Emissions (mt CO_2e)**

[24] ICLEI – Local Governments for Sustainability USA, *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.0* (ICLEI, 2012), Appendix GWP. Global Warming Potential Values.

CO_2	1002.41	140,634.97	1	140,635.0	
CH_4	0.01945	2.73	21	57.3	
N_2O	0.01065	1.49	310	463.2	
Total				**141,155.5**	

TABLE C. 4: 2010 GHG EMISSIONS FROM COMMUNITY-WIDE ELECTRICITY USAGE BY SECTOR

Sector	CO_2 Emissions (mt CO_2)	CH_4 Emissions (mt CH_4)	N_2O Emissions (mt N_2O)	Carbon Dioxide Equivalent Emissions (mt CO_2e)
Residential	114,972.7	2.2	1.2	115,398.2
Commercial	25,588.8	0.5	0.3	25,683.5
Industrial	66.3	0.0	0.0	66.5
Street and Hwy	7.2	0.0	0.0	7.2
Total	**140,635.0**	**2.7**	**1.5**	**141,155.5**

NATURAL GAS

TABLE C. 5: 2010 COMMUNITY-WIOE NATURAL GAS USAGE

Data Source: Laclede Gas Company			
Sector	**2010 Natural Gas Usage (Therms)**	**2010 Natural Gas Usage (MMBtu)**	**Customers served**
Residential	9,672,683	967,268.3	8,995
Commercial	801,733	80,173.3	158
Industrial	0	0	0
Total	**10,474,416**	**1,047,441.6**	**9,153**

TABLE C. 6: EMISSIONS CALCULATION: COMMUNITY-WIDE NATURAL GAS USAGE

Method	**BE.1.1: Calculating GHG Emissions from Stationary Combustion Using Separate CO_2, N_2O, and CH_4 Emissions Factors, *U.S. Community Protocol***

Step One

$$Annual\ Emissions_{GHG} = Fuel\ used \times Ef_{GHG} \div 1000$$

Term	**Definition**	**Source**
Annual $Emissions_{GHG}$	Metric tons of emissions of specified greenhouse gas	Result of equation
Fuel Usage	Community's annual natural gas usage (MMBtu)	Laclede Gas Company
Ef_{GHG}	Emissions factor of specified GHG (kg GHG/MMBtu)	Tables BE.2 and BE.3
1000	Conversion factor to convert from kg to metric tons	Equation BE.1.1

Step Two

$$Total\ Annual\ Emissions = \sum_{GHG} (Annual\ Emissions_{GHG} \times GWP_{GHG})$$

Term	**Definition**	**Source**
Total Annual Emissions	Total emissions from all greenhouse gases (mt CO_2e)	Result of equation
Annual $Emissions_{GHG}$	Result of first equation	Result of equation

GWP_{GHG}	Global Warming Potential of specified greenhouse gas	Appendix GWP[25]

TABLE C. 7: 2010 GHG EMISSIONS FROM COMMUNITY-WIDE NATURAL GAS USAGE BY GREENHOUSE GAS

Greenhouse Gas	Emissions Factor, Ef_{GHG} (kg/MMBtu)	Annual Emissions (metric tons)	Global Warming Potential (GWP)	Annual Emissions (mt CO_2e)
CO_2	53.02	55,535	1	55,535.3
CH_4	.005	5	21	109.9
N_2O	.001	.1	310	32.5
Total				**55,677.8**

TABLE C. 8: 2010 GHG EMISSIONS FROM COMMUNITY-WIDE NATURAL GAS USAGE BY SECTOR

Sector	CO_2 Emissions (mt CO_2)	CH_4 Emissions (mt CH_4)	N_2O Emissions (mt N_2O)	Carbon Dioxide Equivalent Emissions (mt CO_2e)
Residential	51,284.6	4.8	0.09	51,416.1
Commercial	4,250.7	0.4	0.008	4,262.7
Industrial	0	0	0	0
Total	**55,535.3**	**5.2**	**.098**	**55,677.8**

TRANSPORTATION

Missouri's Renewable Fuel Standard Act became effective in 2008 and requires that all gasoline sold in the state must contain 10% ethanol[26], with some exceptions. For the purpose of this inventory, it was assumed that all gasoline consumed by vehicles driving within the City of Wildwood contained 10% ethanol. CO_2 emissions from ethanol are considered biogenic and are not included in emissions totals.

Biogenic emissions result from the combustion or decomposition of biological materials. The CO_2 emissions resulting from combustion of these materials is assumed to be equivalent to the emissions that would have resulted from the materials' natural decomposition, so biogenic emissions are not to be included in emissions totals. The methane (CH_4) and nitrous oxide (N_2O) that result from the combustion of ethanol are not considered biogenic and are included in this inventory's total emissions.

TABLE C. 9: 2010 TRANSPORTATION WITHIN THE CITY OF WILDWOOD

Data source: East-West Gateway	
Total Daily Vehicle Miles Traveled (VMT) within the City of Wildwood (miles)	388,715
Total Annual VMT within the City of Wildwood (miles)	141,880,975
Total Annual VMT within the City of Wildwood (million miles)	141.88

TABLE C. 10: COMMUNITY-WIDE TRANSPORTATION STEP ONE

Method	TR.1.B: Alternative Method for Estimating In-boundary Passenger Vehicle Emissions, *U.S. Community Protocol*
Step One: Vehicle Miles Traveled by Vehicle Type	

[25] ICLEI – Local Governments for Sustainability USA, *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.0* (ICLEI, 2012), Appendix GWP. Global Warming Potential Values.
[26] "Missouri Renewable Fuel Standard Act," Missouri Department of Agriculture, accessed October 25th, 2012, http://mda.mo.gov/weights/fuel/renewablefuelstandard.php

$$VMT_{Vehicle\ Type} = Total\ VMT \times \%_{Vehicle\ Type}$$

Term	Definition	Source
$VMT_{Vehicle\ Type}$	Vehicle Miles Traveled by specified vehicle type (miles)	Result of Equation
Total VMT	Total Annual VMT within the City of Wildwood (miles)	East-West Gateway
$\%_{Vehicle\ Type}$	% of vehicles on the road of specified vehicle type	Table TR.1.3

Step One Results

Vehicle Type	Default Vehicle Mix (Table TR.1.3)	Vehicle Miles Traveled (VMT), 2010 (miles)
Gasoline (E10) Passenger Vehicle	60.6%	85,979,871
Gasoline (E10) Light Truck	32.4%	45,969,436
Diesel Passenger Vehicle	0.3%	425,643
Diesel Light Truck	1.3%	1,844,453
Diesel Heavy Truck[27]	5.4%	7,611,573
Total	**100%**	**141,880,975**

TABLE C. 11: COMMUNITY-WIDE TRANSPORTATION STEP TWO

Step Two: CO_2 emissions, Diesel vehicles

$$CO_2\ emissions_{\ Vehicle\ Type} = \frac{VMT_{Vehicle\ Type}}{Average\ MPG_{Vehicle\ Type}} \times Ef_{fuel}$$

Term	Definition	Source
CO_2 emissions $_{vehicle\ Type}$	CO_2 emissions for specified vehicle type (mt CO_2)	Result of Step Two
$VMT_{vehicle\ type}$	Vehicle Miles Traveled by specified vehicle type (miles)	Result of Step One
Average $MPG_{vehicle\ type}$	Average Fuel efficiency of specified vehicle type (miles per gallon)	Table TR.1.5
Ef_{fuel}	Emissions factor for specified fuel (mt CO_2/gallon)	Table TR.1.6

Step Two Results

Vehicle Type	Average Fuel Efficiency (miles per gallon diesel)	Ef_{Diesel} (mt CO_2/ gallon)	CO_2 emissions (mt CO_2)
Diesel Passenger Vehicle	17.4	0.01021	249.76
Diesel Light Truck	23.8	0.01021	791.25
Diesel Heavy Truck	4.99	0.01021	15,676.28

[27] The *U.S. Community Protocol* recommends against calculating heavy truck VMT in this way, but the data needed to complete the recommended calculation was unavailable.

Total CO_2 emissions, Diesel Vehicles	**16,717.30**

TABLE C. 12: COMMUNITY-WIDE TRANSPORTATION STEP THREE

Step Three: CH_4 and N_2O emissions, Diesel vehicles

$$CH_4, N_2O\ emissions_{Vehicle\ Type} = VMT_{Vehicle\ Type} \times Ef_{fuel}$$

Term	Definition	Source
CH_4, N_2O emissions $_{Vehicle\ Type}$	CH_4 or N_2O emissions for specified vehicle type (mt CH_4 or mt N_2O)	Result of Step Three
VMT $_{vehicle\ type}$	Vehicle Miles Traveled by specified vehicle type (miles)	Result of Step One
Ef $_{fuel}$	Emissions factor for specified fuel (mt CH_4, N_2O/mile)	Table TR.1.6

Step Three Results: CH4 and N2O emissions, Diesel Vehicles

Vehicle Type	VMT $_{vehicle\ type}$	CH_4 Ef $_{Diesel}$ (mt CH_4/mile)	CH_4 emissions (mt CH_4)	N_2O Ef $_{Diesel}$ (mt N_2O/mile)	N_2O emissions (mt N_2O)
Diesel Passenger Vehicle	425,643	5.1×10^{-9}	0.0004	4.8×10^{-9}	0.0004
Diesel Light Truck	1,844,453	1×10^{-9}	0.0018	1×10^{-9}	0.0018
Diesel Heavy Truck	7,661,573	1×10^{-9}	0.0390	1×10^{-9}	0.0368
Total Emissions from Diesel Vehicles		Total CH_4 Emissions (mt CH_4)	0.0412	Total N_2O Emissions (mt N20)	0.0390

TABLE C. 13: COMMUNITY-WIDE TRANSPORTATION STEP FOUR

Step Four: Gallons Used and Miles Traveled by E10 Vehicles

Note: No method for accounting for emissions from biofuels is included in the ICLEI Community Protocol. Missouri's Renewable Fuel Standard Act mandates that all gasoline contain 10% ethanol. Biofuels, such as ethanol, are not considered biogenic, and CO_2 emissions from their combustion are not included in emissions totals. An average fuel efficiency for each vehicle type is used to estimate the gallons of E10 consumed. This technique is inherently inaccurate. Future inventories should follow ICLEI protocols if possible.

$$Gallons\ Used_{E10} = \frac{VMT_{\ Vehicle\ Type}}{Average\ MPG_{Vehicle\ Type}}$$

$$Gallons\ Used_{Gasoline} = .90 \times Gallons\ Used_{E10}$$

$$Gallons\ Used_{Ethanol} = .10 \times Gallons\ Used_{E10}$$

$$Miles\ Traveled_{Gasoline} = .90 \times VMT_{\ Vehicle\ Type}$$

$$Miles\ Traveled_{Ethanol} = .10 \times VMT_{\ Vehicle\ Type}$$

Term	Definition	Source
Gallons Used $_{E10}$	Gallons of E10 (10% ethanol, 90% gasoline) used by specified vehicle type	Step four equation
VMT $_{vehicle\ type}$	Vehicle Miles Traveled by specified vehicle type (miles)	Result of Step One
Average MPG $_{vehicle\ type}$	Average Fuel efficiency of specified vehicle type (miles per gallon)	Table TR.1.5
Gallons Used $_{Gasoline}$	Gallons of Gasoline used by specified vehicle type	Step four equation
Gallons Used $_{Ethanol}$	Gallons of Ethanol used by specified vehicle type	Step four equation

Miles Traveled $_{Gasoline}$	Miles attributable to gasoline by specified vehicle type	Step four equation
Miles Traveled $_{Ethanol}$	Miles attributable to ethanol by specified vehicle type	Step four equation

Results, Step Four		
	Gasoline (E10) Light Truck	Gasoline (E10) Passenger Vehicle
VMT	45,969,436	85,979,871
Average MPG	17.4	23.8
Gallons Used $_{E10}$	2,641,921.60	3,612,599.62
Gallons Used $_{Gasoline}$	2,377,720.44	3,251,339.65
Gallons Used $_{Ethanol}$	264,192.16	361,259.96
Miles Traveled $_{Gasoline}$	41,372,492.31	77,381,883.77
Miles Traveled $_{Ethanol}$	4,596,943.59	8,597,987.09

TABLE C. 14: COMMUNITY-WIDE TRANSPORTATION STEP FIVE

Step 5: CO_2 emissions from E10 Vehicles

$$CO_2 emissions_{fuel,} = Gallons\ used_{fuel} \times Ef_{fuel}$$

Term	Definition	Source
CO_2 emissions $_{fuel}$	CO_2 Emissions attributed to specified fuel type (mt CO_2)	Result of Step 5 equation
Gallons used $_{fuel}$	Gallons of gasoline of specified fuel used by specified vehicle type	Result of Step 4 equation
EF $_{fuel}$	Emissions factor of specified fuel (mt CO_2/gallon)	Table TR.1.6

Step 5 Results				
Vehicle Type	Passenger Vehicles		Light Trucks	
Fuel Type	Gasoline	Ethanol	Gasoline	Ethanol
Ef $_{fuel}$(mt CO_2/gallons)	8.78	5.75	8.78	5.75
CO_2 emissions (mt CO_2)	20,876.46	1,519.10	28,546.76	2,077.24

TABLE C. 15: COMMUNITY-WIDE TRANSPORTATION STEP SIX

Step 6: N2O, CH4 Emissions from E10 Vehicles

$$CH_4, N_2O\ emissions_{Vehicle\ Type} = VMT_{Vehicle\ Type} \times Ef_{fuel}$$

Term	Definition	Source
CH_4, N_2O emissions $_{Vehicle\ Type}$	CH_4 or N_2O emissions for specified vehicle type (mt CH_4 or mt N_2O)	Result of Step Six
VMT $_{vehicle\ type}$	Vehicle Miles Traveled by specified vehicle type and fuel type(miles)	Result of Step Four
Ef $_{fuel}$	Emissions factor for specified fuel (mt CH_4, N_2O/mile)	Table TR.1.6, EPA[28]

[28] "Emissions Factors for Greenhouse Gas Inventories, Table 4" Environmental Protection Agency, accessed October 25th, 2012, http://www.epa.gov/climateleadership/documents/emission-factors.pdf

Step 6 Results				
	E10 Passenger Vehicles		E10 Light Trucks	
	Gasoline	Ethanol	Gasoline	Ethanol
N_2O Ef_{fuel} (mt N_2O/mile)	4.3×10^{-8}	6.7×10^{-8}	2.9×10^{-8}	6.7×10^{-8}
N_2O Emissions (mt N_2O)	1.78	0.31	2.24	.58
CH_4 Ef_{fuel} (mt CH_4/mile)	3.1×10^{-8}	5.5×10^{-8}	2.8×10^{-8}	5.5×10^{-8}
CH_4 Emissions (mt CH_4/mile)	1.28	0.25	2.17	0.47

TABLE C. 16: COMMUNITY-WIDE TRANSPORTATION STEP SEVEN.

Step 7: Total Emissions from Community-Wide Transportation

$$Total\ Emissions_{Vehicle\ Type} = \sum_{GHG} (Emissions_{GHG,} \times GWP_{GHG})$$

Term	Definition	Source
Total Emissions $_{Vehicle\ Type}$	Total emissions of all greenhouse gases for specified vehicle type (mt CO_2e)	Result of Step 7
$Emissions_{GHG}$	CO2, CH4 or N2O Emissions for specified vehicle type (mt CO2, CH4 or N2O)	Result of Steps 2, 3, 5 and 6
GWP_{GHG}	Global Warming Potential of specified greenhouse gas	Appendix GWP

Results

		CO_2 emissions GWP = 1	CH_4 Emissions GWP = 21		N_2O Emissions GWP = 310		Total emissions (not including CO_2 from ethanol)
		mt CO_2	mt CH_4	mt CO_2e	mt N_2O	mt CO_2e	mt CO_2e
E10 Passenger Vehicles	Gasoline	28,546.76	2.17	45.50	2.24	695.66	29,287.92
	Ethanol	2,077.24	0.47	9.93	0.58	178.58	188.51
	Total						**29,476.43**
E10 Light Trucks	Gasoline	20,876.46	1.28	26.93	1.78	551.50	21,454.89
	Ethanol	1,519.10	0.25	5.31	0.31	95.48	100.79
	Total						**21,555.68**
Diesel Passenger Cars		249.76	0.00043	0.01	0.0004	0.13	249.90
Diesel Light Trucks		791.25	0.00184	0.04	0.0018	0.57	791.87
Diesel Heavy Trucks		15,676.28	0.03907	0.82	0.0368	11.40	15,688.50
Total Emissions From Transportation							**67,762.39**

WASTEWATER

TABLE C. 17: POPULATIONS SERVED BY SEWER SYSTEMS, SEPTIC SYSTEMS, AND PACKAGE PLANTS, 2010

Population served by Metropolitan St Louis Sewer District (MSD), Data source: MSD	
Number of MSD residential hookups	8,225
Number of non-residential hookups	201
Estimated Population served (provided by MSD)	33,207
Population not served by MSD, Data Source: MSD and Terri Gaston, Wildwood City Planner	
Number of Residences on Septic Systems	2,271
Number of Residences on Package Plants	234
Average Number of residents per household, 2010	2,93
Estimated population served by Septic Systems	6,654
Estimated population served by Package Plants	686

TABLE C. 18: PROCESS N2O EMISSIONS FROM MSD'S CENTRALIZED WASTEWATER TREATMENT PLANTS

MSD provided data to several GHG inventories taking place in the St. Louis region using the Master Data Workbook ICLEI provided for its Local Government GHG inventory. This workbook calculates emissions internally, listed below are the inputs MSD provided and the resulting emissions calculated by the workbook.	
Does your wastewater treatment plant use nitrification/denitrification processes to treat effluent?	No
Does the wastewater treatment plant use aerobic or anaerobic processes to treat effluent?	Aerobic
Does your jurisdiction record site-specific measurements for the average daily nitrogen load from treated effluent discharged from the wastewater treatment plant?	Yes
If you answered "Yes" in question 3 above, enter the average total nitrogen discharged by your wastewater treatment plant (kg N / day).	2630
Total domestic population served by your wastewater treatment plant	213095
Does your jurisdiction contain commercial and/or industrial facilities?	Yes
Calculated Results	
Total population served by wastewater treatment plant (calculated by worksheet)	266369
Process Emissions from your wastewater (mt N_2O)	.8524
Process Emissions from effluent discharge to rivers and estuaries (mt N_2O)	4.8030
Total N_2O Emissions from your wastewater treatment plant (mt N_2O)	5.6554
Wildwood's Contribution, 10.03% of above (mt N_2O)	**0.567**
Wildwood's Contribution, 10.03% of above (mt CO_2e)	**176.7**

TABLE C. 19: ANNUAL CH_4 EMISSIONS FROM SEPTIC TANKS

Method: WW.11(alt): Alternative Method for Methane Emissiosn from Septic Systems, *U.S. Community Protocol*

$$Annual\ CH_4\ emissions = P \times BOD_5\ load\ x\ Bo\ x\ MCF_s^x \times 365.25\ x\ 10^{-3}$$

$$Annual\ CO_2e = Annual\ CH_4\ Emissions \times GWP_{CH_4}$$

Term	Definition	Value	Source
P	Population served by septic systems	6,654	MSD, Terri Gaston
BOD_5 load	Amount of BOD_5 treated per day (kg BOD_5/person/day)	0.09	Default value
Bo	Maximum CH_4 producing capacity for domestic wastewater (kg CH_4/kg BOD_5)	0.6	WW.11(alt)
MCF_s[29]	CH_4 correction factor for septic systems	0.22	WW.11(alt)
365.25	Conversion factor (days/year)	365.25	WW.11(alt)
10^{-3}	Conversion factor (mt/kg)	0.001	WW.11(alt)
GHP_{CH4}	Global Warming Potential of CH_4	21	Appendix GWP[29]
Results of Method WW.11 (alt)			
Annual CH_4 Emissions from Septic Tanks	28.9 mt CH_4		
Annual CO_2e Emissions from Septic Tanks	606.3 mt CO_2e		

[29] ICLEI – Local Governments for Sustainability USA, *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Version 1.0* (ICLEI, 2012), Appendix GWP. Global Warming Potential Values.

TABLE C. 20: ANNUAL N_2O EMISSIONS FROM PACKAGE PLANTS

Method: WW.8: N_20 Process Emissions from Wastewater Treatment Plants without nitrification or denitrification, *U.S. Community Protocol*

$$Annual\ N_2O\ emissions = (P \times F_{ind-com}) \times Ef \times 10^{-6}$$

$$Annual\ CO_2e\ emissions = Annual\ N_2O\ Emissions \times GWP_{N_2O}$$

Term	Definition	Value	Source
Annual N_2O emissions	Total annual N_2O emitted by package plants (mt N_2O)	Result	First equation above
P	Population served by package plants	234	MSD, Terri Gaston
$F_{ind-com}$	Factor for insignificant industrial or commercial discharge	1	Default value
Ef	Emissions factor for package plant (g N2O/person equivalent/year)	3.2	WW.8
10^{-6}	Conversion factor (mt/g)	10^{-6}	WW.8
Annual CO_2e emissions	Total annual N_2O emitted by package plants in mt CO_2e	Result	Second Equation Above
GHP_{N2O}	Global Warming Potential of N_20	21	Appendix Given

Results of Method WW.11 (alt)	
Annual N_2O Emissions from Package Plants	0.00075 mt N_2O
Annual CO_2e Emissions from Package Plants	0.23 mt CO_2e

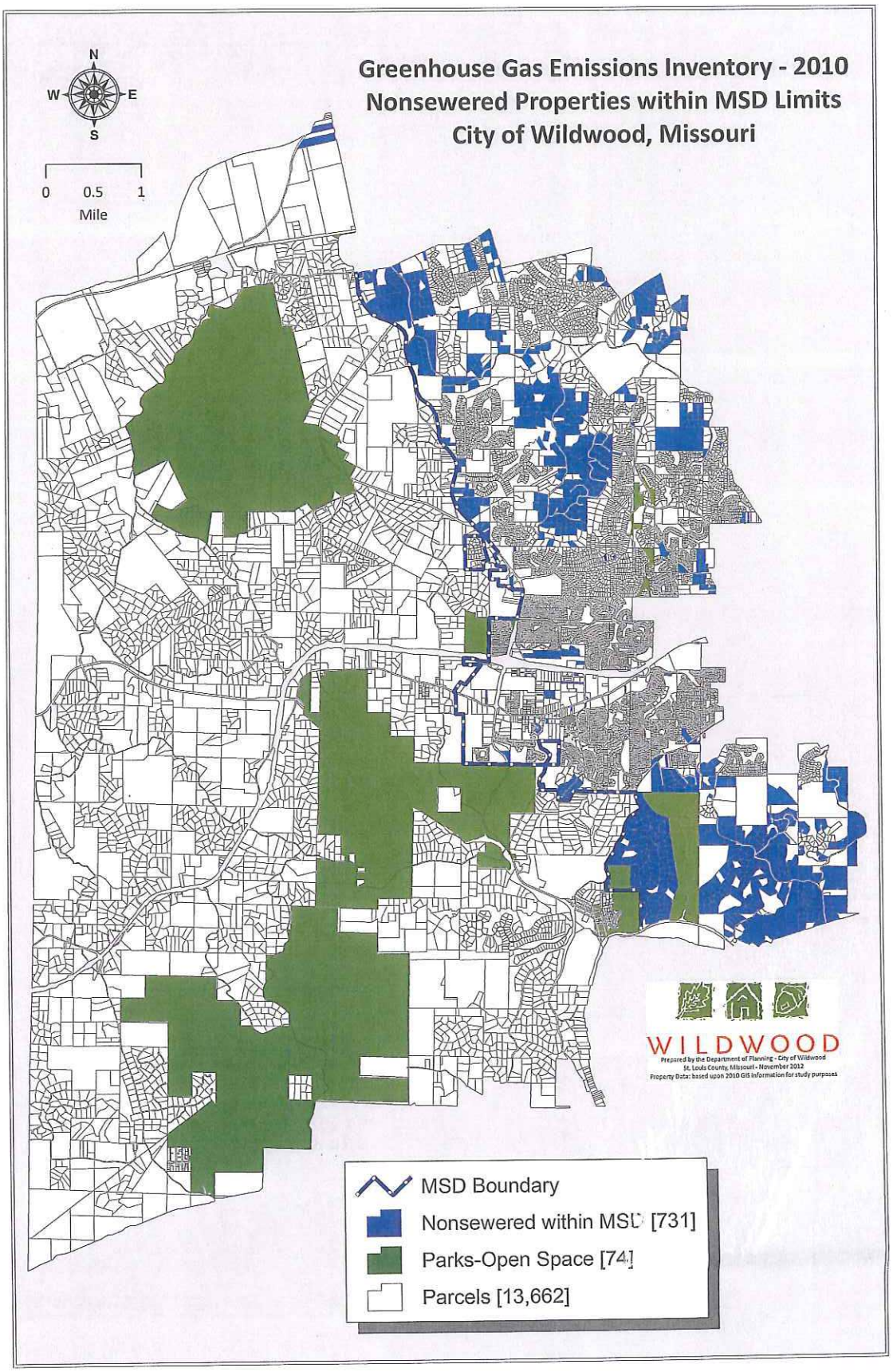

FIGURE C 1: NON-SEWERED PROPERTIES WITHIN MSD LIMITS

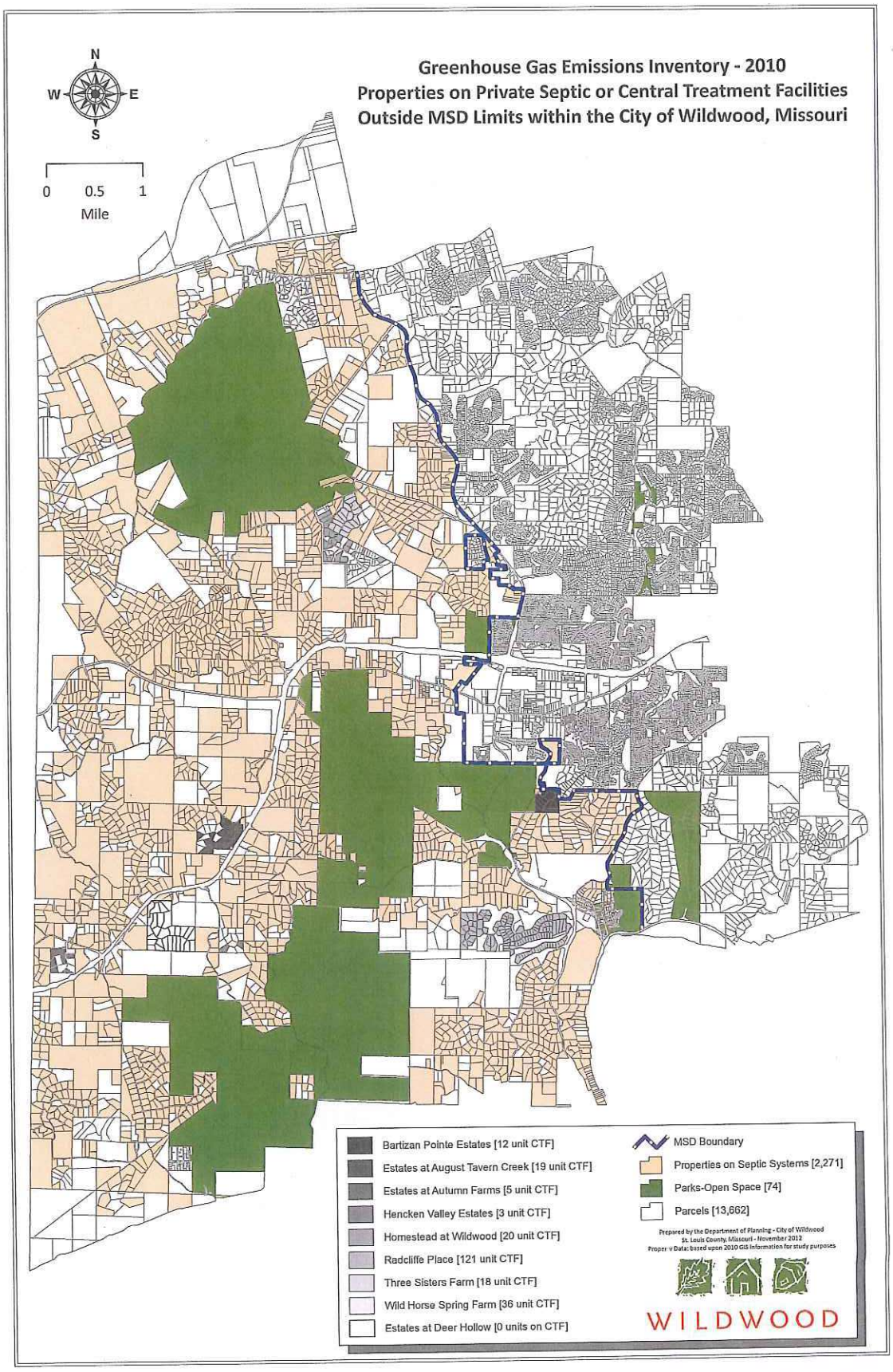

FIGURE C 2: PROPERTIES ON SEPTIC SYSTEMS OR CENTRAL TREATMENT FACILITIES (PACKAGE PLANTS) OUTSIDE MSD LIMITS WITHIN THE CITY OF WILDWOOD, MO

Water Consumption

Table C. 21: Population Served by Missouri American Water, 2010

Data source: Missouri American Water	
Number of water accounts in the City of Wildwood, 2010	8,754
Estimated Population served by Missouri American Water, 2010 (estimated using average population per residence, 2.94[30])	25,737
Water Consumption	
Average water consumption per person (gallons/day) provided by Missouri American Water	90
Average annual water consumption per person (gallons/year)	32,850
Estimated Water Consumed per day, City of Wildwood (gallons/day) Missouri American Water accounts only	2,316,308
Estimated Water Consumed, 2010, City of Wildwood (gallons/year) Missouri American Water accounts only	845,452,566

Table C. 22: Energy Use from Water Conveyance, Treatment, and Distribution

Method: WW.14.1: Total Energy-Related Emissions as a Result of Water Consumption, *U.S. Community Protocol*

Step One

$$Energy\ Use_{CT,D} = P \times Per\ Capita\ Use \times Ei_{CT}$$

Term	Definition	Value	Source
P	Population served by Missouri American Water	25,737	Missouri American Water
Per Capita Use	Estimated annual per capita water usage, 2010, million gallons	.03285	Missouri American Water
Ei_{CT}	Energy intensity of process of conveying water from source to treatment facility and treating the water (MWh/MG)	2.08	Missouri American Water
Ei_{D}	Energy intensity of process of distributing water from treament to consumer (MWh/MG)	.275	Missouri American Water

Results, Step One	
Energy Use_{CT} (MWh)	1758.54
Energy Use_{D} (MWh)	232.50

Table C. 23: Total Annual Emissions from Water Conveyance, Treatment, and Distribution

Method: WW.14.1: Total Energy-Related Emissions as a Result of Water Consumption, *U.S. Community Protocol*

Step Two

[30] US Census Bureau, *Profile of General Population and Housing Characteristics: 2010, City of Wildwood, Missouri* (Washington, DC, 2010).

$$Emissions_{CT} = \sum_{GHG} (Energy\ Use_{CT,D} \times Ef_{GHG})$$

Emissions by Greenhouse Gas

GHG	Emissions Factor, Ef_{GHG} (lb/MWh)	Global Warming Potential (GWP)	Annual Emissions, Conveyance and Treatment (metric tons of GHG)	Annual Emissions, Conveyance and Treatment (metric tons of CO_2e)	Annual Emissions, Distribution (metric tons of GHG)	Annual Emissions, Distribution (metric tons of CO_2e)	Total Annual Emissions (mt CO_2e)
CO_2	1002.41	1	799.59	799.59	105.72	105.72	905.31
CH_4	0.01945	21	0.02	0.33	0.002	0.04	0.37
N_2O	0.01065	310	0.0085	2.63	0.0011	0.35	2.98
			Total Emissions (mt CO_2e)	802.55		106.11	908.66

Solid Waste

Table C. 24:

Method: SW.4.1 Methane Emissions from Solid Waste, *U.S. Community Protocol*

$$CH_4\ Emissions = (1 - CE) \times (1 - OX) \times M \times EF$$

Term	Definition	Value	Source
CE	Default LFG Collection Efficiency	0.75	SW.4.1
OX	Oxidation Rate	0.10	SW.4.1
M	Total mass of waste entering landfill (wet short ton)	10,218.25	Meridian Waste Services
Efi	Emission factor for material entering landfill (mt CH_4/wet short ton)	0.06	Table SW.5

Note: No waste characterization data was available for the City of Wildwood, so the emissions factor for mixed municipal solid waste (mixed MSW) was used to estimate emissions from trash.

Results: SW.4.1	
CH_4 Emissions from Solid Waste (mt CH_4)	137.9
CH_4 Emissions from Solid Waste (mt CO_2e)	2895.9

Appendix D: Local Government Inventory Calculation Details

The Clean Air and Climate Protection (CACP) 2009 Software is an emissions management tool that creates emissions inventories, projects future emissions levels, and quantifies the effect of current and future emissions reduction measures. The CACP tool, co – developed with STAPPA/ALAPCO, the national association of air pollution control officers, is widely used by local governments throughout the United States. All GHG emissions calculations for the local government inventory were completed by the CACP tool. The tables below contain the data input into the CACP tool and the resulting emissions.

Table D. 1: Local Government Emissions CACP Inputs and Outputs

Buildings and Facilities	Usage	CO_2 output (mt CO_2)	N_2O Output (mt N_2O)	CH_4 Output (mt CH_4)	Total Emissions (mt CO_2e)
New City Hall Electricity	266,830 kWh	121.52	0.00	0.00	122.00
New City Hall Natural Gas	1,447 therms	7.67	0.00	0.00	7.69
Police Precinct	89,538 kWh	40.78	0.00	0.00	40.94
Old Pond School Park	31,357 kWh	14.28	0.00	0.00	14.34
Anniversary Park	4,767 kWh	2.17	0.00	0.00	2.18
Streetlights and Traffic Signals					
Traffic Signals/Controllers	26,833 kWh	12.22	0.00	0.00	12.27
Streetlights	45,348 kWh	20.65	0.00	0.00	20.73
Park Lighting	2,756 kWh	1.26	0.00	0.00	1.26
Water Delivery Facilities					
Sprinklers/Irrigation Control	29,957 kWh	13.64	0.00	0.00	13.70

Note: N_2O and CH_4 emissions existed, but these values were too small to appear here. They do have an effect on total emissions.

Table D. 2: Local Government Emissions: Vehicle Fleet CACP Inputs and Outputs

Vehicle Fleet					
The CACP tool allows users to calculate emissions based on fuel use or vehicle mileage. Fuel use data provides more accurate results, and was used when data was available.					
City Government Fleet	Usage	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Gasoline	3,114 gallons of E10	27.35	0.00	0.00	27.48
Ethanol		2.02	0.00	0.00	0.10
Contracted Services					
Street and Right-of-way Maintenance	Miles Traveled	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Gasoline	30,414 miles	18.25	0.00	0.00	18.66
Ethanol		0.50	0.00	0.00	0.03
Snow and Ice Removal	Miles Traveled	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Light Duty Trucks Gasoline	2,220 miles	1.33	0.00	0.00	1.36
Light Duty Trucks Ethanol		0.04	0.00	0.00	0.00
Heavy Duty Trucks Diesel	2,220 miles	3.64	0.00	0.00	3.64
Police Department	Miles Traveled	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Gasoline	478,240 miles	260.14	0.00	0.00	260.22
Ethanol		18.9	0.003	0.003	1.10
Waste Hauling	Fuel Consumed	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Diesel	72,576 gallons	741.00	0.002	0.002	741.71
Employee Commute	Miles Traveled	mt CO_2	N_2O Output	CH_4 Output	mt CO_2e
Gasoline	118,496 miles	50.93	0.003	0.003	52.03
Ethanol		48.02	0.003	0.000	48.14

Appendix E: Labadie Power Plant

Labadie Power Plant is just outside the boundaries of the City of Wildwood in Franklin County, Missouri, so its emissions are not included in the City of Wildwood's local government and community inventories. Labadie is a large source of emissions in both Missouri and the United States, and it is the source of all the purchased electricity consumed within the City of Wildwood.

Labadie meets the EPA's Mandatory Reporting Rule (MRR); electricity generation facilities must disclose and report process emissions data if operating over a threshold of 25,000 mt CO_2e per year. According to MRR data, in 2010 Labadie created 17,354,002.7 mt CO_2e, making it the seventh largest facility reporting to the EPA. Comparatively, the Wildwood community created 284,267 mt CO2e in 2010, approximately 1.6% of the total emissions from Labadie.