

Welcome to the
Town of Germantown
SETTLED 1710

2021 GOVERNMENT OPERATIONS GREENHOUSE GAS INVENTORY

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Town of Germantown, NY

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Introduction

In January of 2021, the Town of Germantown appointed a dozen residents to the Climate Smart Communities Task Force. The Climate Smart Communities (CSC) program encourages local governments around New York State to commit to completing and documenting a suite of actions that mitigate and adapt to climate change at the local level – that means right here in Germantown.

The Government Operations Greenhouse Gas (GHG) Inventory is one of the CSC priority actions. This inventory is an accounting, analysis, and report of the GHG emissions resulting from the day-to-day operations of a Town. It summarizes the GHG emissions from the consumption of energy and materials in government buildings, wastewater and water treatment facilities, municipal vehicle fleets, government-owned outdoor lighting, and other sources.¹ Not included are emissions from the community at large, as we will be separately evaluating those as part of the Community GHG Inventory².

GHG inventory reports identify the largest energy users and sources of GHG emissions (e.g., by building, sector, or department). As a result, GHG inventories help local governments select actions that offer a good return on investment and should be highlighted in subsequent climate action planning.³ The inventory further will serve as a baseline against which we can measure our progress in reducing energy use and GHG emissions of Town government operations.

In other words, while this report primarily looks at GHG emissions, it simultaneously looks at energy uses as the primary driver for GHG emissions in our Town. Taking inventory of the Town's energy use allows us to see where there is room for improvement, think about ways to operate less wastefully, and in turn, reduce the Town's GHG emissions AND make government operations less costly.

The available energy data covers 2016 – 2020, with the calendar year 2016 being the oldest available data set. 2016 thus will serve as the baseline year for the Government Operations GHG Inventory. We report GHG emissions in this inventory in units of metric tons of carbon dioxide equivalent (metric tons CO₂e). This equivalent represents emissions of carbon dioxide as well as other Greenhouse Gases, such as methane and nitrous oxide, normalized for their Global Warming Potentials (GWPs). The exact methodology used, including data collection, sources, and processing, and other assumptions, are described in the section labeled "Inventory Methodology".

The goal is to update this report on an annual basis to track improvements or changes to the way the Town operates.

¹ Climate Smart Communities Website: <https://climatesmart.ny.gov/actions-certification/actions/#open/action/6>

² The Community GHG inventory will be covered separately and is not part of this report.

³ Climate Smart Communities Website: <https://climatesmart.ny.gov/actions-certification/actions/#open/action/6>

Government Operations Greenhouse Gas Emissions Inventory

The Town of Germantown's local government greenhouse gas (GHG) inventory identifies emissions associated with Town buildings and operations. The inventory follows the accounting and reporting methodologies outlined in the Local Government Operations Protocol (LGOP, ICLEI 2010). It includes the Town's GHG emissions from three "scopes" (Scope 1 – 3)⁴ and assesses emission of all six internationally recognized greenhouse gases – carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Scope 1: Direct GHG emissions from government operation like town vehicle fuel combustion and from combustion of natural gas, propane, and heating oil in Town buildings.

Scope 2: Indirect GHG emissions associated with the consumption of purchased electricity.

Scope 3: Indirect emissions not covered in Scope 2, such as from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not controlled by the Town (e.g., employee commuting and business travel), waste disposal, etc.

As recommended in the LGOP, this inventory includes all Scope 1 and Scope 2 GHG emissions, as well as Scope 3 emissions that fall within Germantown's operational control.⁵ Included are buildings, vehicles, streetlights, and wastewater treatment. We further are including the GHG emissions from employee commute as Scope 3 emissions in this report.

The following sectors⁶ categorize the break-down of the emissions in a way that is relevant to the Town's budget, operations, and policy opportunities:

- Buildings and other facilities
- Wastewater Facilities
- Streetlights and traffic signals
- Vehicle Fleet

The Town does not operate Water Delivery Systems or Solid Waste Facilities.

The Town's government operations were responsible for the emission of 179.7 metric tons of carbon dioxide equivalent (CO₂e) in 2016 (see **Table 1**), equivalent to the amount of carbon sequestered annually by 220 acres of U.S. forest.⁷ This amount of forest would take up an area of 2.84% of the Town of Germantown's land area⁸.

⁴ as defined by the WRI/WBCSD GHG Protocol Corporate Standard. (ICLEI, 2010)

⁵ "A local government has operational control over an operation if the local government has the full authority to introduce and implement its operating policies at the operation." (ICLEI, 2010)

⁶ As established in chapter 4.2 of the LGOP (ICLEI, 2010)

⁷ EPA GHG Equivalency Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

⁸ Total area of the Town of Germantown is 13.9 square miles, 12.1 square miles (7,744 acres) of those being land.

As government operations in 2020 were impacted by the COVID-19 pandemic, the significant reduction in related emissions seems plausible. But what happened in 2018?

Total GHG emissions in metric tons CO ₂ e						
Scopes	2016	2017	2018	2019	2020	Average
Scope 1	141.6	137.1	170.0	138.6	112.4	139.9
Scope 2	20.1	19.9	18.8	15.5	17.8	18.4
Scope 3	18.0	17.7	17.6	17.9	15.9	17.4
Total	179.7	174.7	206.4	171.9	146.2	175.8

Table 1 Town Government GHG Emissions by Scope from 2016 - 2020.

If we look at the same data, grouped by government sector instead of scope, we can see the following (**Table 2**): The Buildings and Other Facilities and Vehicle Fleet sectors are commonly the largest sources of GHG emissions in local government operations. After that follow Wastewater Facilities and Employee Commute. LED Streetlights make up about 1%.

Total GHG emissions in metric tons CO ₂ e							
Sector	2016	2017	2018	2019	2020	Average	
Buildings and other facilities	57.8	57.7	53.3	55.1	52.2	55.2	
Employee Commute	18.0	17.7	17.6	17.9	15.9	17.4	
Streetlights and traffic signals	2.4	2.6	2.6	2.4	1.0	2.2	
Vehicle Fleet	84.3	82.3	119.9	86.9	65.4	87.8	
Wastewater Facilities	17.1	14.4	13.0	9.7	11.6	13.2	
Total	179.7	174.7	206.4	171.9	146.2	175.8	

Table 2 Town Government GHG Emissions by Sector from 2016 - 2020.

Table 2 shows the same trend over all sectors: stagnating or slightly declining GHG emissions, except for emissions from the Vehicle Fleet, which spike by 46% in 2018. The reduced emissions from the Wastewater Facilities in 2019 result from the system breaking down and needing replacement during 2019-2020. The significant reduction in emissions from Streetlights resulted from the Town switching them to LED in late 2019. **Figure 1** demonstrates those relations visually.

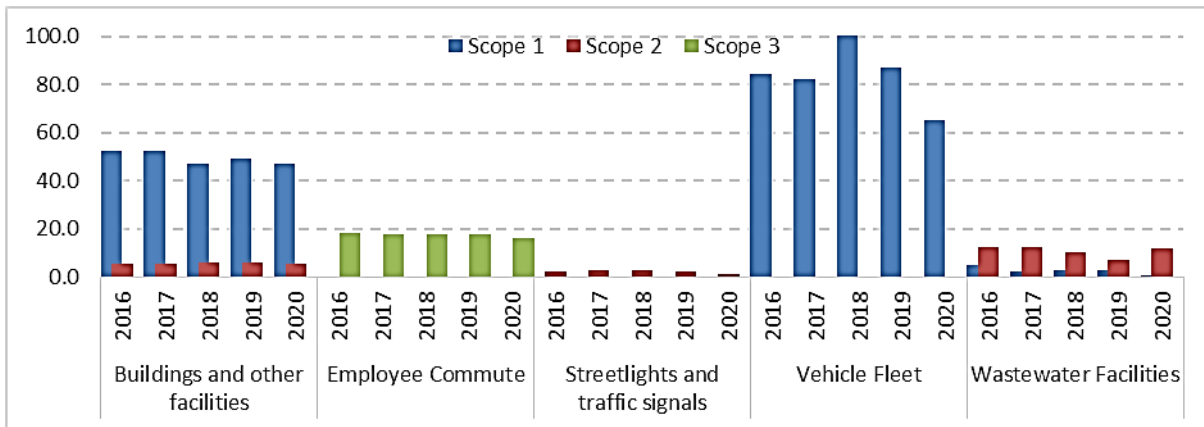


Figure 1 Breakdown of all local government emissions by sector 2016 - 2020.

Scope 1 Emissions – Direct Emissions

The largest source of GHG emissions in 2016, comprising about 79% of all governmental GHG emissions, are Scope 1 Emissions. Scope 1 emissions are direct GHG emissions from government operation like town vehicle fuel combustion and from combustion of natural gas, propane, and heating oil in Town buildings. The fuel types the Town uses are Heating Oil, Gasoline, Diesel and Propane.

Scope 1 GHG Emissions in metric tons CO ₂ e						
Fuel Type	2016	2017	2018	2019	2020	Average
3 Ultra Clean Heating Oil	3.8		4.1	4.0	5.1	4.2
7 Regular Unleaded Gasoline	30.7	27.9	35.7	26.7	25.7	29.4
8 Blnd Ultra Low Sulfur Diesel	53.6	54.4	84.2	60.3	39.7	58.4
Propane	53.5	54.8	45.9	47.7	41.9	48.8
Total	141.6	137.1	170.0	138.6	112.4	139.9

Table 3 Scope 1 Town Government GHG Emissions from 2016 - 2020.

Fuel combustion in Town buildings (Propane & Heating Oil)

Except for the historic Parsonage, the Town converted all buildings from oil to propane. The buildings primarily use propane for heating purposes with clear billing patterns around the winter months. The only building with electric heat is the Wastewater Treatment Plant (WWT Plant), where the propane usage is associated with the operation of a backup generator.

Scope 1 GHG Emissions in metric tons CO ₂ e in Town buildings						
Building	2016	2017	2018	2019	2020	Average
3 Ultra Clean Heating Oil	3.8		4.1	4.0	5.1	4.2
Parsonage	3.8		4.1	4.0	5.1	4.2
Propane	53.5	54.8	45.9	47.7	41.9	48.8
Department of Public Works	26.6	31.7	24.2	25.2	25.4	26.6
Kellner Activity Building	10.9	9.8	11.2	9.9	7.0	9.8
Town Hall	11.4	10.9	7.6	9.9	9.5	9.9
WWT Plant	4.6	2.3	3.0	2.6	0.1	2.5
Total	57.3	54.8	50.1	51.6	47.0	260.7

Table 4 Scope 1 emissions from fuel combustion in Town buildings from 2016 - 2020.

A reduced heating demand resulting from the Covid-19 pandemic can be interpreted into the reduced propane usage in the Kellner Activity Building and the Town Hall in 2020. The Department of Public Works seems not to have been impacted.

Fuel combustion in Town vehicles (Gasoline & Diesel)

The largest share of Scope 1 emissions is generated by Town vehicles, comprising of over 60% of all Scope 1 emissions. Two thirds of those emissions originate from burning Diesel (see **Table 5**). With over 8,500 gallons of fuel annually, the fuel consumption has remained relatively constant (see **Table 6**), with the exception of 2018.

Scope 1 GHG Emissions in metric tons CO ₂ e in Town Vehicles						
Fuel Type	2016	2017	2018	2019	2020	Average
7 Regular Unleaded Gasoline	30.7	27.9	35.7	26.7	25.7	29.4
8 Blnd Ultra Low Sulfur Diesel	53.6	54.4	84.2	60.3	39.7	58.4
Total	84.3	82.3	119.9	86.9	65.4	87.8

Table 5 Scope 1 emissions from fuel combustion in Town vehicles from 2016 - 2020.

Fuel Consumption of Town Vehicles in Gallons						
Fuel Type	2016	2017	2018	2019	2020	Average
7 Regular Unleaded Gasoline	3,500	3,182	4,064	3,038	2,931	3,343
8 Blnd Ultra Low Sulfur Diesel	5,248	5,324	8,249	5,903	3,890	5,722
Total	8,748	8,507	12,313	8,941	6,821	9,066

Table 6 Fuel consumption of Town vehicles from 2016 - 2020.

Direct Emissions from Wastewater Treatment

While wastewater treatment processes potentially are the source of CH₄ and N₂O emissions, the Town's wastewater treatment emissions are assumed to be zero, beyond the emissions associated with electricity (assessed below) and propane use (assessed above).

We are able to make this assumption because our local WWTP uses an aerobic treatment process, which the US EPA inventory methodology and the LGOP (ICLEI, 2010) assume to emit a negligible amount of CH₄ if they comply with current regulation. Process N₂O emissions are also assumed to be negligible for the Town's small WWTP. The Department of Environmental Conservation (NYSDEC) doesn't require our WWTP to monitor ammonia, which means there is no data history available to calculate those emissions. There may be some negligible N₂O emissions, but if it were to a significant degree, respective monitoring would likely be required by the regulating agency, the NYSDEC. Process N₂O emissions are hence also assumed to be zero.

Scope 2 Emissions – Indirect Emissions from Electricity Use

Scope 2 emissions are indirect emissions from electricity use in Town buildings, for streetlights, and in the wastewater facilities. Except for the year 2019, which was directly affected by the changes to the wastewater treatment plant, Scope 2 emissions have been on a constant decline since 2016 (see **Table 7**).

Scope 2 GHG Emissions in metric tons CO ₂ e						
Fuel Type / Sector	2016	2017	2018	2019	2020	Average
Electricity	20.12	19.90	18.78	15.45	17.84	18.42
Buildings and other facilities	5.21	5.18	6.17	6.06	5.30	5.58
Streetlights and traffic signals	2.42	2.62	2.63	2.36	0.96	2.20
Wastewater Facilities	12.49	12.10	9.99	7.02	11.57	9.30
Total	20.12	19.90	18.78	15.45	17.84	18.42

Table 7 Scope 2 emissions, 2016 - 2020.

The origins of those energy savings become more apparent when looking at the electricity use per

property (see **Table 8**). This table also shows the three structural changes to Town's operational patterns:

1. Installation of the EV charging station in late 2019;
2. Switch to LED streetlights in late 2019; and
3. The changes to the wastewater treatment plant in 2019 and the start of operation of the new plant in 2020.

Electricity use per Sector and Property in kWh						
Sector and Property	2016	2017	2018	2019	2020	Average
Buildings and other facilities						
Ball Field	543	426	412	1,963	0	669
Charging Station				135	3,255	1,695
Department of Public Works	11,698	12,838	13,276	13,306	13,835	12,991
Kellner Activity Building	10,095	11,107	17,203	12,450	10,569	12,285
Lake George S. Beach	1,651	2,190	1,863	1,881	894	1,696
Lasher Park	2,081	2,234	2,910	6,237	3,659	3,424
Parsonage	2,875	2,353	2,708	3,373	1,968	2,655
Town Hall	16,264	13,871	15,173	13,279	11,878	14,093
Streetlights and traffic signals						
George Sharpe SUPV	18,881	20,644	20,828	18,417	6,239	17,002
Lighting SVC	2,119	2,119	2,013	2,119	2,119	2,098
Wastewater Facilities						
WWTP Pump1	46,063	49,480	28,724	14,499	11,871	30,127
WWTP Pump2	20,998	21,125	26,193	11,068	20,184	19,914
WWTP Plant	41,435	34,432	31,798	35,433	68,427	42,305
Total	174,704	172,819	163,101	134,160	154,898	159,936

Table 8 Electricity use 2016 - 2020.

Beyond those three changes, **Table 8** offers multiple openings for further investigation into the reasons for changes in energy consumption. Those might indicate opportunities for future energy savings:

- Why did the Ball Field use five times the energy in 2019?
- Why did the DPW steadily increased its energy use since 2016?
- Why do the Parsonage's and Town Hall's annual energy use vary by 10 – 20% between 2016 to 2018?
- Why did the energy use in the Kellner Activity Building rise by 70% in 2018? And is the impact of the COVID-19 pandemic not visible in the 2020 energy use?
- Why did Lasher Park use 100% more energy in 2019?

Rooftop Solar at Kellner Activity Building

The Town owns and operates a **rooftop solar system** on top of the pavilion of the activity building. The generation from the system is directly netted with the use at Kellner Activity Building meter. The electricity

use as displayed for that meter hence is net consumption, with the solar generation already deducted from the use. Solar export is not separately metered, and there are no monthly generation records. As of March 25, 2021, the solar system’s total lifetime generation was 131,795 kWh. The following are the system parameters:

Nameplate Capacity	15.12 kW
Estimated Annual Energy Output	17,325 kWh
Date of Installation	Sept. 2010
Total Energy Output To Date	131,795 kWh
Average Actual Annual Energy Output	~13,180 kWh

Table 9 Kellner Activity Building Solar System Parameters

The average actual energy output is significantly lower than the estimated annual energy output which could indicate the system is not operating as it should. A combination of two factors⁹ might explain the difference – at least partially:

1. Because of an issue with the inverter, the inverter was off for about one summer, and
2. Normal degradation of the solar panels over the past 10 years.

We recommend further investigation into this matter.

Scope 3 Emissions – Employee Commute

Scope 3 emissions are indirect emissions not covered in Scope 2, such as from the extraction and production of purchased materials and fuels, waste disposal, or, like in this case, transport-related activities in vehicles not controlled by the Town, i.e., employee commuting. In larger communities, these emissions are estimated based on an annual employee survey, asking about distance, mode of transportation, and commute frequency. Most of this information naturally ends up on the administrative assistant’s desk in a town of our size.

Based on the number of employees, their number of workdays a year, and their commute, we estimated the emissions related to employee commute for the past five years. **Table 10** shows those emissions and displays that even though the vast majority of Town employees live within a 5-mile radius of their workplace, their collective emissions from driving that distance twice a day almost reach the emissions associated with the electricity use in all the Town’s buildings. In 2019, Scope 3 emissions even exceed the Scope 2 emissions.

Scope 2 GHG Emissions in metric tons CO ₂ e						
Sector	2016	2017	2018	2019	2020	Average
Employee Commute	18.02	17.70	17.61	17.86	15.94	17.42
Total	18.02	17.70	17.61	17.86	15.94	17.42

Table 10 Scope 3 emissions, 2016 - 2020.

The emissions in 2020 declined because the number of full-time employees shrunk from six to four in that year.

⁹ Based on an email inquiry with Steven Mammoser from Sundog Solar, a Chatham based solar company.

Inventory Methodology

This Methodology section supplements the Town of Germantown 2021 Government Operations Greenhouse Gas Inventory. In this section, we will describe the process, data sources, and assumptions utilized in the inventory process. It will hopefully answer more detailed questions about the data and provide the guidance necessary for the Town to update the inventory in later years. The inventory methodology follows the Local Government Operations Protocol (ICLEI, 2010).

Defining GHG Emissions, Sources, and Sectors

The Government Inventory accounts for GHG emissions from Town government facilities and operations according to the organizational and operational boundaries outlined in the LGOP.¹⁰ Per the LGOP, this inventory assessed emissions of the following GHGs:¹¹

- Carbon Dioxide (CO₂)
- Methane (CH₄)
- Nitrous Oxide (N₂O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur Hexafluoride (SF₆)

The LGOP stipulates that local governments should calculate the above GHG emissions from all Scope 1 and Scope 2 emissions sources that fall within their operational control,¹² and encourages municipalities to report as many Scope 3 emissions sources as possible. GHG sources are those activities that directly or indirectly result in the emissions of GHGs. Examples include: energy consumption in buildings, fuel consumption in vehicles, methane emissions from landfills, and fugitive emissions from leaking refrigerants.

The LGOP also defines sectors under which these GHG emissions should be reported, as described in **Table 12**. The sectors refer to various property or activity types within local government operations where the sources for GHG emissions are likely to exist and provide a useful framework for organizing and reporting GHG information within sector designations that are familiar to local governments.

¹⁰ See Chapters 3 and 4 of the LGOP (ICLEI, 2010) for defining operational and organizational boundaries.

¹¹ PFCs and SF₆ were not found to be emitted from Town of Germantown government operations. PFCs are sometimes used in refrigeration, air-conditioning, and fire-suppression equipment. SF₆ emissions are relevant for municipalities that own transmission and distribution lines for electricity, which the Town of Germantown did not operate in 2018.

¹² *Operational control* is defined as having the authority to introduce and implement operating policies and procedures at an operation. For more information on determining operational control, see Chapter 3 of the LGOP (ICLEI, 2010).

Scope 1	All direct GHG emissions (with the exception of direct CO ₂ emissions from biogenic sources ¹³)
Scope 2	Indirect emissions associated with the consumption of purchased or acquired electricity, steam, or heat
Scope 3	All other indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the Town, outsourced activities, waste disposal in facilities not operated by the Town, etc.

Table 11 Definitions of GHG Emissions Scopes.

Buildings and Other Facilities	GHG emissions from stationary energy use and emissions from leaking refrigerants and fire suppressants in all government operated buildings and facilities that do not fit into any other sector below.
Streetlights and Outdoor Lighting	GHG emissions from electricity used by streetlights and traffic signals, including pedestrian signals, flashers, etc.
Vehicle Fleet / Transit Fleet	GHG emissions from energy use and from leaking refrigerants in mobile equipment and vehicles used in the Town’s vehicle fleet and transit fleet.
Wastewater Facilities	GHG emissions from stationary energy use and from leaking refrigerants and fire suppressants from facilities used to treat or transport wastewater or sewage. This also includes non-energy related emissions from the processes used to treat wastewater in treatment plants and septic systems.
Optional Scope 3 GHG Emissions	Optional reporting under LGOP. Common scope 3 emissions sources include energy use from employee vehicles commuting to work and from government-generated solid waste disposed of in non-Town-owned facilities.

Table 12 LGOP Sector Definitions.

To determine the GHG emissions in this report, we followed the same general process, comprised of four steps:

- 1. Data collection.** Activity data necessary to calculate GHG emissions were collected from the appropriate individuals or departments in the Town of Germantown.
- 2. Data processing.** Data were often provided in a format that required reformatting or supplemental calculations prior to use in calculating GHG emissions.
- 3. Account mapping (stationary energy use only).** In the account mapping phase, utility and other fuel provider account numbers were matched to the actual buildings, facilities, departments, or lighting fixtures that used the energy.
- 4. GHG Calculations.** Once activity data were in a usable format, GHG emissions were calculated based on the appropriate emissions factors and formulas from the LGOP.

The following describes the four steps for the determination of the GHG emissions in this report.

¹³ Biogenic CO₂ emissions come from sources that recently contained living organic matter. These emissions are reported as information items only, and do not count towards the Town’s overall GHG emissions total. In theory, the CO₂ emitted by these sources would have occurred naturally if the material were to decay under natural conditions. However, any CH₄ and N₂O emissions from biogenic sources are assumed not to have occurred under natural conditions and do count towards the Town’s overall GHG emissions total.

Data Collection and Processing

	EMISSIONS SOURCE	DATA SOURCE	NOTES
SCOPE 1 EMISSIONS	Heating Oil	2016 – 2020 Heating Oil bills from Town of Germantown, NY archive – physical paper bills.	Data assumed to be complete.
	Propane	2016 – 2020 Propane bills from Town of Germantown, NY archive – physical paper bills.	Data assumed to be complete.
	Gasoline	2016 – 2020 Gasoline bills from Town of Germantown, NY archive – physical paper bills.	Data assumed to be complete.
	Diesel	2016 – 2020 Diesel bills from Town of Germantown, NY archive – physical paper bills.	Data assumed to be complete.
SCOPE 2 EMISSIONS	Purchased Electricity	2016 – 2020 Electric bills from Town of Germantown, NY archive – physical paper bills and digital inquiries with utility.	Data assumed to be complete, except street lighting (see Table 14).
SCOPE 3 EMISSIONS	Employee Commute	Town Administrative Assistant.	Data was summarized and averaged. Future inventories should include employee questionnaires for more detail.

Table 13 GHG Inventory Data Sources.

The Town provided access to the data archive, comprising all paper bills of the last five years. We obtained raw electric data from National Grid, raw propane data from multiple vendors, and heating oil data via hardcopy invoice for the Town of Germantown. We summed up the total consumption for calendar years 2016 – 2020 per account, per year, per fuel type, and then aggregated the data by the LGOP sectors.

Electricity

Most electric bills contain the energy use data for the current month and all 12 previous months, which made collecting the raw electricity data from hardcopy invoices significantly easier. Unfortunately, this was not the case for the two street lighting accounts, which only display the billing amount for the current billing period. So while all other electric accounts consist of complete data sets with every month of the five-year billing period accounted for, the street lighting account data – for the accounts named “George Sharpe SUPV” and “Lighting SVC” – contains significant gaps (see **Table 14**).

As street lighting energy consumption directly correlates to the number of night-time hours and the season/month, we made the following assumptions to complete the dataset to receive a realistic annual energy use total for each year between 2016 and 2020.

George Sharpe SUPV

- 2018 is the year with an almost-complete data set / the least gaps;
- We assumed that gaps in between two months with data follow the linear trend of the neighboring months, like Oct '17, Feb '18, Aug and Nov '19;
- Due to the general similarity between the available data from 2018 and 2017, we assumed Jan – Apr '17 to be identical to Jan – Apr '18;

- We assumed that 2016 followed the trend of 2017 with overall consumption levels 8.5% lower, represented by the relative difference of Nov '16 and Nov '17 (1,886 kWh / 2,062 kWh). The unproven theory behind this is that the Town might have installed additional street lights at the end of 2016 to explain the increased usage starting in 2017;
- In December 2019, replacing the old street lights with LED street lights was completed, reducing the overall energy consumption by about 70%. Hence, we assumed the consumption in 2020 to follow the 2018 trend, but reduced by 70%.

Lighting SVC

- As Dec '18 and Dec '19 are identical, it has been assumed that the same lights were operating during both years and that thus all months should be identical;
- June is the only month with data in more than one year, but Jun '18 seems unrealistically low. To explain the 22 kWh, a portion of the street lights under this account must have been out of order. We hence expect the Jun '19 value to be the operational value for June.
- The only months that don't have a single verified energy consumption are Jan, May, Jul, Aug, and Oct:
 - We assume May and Oct follow the linear trend of the neighboring months;
 - We assume Jan, Jul, and Aug follow the 2018 trend of the George Sharpe SUPV account, proportionally to the 'Lighting SVC to George Sharpe SUPV' - September 2018 ratio (163 kWh/1,685 kWh)

Table 14 displays the complete street lighting data set, including the calculated values, based on the above assumptions.

Sum of kWh	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lighting SVC	1,110	1,030	920	895	768	534	568	712	815	938	1,060	1,140	10,489
2016	222	206	184	179	154	128	114	142	163	188	212	228	2,119
2017	222	206	184	179	154	128	114	142	163	188	212	228	2,119
2018	222	206	184	179	154	22	114	142	163	188	212	228	2,013
2019	222	206	184	179	154	128	114	142	163	188	212	228	2,119
2020	222	206	184	179	154	128	114	142	163	188	212	228	2,119
George Sharpe SUPV	9,810	8,654	7,788	7,101	5,810	5,160	5,184	6,009	6,669	7,505	7,875	7,443	85,008
2016	2,099	1,911	1,723	1,541	1,261	1,109	1,111	1,271	1,407	1,646	1,886	1,914	18,881
2017	2,295	2,090	1,884	1,685	1,379	1,213	1,215	1,390	1,538	1,800	2,062	2,093	20,644
2018	2,295	2,090	1,884	1,685	1,386	1,255	1,174	1,473	1,685	1,685	2,070	2,146	20,828
2019	2,431	1,936	1,731	1,683	1,367	1,205	1,331	1,432	1,533	1,867	1,256	645	18,417
2020	690	628	566	506	417	377	353	443	506	506	601	645	6,239

Table 14 Street lighting data; available (black) and calculated/assumed (red).

Propane and Heating Oil

While electricity bills are accounted for on a monthly basis, Scope 1 fuel sources are billed per fuel

delivery. Some months have multiple fuel bills, others have none. As there is no indication of missing fuel bills, completeness has been assumed.

Diesel and Gasoline

The vehicles and other fuel-powered equipment owned and operated by the Town are a source of Scope 1 emissions. All Town vehicles and equipment refuel via Town-operated gasoline and diesel fuel storage tanks. Therefore, the total annual fuel consumption is accurately accounted for in the same manner as propane and heating oil are: via the hardcopy bills from the Town's archive.

What is unknown is the exact distribution of the fuel consumption on a vehicle level. In addition, the exact size and composition of the vehicle fleet before 2021 are also unknown. Currently, the Town operates the following vehicles and equipment (excerpt from the fleet inventory):

- Ford F-350
- Ford F150
- 1-Ton Ford Dump Truck
- International 6-Wheel Dump Truck/Snowplow (being replaced)
- International 10 Wheel Dump/Snowplow
- Ford F250 Pick Up
- John Deere Gator
- 420F CAT Backhoe
- John Deere Tractor
- Bobcat Skidsteer
- Volvo Loader
- Mower
- Mower2

We accounted for the diesel and gasoline emissions on a total annual basis.

Wastewater

The Town of Germantown owns its wastewater treatment plant (WWTP) and operates it through a third-party operator. Section 10 of the LGOP describes four types of emissions related to the operation of wastewater treatment plants:

1. Stationary CH₄ emissions
2. Process CH₄ emissions
3. Fugitive CH₄ emissions, and
4. Process N₂O emissions

“Within the wastewater treatment systems owned and/or operated by local governments, CH₄ emissions can arise from septic systems, aerobic systems that are not well managed, anaerobic treatment and facultative treatment lagoons, and from anaerobic digesters when the captured biogas is not completely combusted.” (ICLEI, 2010) The Town of Germantown operates a rotating biological contactor, an aerobic process, to treat its wastewater. As the “regulatory system in the US ensures that wastewater treatment plants are routinely in compliance with their discharge requirements”, they need to be well-operated – an assumption in line with US EPA inventory methodology and the LGOP. (ICLEI, 2010). CH₄ emissions for well-managed (i.e., in-compliance) aerobic systems are negligible and the Town's WWTP falls under that category.

The remaining type of emissions, process N₂O emissions, are also assumed to be negligible for the Town’s small WWTP. Nitrous oxide would be the result of nitrification and denitrification (a process to treat for ammonia). The Department of Environmental Conservation (NYSDEC) doesn’t require the WWTP to monitor ammonia, so no data history is available. Some of it may be happening, but if it were to a significant degree, respective monitoring would likely be required by the regulating agency, the NYSDEC. Process N₂O emissions are hence assumed to be zero.

Though liquid sludge is trucked once a year to another facility in Albany County for further processing, the associated emissions fall outside of the Town’s operational boundaries. They will be counted at the receiving facility, to not double count emissions.

Beyond the emissions associated with electricity and propane use (assessed as for every other building in the respective sections), the wastewater treatment emissions are assumed to be zero.

As of 2021, based on data from the Town Administrative Assistant, the wastewater treatment plant serves:

Structure	Total Number
Houses	101
Businesses	48
2 or more family residences	16
Schools	1
Palatine Manor	1
Vacant Lots	17

Employee Commute

Based on reporting from the Town’s Administrative Assistant, Germantown employed six full-time employees in the years 2016 – 2019, and since 2020, only four full-time employees. In addition, the Town has employed 15 part-time employees, continuously since 2016. Of those employees, 90% commute less than five miles to their workplace, the other 10% less than 10 miles – on average 5.5 miles per commute. None walk or bike.

Full-time employees get 11 Holidays (No One works on these days, all offices are closed). Part-time employees work different days and only parts of the week (for example, only Mon.-Thur.). Time off is determined by how long an employee has worked for the Town. Most full-time employees receive two weeks of vacation time and one receives four weeks. Full-time employees earn one sick day per month and one personal day, based on full-time staff union stipulations. Additionally, they also receive up to 80 hours of compensatory time, where overtime is compensated with time off instead of additional pay. This information is the base for the assumptions made in the calculation below, used to estimate the annual fuel consumption and the annual GHG emissions from employee commute (see **Table 15**). Detailed data regarding individuals’ cars’ fuel efficiencies and the type of fuel used were unavailable.

Year	Working Days ^{a)} (Holidays incl.) [PSV days incl.]	Commutes per person ^{b)}	Employees commuting ^{c)}	Vehicle miles travelled ^{d)}	Annual Fuel consumption ^{e)}	Annual GHG emissions ^{f)}
2016	228 (10) [23]	456	18	45,144 miles	2,052 gallons	18.0 tons
2017	227 (10) [23]	454	18	44,946 miles	2,016 gallons	17.7 tons
2018	228 (10) [23]	456	18	45,144 miles	2,006 gallons	17.6 tons
2019	228 (10) [23]	456	18	45,144 miles	2,034 gallons	17.9 tons
2020	229 (9) [23]	458	16	40,304 miles	1,815 gallons	15.9 tons

- a) Working days: #days in a year – weekends – #holidays - #PSV (personal/sick/vacation) days. PSV days depend on how long an employee has worked for the Town, but most full-time employees receive two weeks of vacation, one sick day a month, and one personal day. The Town also offers compensatory time, which has been neglected here. The average number of PSV days has been assumed to be 23 for all employees.
- b) Commutes per Person per year: 2 x Working Days per year, assuming each working day prompts two commutes of the single-way distance.
- c) Employees commuting: #Full-time employees + 80% x Part-Time Employees, assuming part-time employees have shorter work weeks. The 80%-factor assumes a 4-day work week for part-time employees which is likely higher than the real average work week lengths. This over-estimation is balanced by the assumptions made under a) in relation to part-time employees' PSV days.
- d) Annual Vehicle miles travelled: #Commutes per person x #Employees commuting x 5.5 miles (average commute distance). The average commute distance is likely over-estimated, as the 5.5 miles average assumes 90% of the employees live exactly 5 miles from their workplace, instead of "less than 5 miles" from their workplace.
- e) Annual Fuel Consumption: #Vehicle miles travelled / Average annual fuel efficiency¹⁴.
- f) Annual GHG emissions: Annual Fuel Consumption x 8.78Kg CO₂e per gallon (Emissions Factor of Gasoline), assuming employees use gasoline operated cars.

Table 15 Calculation of Annual GHG emissions from Employee Commute 2016 - 2020.

Neglected Data

Beyond the before-mentioned sources of GHG emissions, the Town:

1. generates trash;
2. uses materials for the upkeep of roads, buildings, and other structures;
3. uses office materials for its administrative tasks;
4. receives services from sub-contractors;
5. has board and committee members, and other Town volunteers commute to and from government buildings; and
6. alters the landscape, i.e. disturbs soils and fells trees.

¹⁴ The Bureau of Transportation Statistics, Average Fuel Efficiency of U.S. Light Duty Vehicles per calendar year: 22.0 mpg (2016), 22.3 mpg (2017), 22.5 mpg (2018), 22.2 mpg (2019). Fuel efficiency for 2020 has been assumed to remain on the 2019 level.

There is no accounting and record-keeping system in place to adequately quantify the GHG emissions associated with the above activities. Due to a lack of data, we were not able to include those sources of GHG emissions in this inventory.

Account Mapping

Account mapping refers to the process of associating electric, fuel oil, and propane account numbers with specific Town facilities and properties. Town Supervisor, Administrative Assistant, and other Town staff were the primary resources for the mapping displayed in **Table 16** and used as the basis for the inventory.

Building	Address	Primary Use	Area (sq. ft.)	Electricity Use, 2016 (kWh)	Propane, 2016 (Gal)
Town Hall	50 Palatine Park Rd.	Admin / Office	3,200	16,264	2,015
Beach House	50 Palatine Park Rd.	Misc. / Historic Beach Shack	1,200	1,651	None
Kellner Activity Building	54 Palatine Park Rd.	Even Space	4,200	10,095	1,934
-> Pavilion		Event space / farmer's market	~3,000		None
-> Snack Bars		Snack bars during events	~950		None
-> Storage Sheds		Storage	~2,200		None
-> Maintenance Building		Storage	~6,500		None
Department of Public Works	65 Palatine Park Rd.	Office and machine shop space	6,000	11,698	4,698
-> Wash Shed		Machine Maintenance	~1,100		298
-> Salt Shed		Salt storage	~7,000		none
Ball Field	28 Palatine Park Rd.	Ball Field	0	543	none
Parsonage	52 Maple Avenue	Historic Building / Museum	2,313	2,875	365 (Heating Oil)
Sewer Plant and Pumps	9 Main Street, 250 Main Street	Wastewater Treatment Plant	~1,375	108,496	821
Lasher Park	Anchorage Rd.	Waterfront Park	0	2,081	none
EV Charging Station I	189 Main Street	EV Charger	0	(2019) 3,255	none

Table 16 Account Mapping and Building Inventory.

We plotted the location of the Town buildings in direct vicinity to Town Hall to help visualize the mapping (see **Figure 2**).



Figure 2 - Government Buildings on Palatine Park Rd.

GHG Emissions Calculation

GHG emissions, reported in metric tons of carbon dioxide equivalent (metric tons CO₂e), were calculated by individual facility, sector, and source.

We used the carbon dioxide, methane, and nitrous oxide emissions factors for **electricity** from the Environmental Protection Agency's most recent eGRID data¹⁵. An emissions factor is a constant used to convert activity data (such as electricity consumption) into units of GHG emissions by multiplying the activity data by the emissions factor. Germantown is in the NYUP (NPCC Upstate NY) eGRID sub-region, and the emissions factors are shown in **Table 17**. We then converted pounds of carbon dioxide, methane, and nitrous oxide to metric tons by dividing by 2,204.62 lbs per metric ton.

We used a similar approach for heating oil, propane, gasoline and diesel.

¹⁵ eGRID2018 (eGRID2018v2 is based on the November 21, 2019 revision to EIA-923 data.)

GHG	Emissions Factor eGRID2018v2	
Carbon Dioxide (CO ₂)	253.112	lbs CO₂ per MWh
Methane (CH ₄)	0.018	lbs CH₄ per MWh
Nitrous Oxide (N ₂ O)	0.002	lbs N₂O per MWh
CO ₂ Equivalent	253.889	lbs CO₂e per MWh

Source: eGRID2018.

Table 17 GHG Emissions Factors for Electricity (eGRID)

Emissions factors for **heating oil #2 and propane** were taken from the LGOP, see **Table 18**.

GHG	Heating Oil #2	Propane
Carbon Dioxide (CO ₂)	10.21 Kg CO ₂ / gallon	5.59 Kg CO ₂ / gallon
Methane (CH ₄)	0.0015 Kg CH ₄ / gallon	0.001 Kg CH ₄ / gallon
Nitrous Oxide (N ₂ O)	0.0001 Kg N ₂ O / gallon	0.0001 Kg N ₂ O / gallon

Source: ICLEI, 2010.

Table 18 GHG Emissions Factors by Stationary Fuel Type

Emissions factors for **gasoline and diesel** were taken from the LGOP, see **Table 19**.

GHG	Gasoline	Diesel
Carbon Dioxide (CO ₂)	8.78 Kg CO ₂ / gallon	10.21 Kg CO ₂ / gallon
Methane (CH ₄)	0 Kg CH ₄ / gallon	0 Kg CH ₄ / gallon
Nitrous Oxide (N ₂ O)	0 Kg N ₂ O / gallon	0 Kg N ₂ O / gallon

Source: ICLEI, 2010.

Table 19 GHG Emissions Factors by Stationary Fuel Type

We converted Kilograms of carbon dioxide, methane, and nitrous oxide to metric tons by dividing by 1,000 kg per metric ton.

Finally, we multiplied carbon dioxide, methane, and nitrous oxide by their respective global warming potentials (see **Table 20**) and added together to calculate the total carbon dioxide equivalent in metric tons per source of emission.

“The IPCC updates GWPs routinely through a series of “Assessment Reports.” The most current is the fifth assessment report (AR5). This New York State guidance differs from the U.S. Community Protocol in that the latter recommends using a combination of the second assessment report (SAR) and the fourth assessment report (AR4) GWPs. However, GWP choice is often made based on what assessment is current at the time protocol is written or updated. Therefore, the CSC Program recommends communities follow whatever GWP rules are in place for the U.S. EPA’s Mandatory Report Rule (MRR) at the time they develop the inventory. As of this report writing, MRR has adopted the AR4 GWPs. If and when MRR advances to AR5 or subsequent assessments, communities should follow suit.” (NYSERDA, 2015)

“The EPA considers the GWP estimates presented in the most recent IPCC scientific assessment to reflect

the state of the science. In science communications, the EPA will refer to the most recent GWPs.”¹⁶ At the time of writing of this report, the IPCC's Fifth Assessment Report is the most current IPCC scientific assessment with the Sixth Assessment Report anticipated in 2022. The values used, and displayed in **Table 20**, have been published in the Fifth Assessment Report's GWP of GHGs.

GHG	GWP
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	34
Nitrous Oxide (N ₂ O)	298
Source: IPCC, 2013, Table 8.7.	

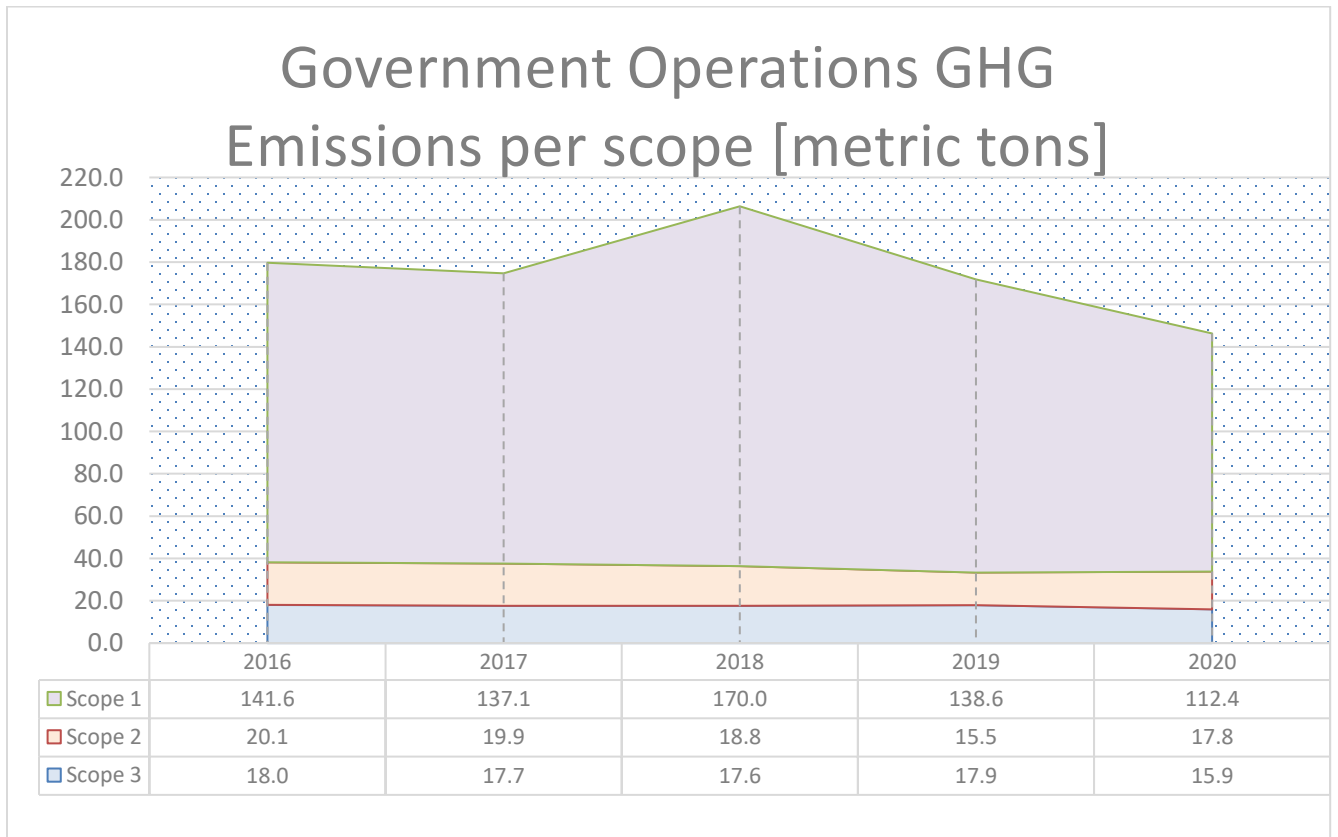
Table 20 Global Warming Potential

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- ICLEI, 2010 - California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, The Climate Registry. "Local Government Operations Protocol For the quantification and reporting of greenhouse gas emissions inventories." Version 1.1. May 2010. Accessed: May 8, 2021: https://ww3.arb.ca.gov/cc/protocols/localgov/pubs/lgo_protocol_v1_1_2010-05-03.pdf
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¹⁶ U.S. Environmental Protection Agency, "Understanding Global Warming Potentials"-website. Accessed: May 8th, 2021: <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>

Government Operation GHG Emissions Reports



2016 Detailed Government Operations GHG Inventory Report				
Sector / Source	Scope 1	Scope 2	Scope 3	Total
Buildings and other facilities				
Ball Field		0.06		0.06
Electricity		0.06		0.06
Charging Station		0.00		0.00
Electricity		0.00		0.00
Department of Public Works	26.56	1.35		27.91
Electricity		1.35		1.35
Propane	26.56			26.56
Kellner Activity Building	10.93	1.16		12.10
Electricity		1.16		1.16
Propane	10.93			10.93
Lake George S. Beach		0.19		0.19
Electricity		0.19		0.19
Lasher Park		0.24		0.24
Electricity		0.24		0.24
Parsonage	3.75	0.33		4.08
3 Ultra Clean Heating Oil	3.75			3.75
Electricity		0.33		0.33
Town Hall	11.39	1.87		13.26
Electricity		1.87		1.87
Propane	11.39			11.39
Employee Commute				
Employee Commute			18.02	18.02
7 Regular Unleaded Gasoline			18.02	18.02
Streetlights and traffic signals				
George Sharpe SUPV		2.17		2.17
Electricity		2.17		2.17
Lighting SVC		0.24		0.24
Electricity		0.24		0.24
Vehicle Fleet				
Vehicle Fleet	84.31			84.31
7 Regular Unleaded Gasoline	30.73			30.73
8 Blnd Ultra Low Sulfur Diesel	53.58			53.58
Wastewater Facilities				
WWTP Pump1		5.30		5.30
Electricity		5.30		5.30
WWTP Pump2		2.42		2.42
Electricity		2.42		2.42
WWT Plant	4.64	4.77		9.41
Electricity		4.77		4.77
Propane	4.64			4.64
Total	141.59	20.12	18.02	179.72

2017 Detailed Government Operations GHG Inventory Report				
Sector / Source	Scope 1	Scope 2	Scope 3	Total
Buildings and other facilities				
Ball Field		0.05		0.05
Electricity		0.05		0.05
Charging Station		0.00		0.00
Electricity		0.00		0.00
Department of Public Works	31.74	1.48		33.22
Electricity		1.48		1.48
Propane	31.74			31.74
Kellner Activity Building	9.79	1.28		11.07
Electricity		1.28		1.28
Propane	9.79			9.79
Lake George S. Beach		0.25		0.25
Electricity		0.25		0.25
Lasher Park		0.26		0.26
Electricity		0.26		0.26
Parsonage		0.27		0.27
Electricity		0.27		0.27
Town Hall	10.94	1.60		12.54
Electricity		1.60		1.60
Propane	10.94			10.94
Employee Commute				
Employee Commute			17.70	17.70
7 Regular Unleaded Gasoline			17.70	17.70
Streetlights and traffic signals				
George Sharpe SUPV		2.38		2.38
Electricity		2.38		2.38
Lighting SVC		0.24		0.24
Electricity		0.24		0.24
Vehicle Fleet				
Vehicle Fleet	82.30			82.30
7 Regular Unleaded Gasoline	27.94			27.94
8 Blnd Ultra Low Sulfur Diesel	54.36			54.36
Wastewater Facilities				
WWTP Pump1		5.70		5.70
Electricity		5.70		5.70
WWTP Pump2		2.43		2.43
Electricity		2.43		2.43
WWT Plant	2.31	3.97		6.28
Electricity		3.97		3.97
Propane	2.31			2.31
Total	137.08	19.90	17.70	174.68

2018 Detailed Government Operations GHG Inventory Report				
Sector / Source	Scope 1	Scope 2	Scope 3	Total
Buildings and other facilities				
Ball Field		0.05		0.05
Electricity		0.05		0.05
Charging Station		0.00		0.00
Electricity		0.00		0.00
Department of Public Works	24.16	1.53		25.69
Electricity		1.53		1.53
Propane	24.16			24.16
Kellner Activity Building	11.20	1.98		13.18
Electricity		1.98		1.98
Propane	11.20			11.20
Lake George S. Beach		0.21		0.21
Electricity		0.21		0.21
Lasher Park		0.34		0.34
Electricity		0.34		0.34
Parsonage	4.13	0.31		4.44
3 Ultra Clean Heating Oil	4.13			4.13
Electricity		0.31		0.31
Town Hall	7.61	1.75		9.36
Electricity		1.75		1.75
Propane	7.61			7.61
Employee Commute				
Employee Commute			17.61	17.61
7 Regular Unleaded Gasoline			17.61	17.61
Streetlights and traffic signals				
George Sharpe SUPV		2.40		2.40
Electricity		2.40		2.40
Lighting SVC		0.23		0.23
Electricity		0.23		0.23
Vehicle Fleet				
Vehicle Fleet	119.90			119.90
7 Regular Unleaded Gasoline	35.68			35.68
8 Blnd Ultra Low Sulfur Diesel	84.22			84.22
Wastewater Facilities				
WWTP Pump1		3.31		3.31
Electricity		3.31		3.31
WWTP Pump2		3.02		3.02
Electricity		3.02		3.02
WWT Plant	2.97	3.66		6.63
Electricity		3.66		3.66
Propane	2.97			2.97
Total	169.97	18.78	17.61	206.36

2019 Detailed Government Operations GHG Inventory Report				
Sector / Source	Scope 1	Scope 2	Scope 3	Total
Buildings and other facilities				
Ball Field		0.23		0.23
Electricity		0.23		0.23
Charging Station		0.02		0.02
Electricity		0.02		0.02
Department of Public Works	25.25	1.53		26.78
Electricity		1.53		1.53
Propane	25.25			25.25
Kellner Activity Building	9.91	1.43		11.34
Electricity		1.43		1.43
Propane	9.91			9.91
Lake George S. Beach		0.22		0.22
Electricity		0.22		0.22
Lasher Park		0.72		0.72
Electricity		0.72		0.72
Parsonage	3.97	0.39		4.36
3 Ultra Clean Heating Oil	3.97			3.97
Electricity		0.39		0.39
Town Hall	9.87	1.53		11.40
Electricity		1.53		1.53
Propane	9.87			9.87
Employee Commute				
Employee Commute			17.86	17.86
7 Regular Unleaded Gasoline			17.86	17.86
Streetlights and traffic signals				
George Sharpe SUPV		2.12		2.12
Electricity		2.12		2.12
Lighting SVC		0.24		0.24
Electricity		0.24		0.24
Vehicle Fleet				
Vehicle Fleet	86.94			86.94
7 Regular Unleaded Gasoline	26.67			26.67
8 Blnd Ultra Low Sulfur Diesel	60.27			60.27
Wastewater Facilities				
WWTP Pump1		1.67		1.67
Electricity		1.67		1.67
WWTP Pump2		1.27		1.27
Electricity		1.27		1.27
WWT Plant	2.64	4.08		6.72
Electricity		4.08		4.08
Propane	2.64			2.64
Total	138.58	15.45	17.86	171.89

2020 Detailed Government Operations GHG Inventory Report				
Sector / Source	Scope 1	Scope 2	Scope 3	Total
Buildings and other facilities				
Ball Field		0.00		0.00
Electricity		0.00		0.00
Charging Station		0.37		0.37
Electricity		0.37		0.37
Department of Public Works	25.38	1.59		26.97
Electricity		1.59		1.59
Propane	25.38			25.38
Kellner Activity Building	6.96	1.22		8.18
Electricity		1.22		1.22
Propane	6.96			6.96
Lake George S. Beach		0.10		0.10
Electricity		0.10		0.10
Lasher Park		0.42		0.42
Electricity		0.42		0.42
Parsonage	5.11	0.23		5.34
3 Ultra Clean Heating Oil	5.11			5.11
Electricity		0.23		0.23
Town Hall	9.45	1.37		10.82
Electricity		1.37		1.37
Propane	9.45			9.45
Employee Commute				
Employee Commute			15.94	15.94
7 Regular Unleaded Gasoline			15.94	15.94
Streetlights and traffic signals				
George Sharpe SUPV		0.72		0.72
Electricity		0.72		0.72
Lighting SVC		0.24		0.24
Electricity		0.24		0.24
Vehicle Fleet				
Vehicle Fleet	65.45			65.45
7 Regular Unleaded Gasoline	25.74			25.74
8 Blnd Ultra Low Sulfur Diesel	39.71			39.71
Wastewater Facilities				
WWTP Pump1		1.37		1.37
Electricity		1.37		1.37
WWTP Pump2		2.32		2.32
Electricity		2.32		2.32
WWT Plant	0.07	7.88		7.95
Electricity		7.88		7.88
Propane	0.07			0.07
Total	112.44	17.84	15.94	146.21