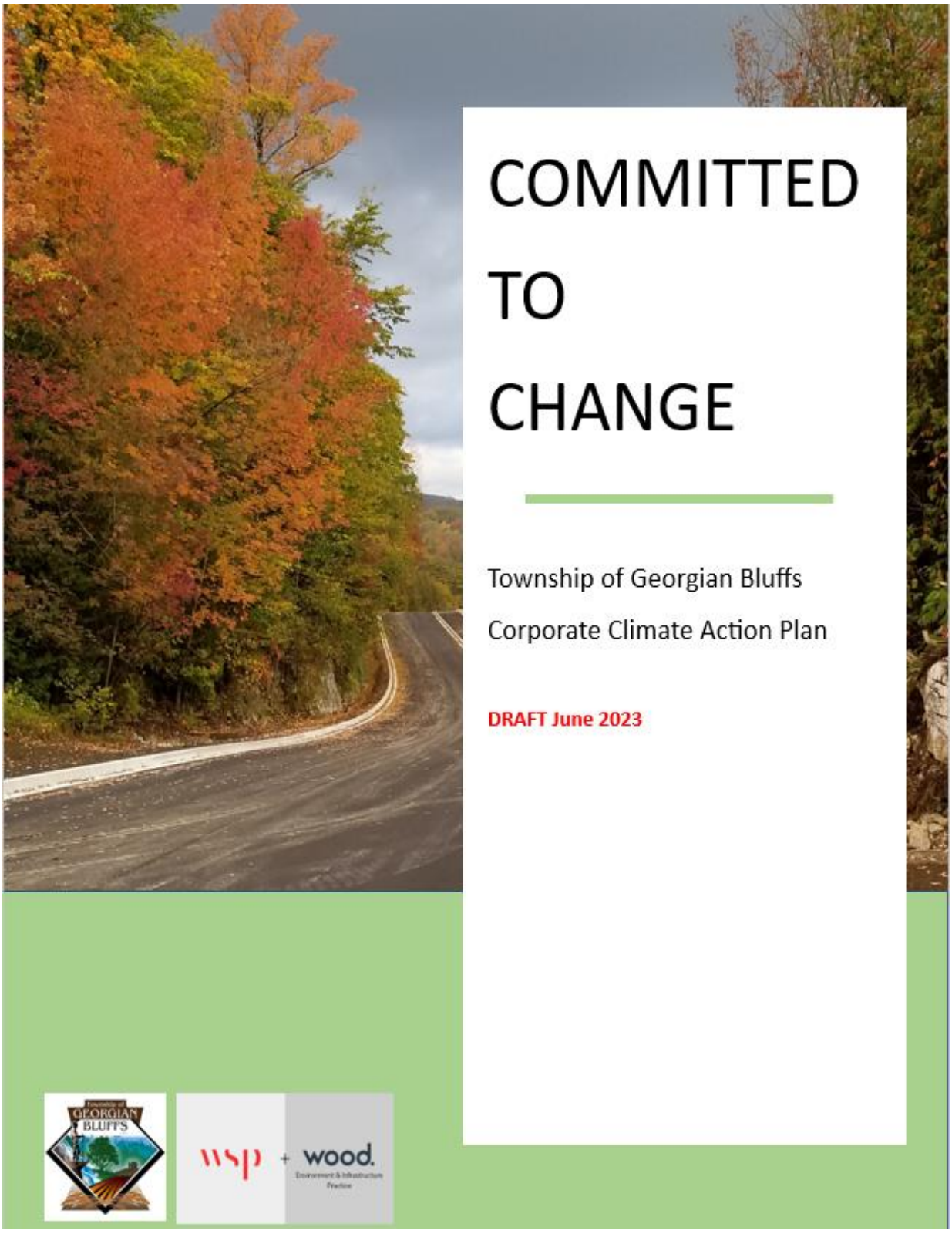

COMMITTED TO CHANGE

Township of Georgian Bluffs

Corporate Climate Action Plan

DRAFT June 2023

Land Acknowledgment

We acknowledge with respect, the history, spirituality, and culture of the Anishinabek: The People of the Three Fires known as Ojibway, Odawa, and Pottawatomi Nation, who have inhabited this land from time immemorial. And further give thanks to the Chippewas of Saugeen, and the Chippewas of Nawash, now known as the Saugeen Ojibway Nation, as the traditional keepers of this land. We also recognize, the Metis and Inuit whose ancestors shared this land and these waters. May we all, as Treaty People, live with respect on this land, and live-in peace and friendship with all its diverse peoples.

In reflecting on the long, lasting and continuing Indigenous culture on the lands that we now occupy, the imperative to address climate change, and to stop and seek to reverse the damaging environmental impacts that we have had on these lands since settlement, becomes ever more critical. Through seeking to redress the unsustainable and damaging ways in which we use the land, to repair damage done, and seeking to heal with the land, the Townships work on Climate Change can be a meaningful act of reconciliation with First Nations and Indigenous Communities.

Accessibility

This document has been formatted to be accessible to screen readers to support community members in accessing the material within it.

There are sections of this document that rely on tables, pie charts and various graphs which the Township understands do not convey well for readers using adaptive technologies and screen readers.

Wherever a call out box, table or graph is used, alternative text options are provided to summarize the nature of these figures and graphs is included to aid in the use of adaptive technologies and screen readers.

If you wish to access this document in a more accessible way, staff at the Township would be happy to provide support and assistance in accessing the materials used in this document.

Language and Translation

This text in this document can be made available in a range of languages to meet the needs of Community. If you would like to access this document in an alternative format, please contact the Township and we will strive to provide a translated version.

Langue et Traduction

Le texte de ce document peut être mis à disposition dans une gamme de langues pour répondre aux besoins de la Communauté. Si vous souhaitez accéder à ce document dans un format alternatif, veuillez contacter la Municipalité et nous nous efforcerons de fournir une version traduite.

Acknowledgments

The development of a Corporate Climate Action Plan is no small undertaking, and, like is often said of raising a family, it takes a village. Climate change is the challenge of a generation, and while a Corporate Plan is one small step toward meeting that challenge, it is a vital step for a municipality to take. This step could not have been made without the commitment drive and passion of the community of Georgian Bluffs, through the work of the Climate Action Committee between 2019 and 2022 and continuing as the Climate Action Working Group, in 2023 and beyond. Alongside this community commitment and passion, two terms of elected Council have reaffirmed repeatedly their commitment to addressing climate change through, as a first step, this Corporate Climate Action Plan, and staff at the Township have tracked trends, implemented changes and driven forward the development of this Plan. Supporting the staff team, staff at ICLEI Canada and PCP have provided direct support to the development of the Plan, especially in quality assuring the data conclusions within it, and the Climate Change Community of Practice at Grey County has provided the moral support when challenges arose. Quarterbacking these efforts has been the dedicated and sustained support of Wood Environmental and WSP Consulting teams that have provided support in puling together this Plan. Thank you to all involved in helping make this plan what it is today.

Executive Summary

The climate is changing. In the Township of Georgian Bluffs, climate changes will include weather that is warmer and wetter, with larger more frequent storms. Climate change is an imperative global issue that affects us all. No one is immune to its effect, impacts and local solutions and collaborative efforts are required by everyone. Even a community like the Township of Georgian Bluffs – small, rural townships and slightly removed from the large and big city areas we often associate with the most significant sources of emissions driving climate change and the significant impacts of climate change – will be impacted. Climate change will impact the Township of Georgian Bluffs residents, infrastructure, municipal operations and the economy.

The scale to which the Township of Georgian Bluffs is impacted will depend on the actions that the municipality takes now. This Corporate Climate Action Plan is the next chapter in the Township's Strategy to manage climate change in the Township of Georgian Bluffs – reduce its emissions sources and prepare for the impacts. Strengthening municipal action on climate change is an important continued step by the Township of Georgian Bluffs to enhance the municipality's commitment to sustainable development and climate action.

The Township of Georgian Bluffs identifies the objective of continually strive to reduce environmental footprint by reducing energy consumption and greenhouse gas emissions to minimize climate change (Objective 3.1 of the Strategic Plan 2020-2024).

The Corporate Climate Action Plan sets out two goals and takes a dual approach in responding to the causes and impacts of climate change:

- Goal 1: Lead to the reduction of climate change causing greenhouse gas emissions and energy consumption resulting in energy savings.
  Mitigation components of this plan focus on decreasing the severity of future climate change impacts by reducing greenhouse gas (GHG) emissions that are contributing to climate change. By doing its part to reduce GHG emissions, the Township can help to slow climate change and limit its negative impacts.

- Goal 2: Recognize and begin to prepare for the risk of a changing climate on the assets and operations of the Township.
  Adaptation components of this plan focus on preparing the Township for the impacts of climate change. By preparing for future climate conditions, the Township will lessen the negative impacts that climate change will have on municipal corporate assets and operations, the provision of services, residents and the local economy.

The Corporate Climate Action Plan (CorCAP) introduces a baseline GHG emissions inventory for the Municipal Corporation, as well as emissions reduction targets based on the data captured in the inventory and actions that the Municipal Corporation will take to reduce the production of emissions.

Municipal Corporate GHG emissions reduction targets for the Township have been set and a suite of actions developed to help achieve them.

Corporate Targets:

40% reduction in greenhouse gas emissions by 2030, relative to 2018 levels.
70% reduction in greenhouse gas emissions by 2040, relative to 2018 levels.
80% reduction in greenhouse gas emissions by 2050, relative to 2018 levels.

These GHG emissions reduction targets are aligned with the emission reduction targets of higher levels of government to meet climate change action and align with Grey County's emission reduction targets and actions outlined in the Grey County Climate Action Plan (2022). However, it is noted that at a Federal level, and at the County level, Climate plans aspire to achieve Net Zero by 2050; a target that this Climate Action Plan does not include in the immediate term. The CorCAP focusses on achievable actions and provides information for the Township to begin a pathway towards emission reductions and preparation for climate impacts.

The CorCAP is a long-term initiative that will require engagement and actions over several years to succeed. Ongoing support from Council will be essential to ensure that implementation of this plan maintains momentum. Some actions contained in this plan will require capital investments to be successful. Funding requirements for specific climate actions will be integrated into the annual municipal budget cycle. Staff will work to capitalize on funding opportunities as they become available from sources outside of the Township.

By implementing this corporate climate action plan, the Township of Georgian Bluffs is fulfilling its responsibility to work in the community's best interests. The knowledge contained in this plan will enable the Township to make informed decisions to prioritize actions to limit GHG emissions that are contributing to climate change and minimize the impacts that climate change will have on Township operations and services.

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Why a Climate Change Plan?

The climate is changing and municipalities across Canada and in Ontario are leading the efforts to reduce greenhouse gas emissions in their operations and prepare for the coming impacts of a changing climate (temperature increases, increase extreme precipitation events, flooding, drought).

Ontario's Ministry of the Environment, Conservation and Parks reports that the average annual temperature in Ontario has increased by 1.4°C over the last 60 years. Models suggest that by 2050, the average annual temperature in Ontario could increase by another 2.5°C to 3.7°C. Cascading climatic impacts and stresses of this temperature change include increased precipitation, temperature shifts, flooding, increased windstorms, and extreme weather. These impacts will affect municipalities large and small, urban and rural, and have both positive and negative implications on infrastructure (e.g., transportation, energy, water supply, and sewage).

Changes in climate significantly impact rural communities because rural communities such as the Township of Georgian Bluffs rely on and are dependent upon climate-sensitive natural resources and ecosystems for their livelihoods, economy and well-being.

> *The Township of Georgian Bluffs identifies the objective of continually strive to reduce environmental footprint by reducing energy consumption and greenhouse gas emissions to minimize climate change.*
>
> Township of Georgian Bluffs Strategic Plan 2020-2024

The Township of Georgian Bluffs recognizes the need to address greenhouse gas emissions that cause climate change in its operations, prepare for climate impacts to its assets, and to demonstrate local climate action to the community. This Corporate Climate Action Plan provides a means to address climate change by the Township of Georgian Bluffs.

A Corporate Climate Action Plan (CorCAP) is a corporate-wide plan to reduce energy and emissions from municipal operations and fleets. The CorCAP focuses exclusively on energy and greenhouse gas emissions that are directly controlled by the Township of Georgian Bluffs. The CorCAP includes direct and indirect greenhouse gas emissions produced by the Township as a result of its operations. The CorCAP does not include emissions that are a consequence of activities from sources not controlled or owned by the Township (including third-party contractors, construction activities, businesses, or air travel).

There are several drivers behind municipal climate change planning in Ontario, including the Federation of Canadian Municipalities (FCM) Partners for Climate Protection (PCP) program, the Provincial energy reporting and conservation and demand management program that requires municipalities to track and report on energy usage and related greenhouse gas emissions, Provincial planning legislation that mandates municipalities to consider climate change in their Community Official Plans, and Provincial asset management legislation that mandates municipalities to develop asset management plans that consider the impacts of climate change on municipal assets. In Ontario, approximately 51% of the population is covered under a municipal climate change action plan .

The Township of Georgian Bluffs is within Grey County, which undertook the Grey to Green Climate Action Plan 2022- 2055 in 2022 outlining actions to address greenhouse gas emission reductions and energy conservation in the broader community of Grey County. The Township of Georgian Bluffs is committed to supporting the community actions laid out in Grey County's Climate Change Action Plan, the Township will refer to Grey County's implementation plan for community actions.

Figure 1 below illustrates how the CorCAP relates to the Grey Country Climate Action Plan and to the Ontario and Canadian Climate Change Plans and actions. As indicated in the Figure 1 below, the Grey County Climate Change Action Plan outlines actions for the community in the Township of Georgian Bluffs. This CorCAP focusses on corporate emissions and actions by the Township and considers actions that were identified in the Grey County Grey to Green Climate Action Plan to support and sustain local and regional climate change actions.

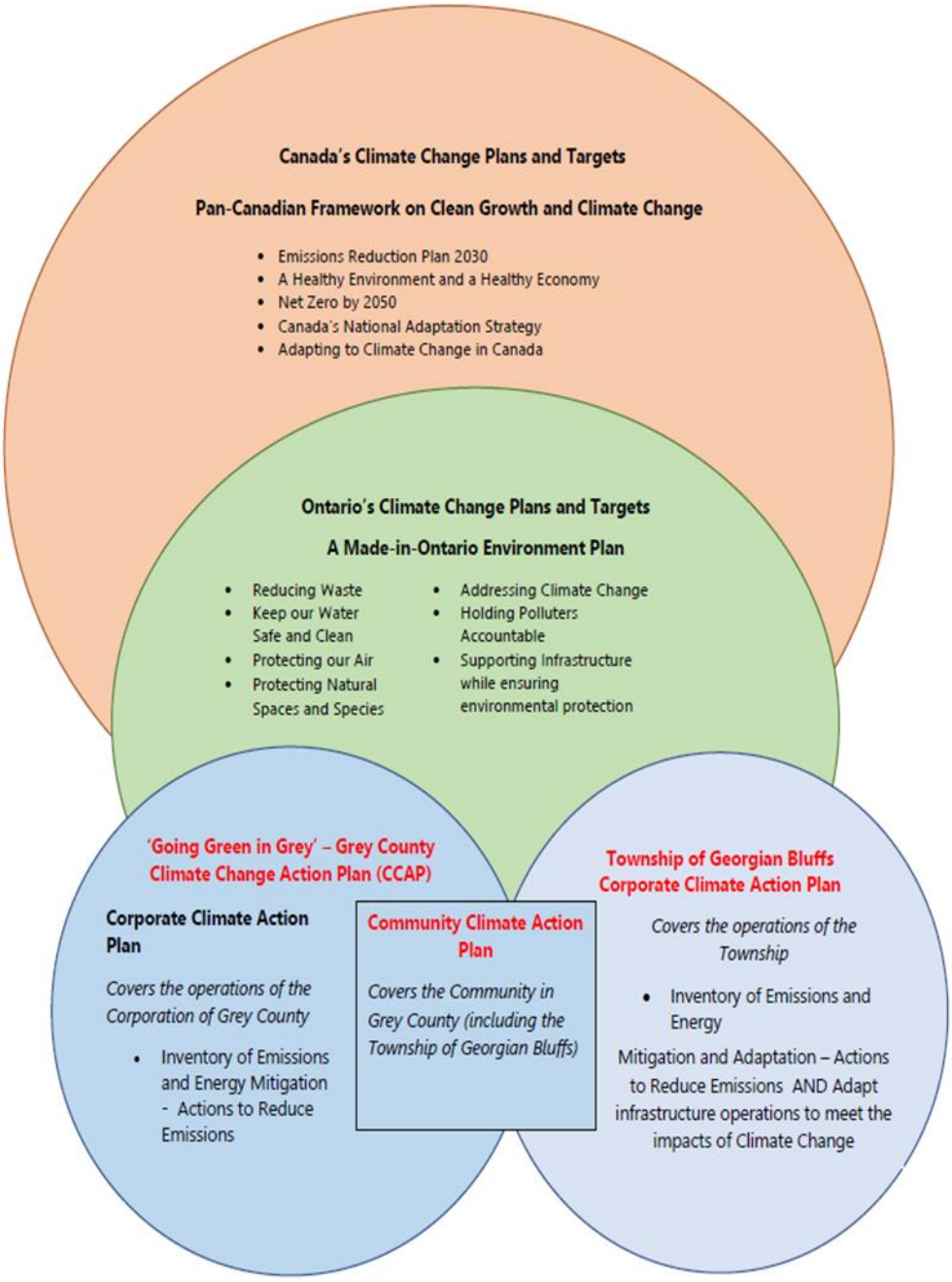

Figure 1 The Relationship of the Corporate Climate Action Plan to other Climate Action Plans (Grey County, Ontario and Canada)

The intent of this CorCAP is to outline corporate municipal actions that the Township of Georgian Bluffs can undertake to address climate change through their operations and prepare for climate change impacts and hazards to their assets.

What is Climate Change?

Climate Change is a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators. Climate change can involve both changes in average conditions and changes in variability, including, for example, extreme events. The term "weather" refers to what happens each day, while "climate" is the trend over a long period of time.

Human activities contribute to climate change primarily by emitting greenhouses gases (GHG) into the atmosphere. Common GHGs include carbon dioxide, methane and nitrous oxide. GHGs surround our planet and act as a barrier to prevent the loss of heat and energy into the outer space, in turn causing the atmosphere to warm. GHGs occur naturally and are required to support life on earth; however, in excess quantity, the gases can change the Earth's climate and negatively impact the health of the environment and humans.

Carbon dioxide is the main cause of human-induced climate change. It has been emitted in vast quantities from the burning of fossil fuels and it is a very long-lived gas, which means it continues to affect the climate due to its long residence time in the atmosphere.

While efforts to reduce GHG emissions must be pursued, to reduce the amount of GHG emissions in the atmosphere and their impacts on the climate, it is also essential to implement adequate adaptation measures to face an uncertain future climate of extreme weather.

How can the Municipal Corporation Take Action?

There are two broad types of actions that all municipalities can focuses on to address climate change.

1. Mitigation (reducing GHG emissions) - efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean retrofitting buildings to make them more energy efficient, making older equipment more energy efficient, using new technologies and renewable energies, or changing management practices or consumer behavior.
2. Adaptation (responding to climate impacts) – efforts that prepare for, reduce and recover from the negative impact of climate change, while taking advantage of potential new opportunities. It involves adjusting policies and actions because of observed or expected changes in climate. Adaptation can be reactive, occurring in response to climate impacts, or anticipatory, occurring before impacts of climate change are observed. In most circumstances, anticipatory adaptations result in lower long-term costs and be more effective than reactive adaptation actions.

Mitigation (reducing GHG emissions) and Adaptation (responding to climate impacts) are necessary complements in addressing climate change (Figure 2)

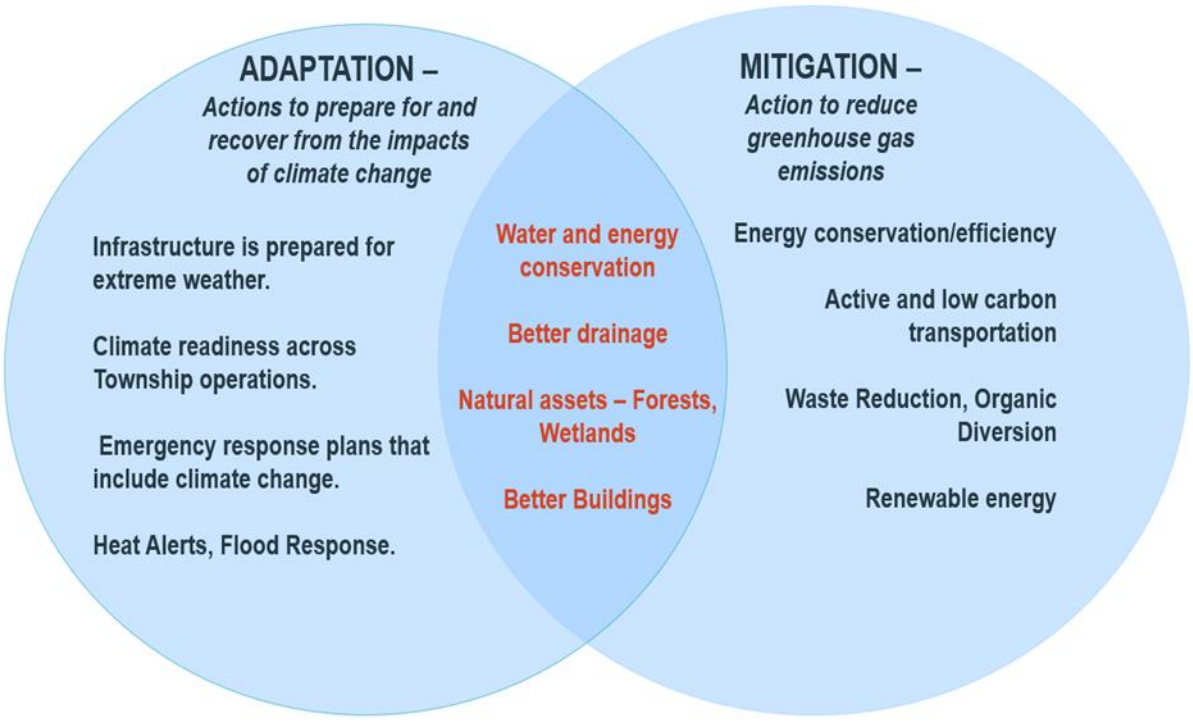

Figure 2: Climate Change Mitigation and Adaptation

The Township of Georgian Bluffs- A Snapshot of Operations and Services

Georgian Bluffs is a small, rural municipality serving approximately 11,000 residents. The community is an amalgamation of three smaller townships and communities with a strong agricultural history, post settlement. Over recent years, the location of the Township, featuring the magnificent Niagara Escarpment, rich and protected environment and stunning location on the clear waters of Georgian Bay, have made the Township a popular summer cottage destination and area attractive to retirees.

The Municipality provides a range of typical municipal services to this community with a staff of forty-two full time employees. The Township provides:

1. Planning and Building services to support development, growth, and change,
2. Community Services oversees trails, parks, open spaces, two community centers and an arena with seasonal ice,
3. The Operations team that provides year-round road maintenance and management of both asphalt and granular rural roads, including snow removal; this team also looks after stormwater management,
4. The Finance team helps manage and provide for property tax collection and management as well as ensures the smooth running of municipal budgets,

5. The administration of the municipality is supported by a Corporate Services team providing human resource and communications support alongside other functions to ensure the smooth running of the organization.

Sources of GHG emissions in corporate municipal operations include the energy (electricity, natural gas, propane) used for heating, cooling and lighting administrative buildings and recreational facilities including the maintaining of ice in local arenas, the fuel used by vehicles in the Township fleet in daily operations but also in services such as snow removal, the energy used in the pumping and treating water and wastewater in the community, the energy used to light up streetlights, and in the waste (i.e. garbage and recycling) generated by the Township in daily operations and the delivery of services.

The Township's Commitment to Climate Change

The Township has committed to change when it come to the impacts of Climate Change, and this Corporate Plan (CorCAP) is the evolution of actions take over recent years. In 2016/17, the Township recognized the opportunity and benefit of upgrading its streetlight inventory to lower energy LEDs, both from an energy use and climate perspective, but also from a financial and community benefit perspective. In 2018, the Township reviewed the use of energy across its buildings and developed the first Energy Demand and Conservation Plan for the Township. This plan reflected a commitment to seeking to reduce energy related emissions from buildings and paved the pathway to changing fuel sources used and lowering emissions.

In 2020 this commitment to change was repeated through the 2020 – 2024 Corporate Strategic Plan which positioned the Township to 'strive to leadership in Environmental Stewardship by reducing energy consumption, reducing solid waste, increasing diversion rates of recyclable materials, and lessening the environmental impact of existing and future infrastructure'. Progress has been made in all these areas.

Also in 2020, the Township and Community worked together to form the Climate Change Action Committee. This collaboration between Township staff, Councillors and community members drove forward work on developing Community and Corporate Climate Actions and ultimately has led to the delivery of this plan; the next step in this Township work to address climate change.

Goal and Objectives

The Township of Georgian Bluffs identifies the objective of continually strive to reduce environmental footprint by reducing energy consumption and greenhouse gas emissions to minimize climate change (Objective 3.1 of the Strategic Plan 2020-2024).

1. The primary goal of this CorCAP is to lead to the reduction of climate change causing greenhouse gas emissions and energy consumption resulting in energy savings.
2. A secondary goal is to recognize and begin to prepare for the risk of a changing climate on the assets and operations of the Township.

The actions identified in this Corporate Plan were scoped to ensure that they reflect actions that can be undertaken by a rural municipality and by the Township of Georgian Bluffs and reflect current legislative requirements by the Province of Ontario to address climate change in municipal operations.

Developing the Plan

This Corporate Climate Action Plan (CorCAP) for the Township has been developed using the Partners for Climate Protection (PCP) Framework to develop mitigation actions and following the guidance of the ICLEI (International Council of Local Environmental Initiatives) Canada Building Adaptive & Resilient Communities (BARC) Framework and the use of Engineers Canada Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol to identify climate impacts and begin developing adaptation actions. These frameworks and protocols were followed as they provide a recognized standard approach and steps to the development of municipal climate change action plans used by municipalities across Canada and recognized by the Federation of Canadian Municipalities (FCM) and the Partners for Climate Protection (PCP) program.

Mitigation Planning – The Partners for Climate Protection (PCP) Program

In 2020, the Township of Georgian Bluffs joined the Partners for Climate Protection (PCP) program which is delivered by the Federation of Canadian Municipalities (FCM) and ICLEI-Local Governments for Sustainability.

The PCP program supports and guides the Township in reducing GHG emissions through a five (5) Milestone Framework (Figure 3), beginning with the creation of an initial inventory of GHG emissions, establishing targets, creation of an Action Plan, through to the implementation of measures and reporting on results. This framework has been used by a large number of municipalities across Canada for developing Climate Action Plans which allows for results and actions to be comparable and based on Canadian municipal climate planning experience.

Figure 3: PCP 5 Milestone Framework for Climate Change (Mitigation). Courtesy of PCP.

The five (5) Milestones are:

1. Milestone 1: Creating a baseline emissions inventory and forecast.
2. Milestone 2: Set emissions reduction target.
3. Milestone 3: Develop a local action plan.
4. Milestone 4: Implement the local action plan.
5. Milestone 5: Monitor progress and report results.

Progress on PCP

Milestone 1 - The baseline emissions inventory and forecast of the Township Corporate operations is presented in Corporate Greenhouse Gas Emissions (Mitigation Milestone 1)

Milestone 2 – This Corporate Climate Action Plan establishes reduction targets in Corporate GHG Emissions Targets (Mitigation Milestone 2)

Milestone 3- Is this document - the Corporate Climate Action Plan (CorCAP) that establishes actions, monitoring and evaluation of progress to meet the corporate emissions targets established in this Corporate Plan of the Township.

Adaptation Planning- Building Adaptive & Resilient Communities (BARC) Program

The ICLEI Canada Building Adaptive & Resilient Communities (BARC) Program supports and guides the Township in climate adaptation and resiliency through a five (5) Milestone Framework (Figure 4) , beginning with the initiation of the process and identify stakeholders and current climate actions, undertake a vulnerability and risk assessment, creation of an Action Plan, through to the implementation of measures and review and reporting on results. The BARC methodology has been used by a number of municipalities across Canada which allows for actions to be comparable and based on Canadian municipal climate planning experience.

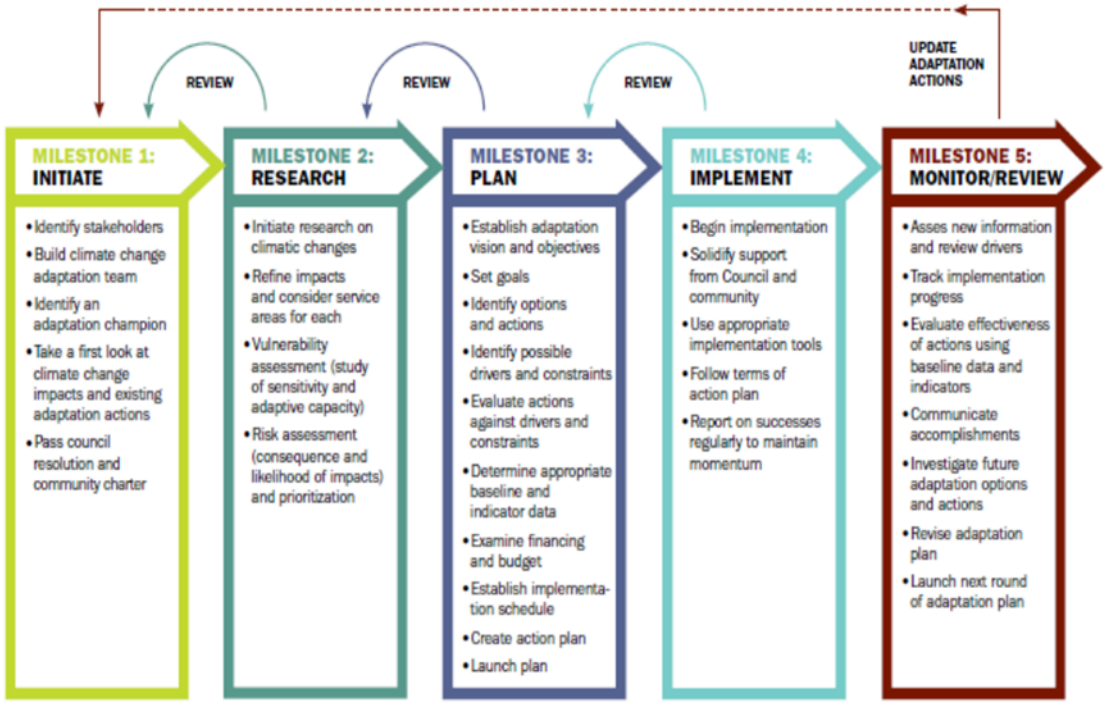

Figure 4: ICLEI BARC 5 Milestone Framework for Climate Adaptation. Courtesy of BARC and ICLEI

The five (5) Milestones are:

1. Milestone 1: Initiate the process.
2. Milestone 2: Research – climate parameters, impacts, undertake vulnerability and risk Assessment.
3. Milestone 3: Develop a local action plan.
4. Milestone 4: Implement the local action plan.
5. Milestone 5: Monitor and review progress and report results.

Progress on BARC

Milestone 1 – Initiate the process was taken by starting this climate action plan work.

Milestone 2 – This Corporate Climate Action Plan (CorCAP) identifies the climate parameters, impacts, vulnerabilities and risks assessment in Climate Risk and Impacts - Climate Change Risk Assessment (Adaptation Milestone 1 & 2)

The Engineer Canada's PIEVC (Public Infrastructure Engineering Vulnerability Committee) Engineering Protocol helps assess potential infrastructural vulnerabilities to projected climate-related changes and extreme weather. The PIEVC Protocol methodology was used in the identification of climate events, impacts and the understanding of the vulnerability and risk of climate change on Township assets. The PIEVC Protocol is compliant with an ISO 31000 Risk Management approach and supports the philosophy of ISO 14090/14091 adaptation to climate change, the PIEVC approach is also recognized by Infrastructure Canada for undertaking climate risk assessments on public assets and services.

The Impacts and the Opportunities

Corporate Greenhouse Gas Emissions (Mitigation Milestone 1)

A Corporate Greenhouse Gas (GHG) Emissions Inventory was completed with a baseline year of 2018. The inventory is the foundation for setting emission reduction targets and monitoring performance in the years ahead. The emissions inventory highlights the energy and GHG emissions profile of the corporate Township of Georgian Bluffs and focusses on municipal corporately owned and operated assets (vehicles, buildings, water treatment, and waste).

Corporate energy and greenhouse gas emissions were examined under the categories of Corporate Buildings, Corporate Fleet, Streetlights, Water & Sewage, and Waste. Energy was broken down into the respective fuel type – Electricity, Natural Gas, Diesel, Propane and Oil 1&2 .

The Corporate emissions inventory was undertaken following the Global Protocols for Community-Scale Greenhouse Gas Emissions Inventories (GPC) BASIC level of reporting, which is considered the international best-in-class approach for quantifying emissions at the local level. Developing this GPC-compliant inventory aligns with the Partners for Climate Protection (PCP) Protocol and meets the requirements for the PCP Milestone Framework 1. This baseline energy profile year and emissions inventory year of 2018 aligns with the Township's energy reporting to the Province of Ontario as required under Ontario Regulation 507/18 on Energy reporting, conservation, and demand management.

The municipal corporate GHG inventory examined the three most common greenhouse gases (GHGs) of Carbon Dioxide (CO2), Nitrous Oxide (N20) and Methane (CH4). All GHG emissions are converted and reported to carbon dioxide equivalents (CO2e) in tonnes (t) to allow for meaningful comparison among different GHGs.

Corporate Inventory Baseline Year (2018)

In 2018, the corporate municipal Township of Georgian Bluffs generated 729 tonnes (t) of carbon dioxide equivalent (tCO2e) from fossil fuel combustion used in operations and assets as well as electricity consumed from the Ontario electrical grid. Figure 5 and Table 1 summarizes the total municipal corporate GHG emissions by category and Figure 6 and Table 2 summarizes the emissions by energy sources.

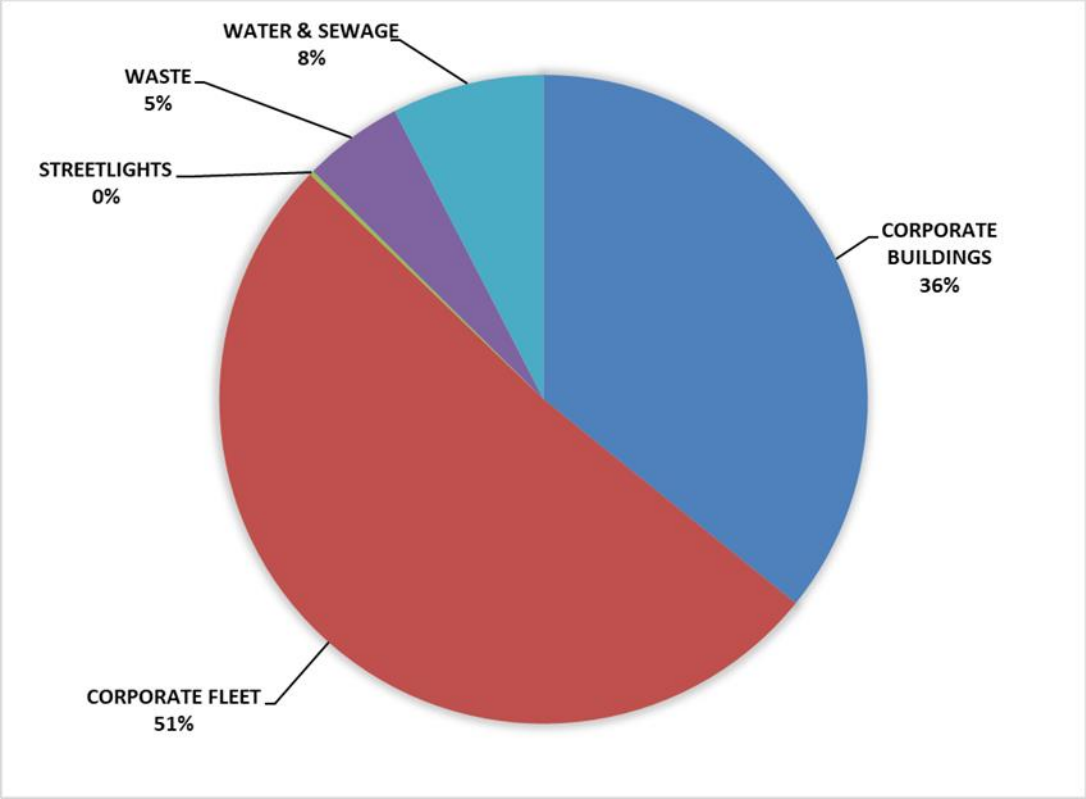

Figure 5: Township of Georgian Bluffs Municipal Corporate Emissions by Category, 2018

CATEGORY	CO_2e PRODUCED (Tonnes)	CO_2e PRODUCED PERCENTAGE (%)
CORPORATE BUILDINGS	261	36
CORPORATE FLEET	375	51
STREETLIGHTS	2	0
WASTE	36	5
WATER & SEWAGE	55	8
TOTAL	729	100

Table 1: Township of Georgian Bluffs Municipal Corporate Emissions by Category, 2018

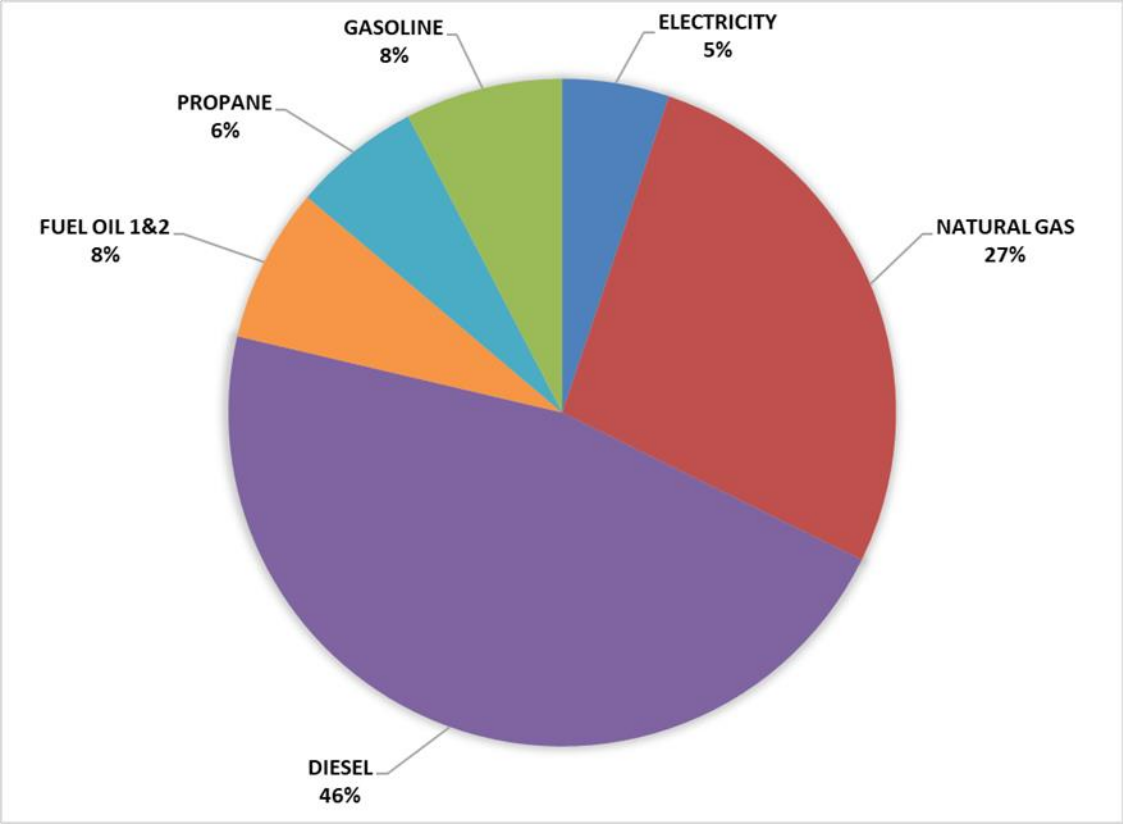

Figure 6: Township of Georgian Bluffs Municipal Corporate Emissions by Energy Source in 2018

ENERGY SOURCE	CONSUMPTION (GJ)	CO_2e PRODUCED (Tonnes)	CO_2e PRODUCED PERCENTAGE (%)
ELECTRICITY	4,376	36	5
NATURAL GAS	3,801	188	27
DIESEL	4,509	322	46
FUEL OIL 1&2*	726	52	8
PROPANE	701	43	6
GASOLINE	795	53	8
TOTAL**	14,908	694	100

Table 2: Township of Georgian Bluffs Corporate Emissions by Fuel Source, 2018

Notes:

1. Fuel Oil 1&2 is considered diesel for building heating used in boilers and furnaces, also known as home heating oil winter blend.

2. Waste does not consume energy, as a result the total CO2e (t) produced is based on energy consumption and the total differs because of the exclusion of the category of waste.

These results are typical of municipal corporate operations with buildings, fleet and water & sewage generating the most greenhouse gas emissions from energy consumption and are influenced by the type of energy and source used in operations (for example electricity generated by hydroelectric vs. coal), the amount of time operations run (seasonal, yearly, weekly), any impacts by weather (high snow vs. low snow season, heat, wind, rain) and increasing demands and growth of the Township's community that depend on services (water supply and treatment, recreational centres and arenas, and road clearing).

Corporate Energy Consumption (2018)

In 2018, the corporate municipal Township of Georgian Bluffs consumed 14,908 Gigajoules (GJ) from fossil fuel combustion used in operations and assets as well as electricity consumed from the Ontario electrical grid. Figure 7 and Table 3 summarizes the total municipal corporate energy consumption by energy source. Tracking energy consumption and energy source provides measures and indicators for meeting greenhouse gas targets and provides energy consumption tracking for the Township.

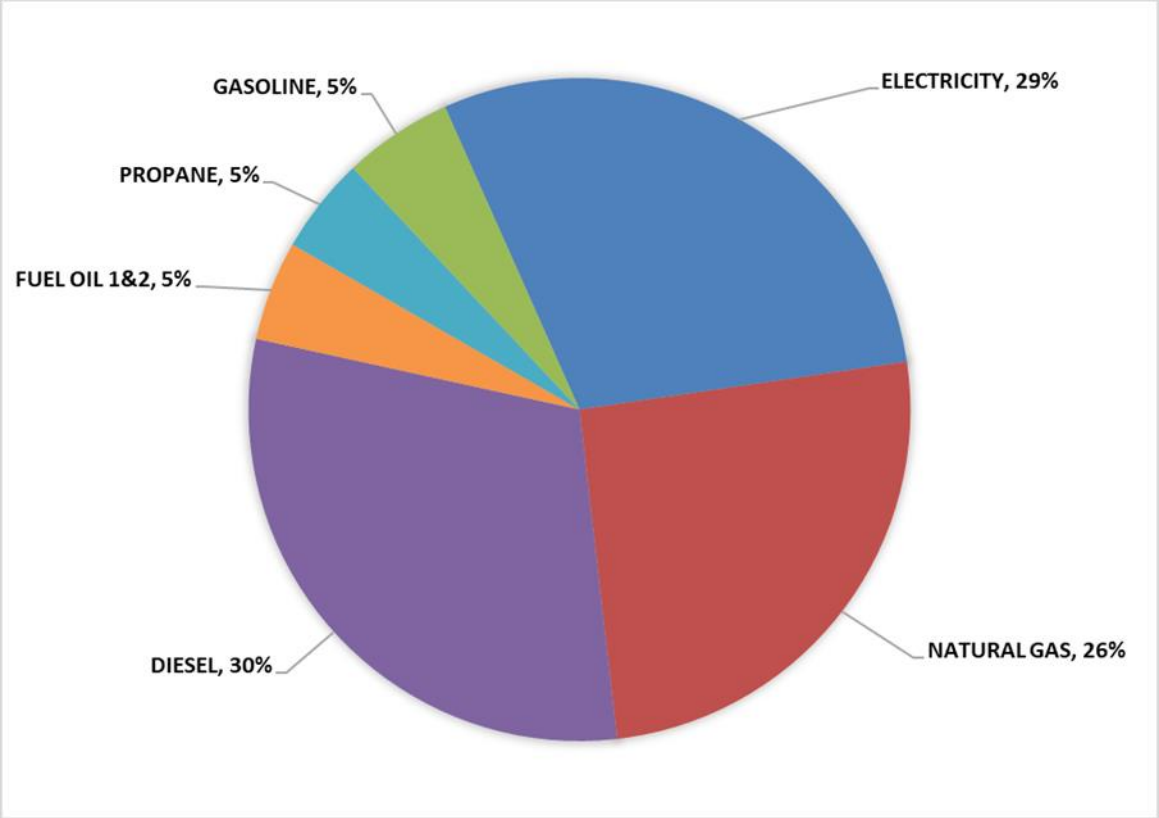

Figure 7: Township of Georgian Bluffs Corporate Energy Use by Energy Source, 2018

ENERGY SOURCE	CONSUMPTION (GJ)	CONSUMPTION PERCENTAGE (%)
ELECTRICITY	4,376	29
NATURAL GAS	3,801	26
DIESEL	4,509	30
FUEL OIL 1&2*	726	5
PROPANE	701	5
GASOLINE	795	5
TOTAL	14,908	100

Table 3: Township of Georgian Bluffs Municipal Corporate Energy use (GJ) by Energy Source, 2018

Township of Georgian Bluffs Emissions Targets

Corporate GHG Emissions Targets (Mitigation Milestone 2)

	2030 GHG Reduction Target (%)	2040 GHG Reduction Target (%)	2050 GHG Reduction Target (%)
TOWNSHIP OF GEORGIAN BLUFFS (2018 BASE YEAR)	**40**	**70**	**80**

Table 4: Corporate GHG Emission Reduction Targets 2030 to 2050

These GHG emissions reduction targets are in line with the emission reduction targets of higher levels of government to meet climate change action and align with Grey County's emission reduction targets and actions outlined in the Grey County Climate Change Action Plan (2022). Higher levels of government are aspiring to achieve Net Zero by 2050, a target not included in the immediate term for this Plan.

These targets recognized the opportunities for the Township to partner and support higher levels of government in tacking action on climate change, the current and emerging climate and energy polices of the Province and the Canadian government, and the resources and ability for the Township to act locally on climate change.

Achieving Net Zero

Achieving Net Zero emissions means the Township either emits no greenhouse gas emissions or offsets its emissions, for example, through actions such as tree planting or employing technologies that can capture carbon before it is released into the air.

This CorCAP does not forecast achieving Net Zero emissions in the immediate term but focusses on achievable actions and provides information for the Township to begin the pathway towards emission reductions and preparation for climate impacts. Net Zero is an objective to be strived for, but is not considered to be realistically achievable within the timeframe of this plan.

As a living document, this Plan will need to continue to evolve as actions are achieved to continue progress towards achieving the greenhouse gas emission targets. As part of the updating of the CorCAP, the Township will continue to monitor progress and implementation of new technologies and methods (including carbon offsets and carbon capture) that can help achieve Net Zero emissions to determine applicability and costs to the Township operations and services.

How were these Targets established?

GHG Emissions targets were set through the use of forecasting as outlined in the PCP Framework and GHG Inventory Protocol. Forecasting emissions helps determine targets and uses scenarios that

incorporate available and potentially available technology, changes in energy consumption and sources, influence of other levels of government through land use, transportation, energy, climate change policies and programs, and population growth.

The initial scenario is known as the Business-as-Usual (BAU) scenario and assumes no action is taken to reduce energy or emissions. The BAU's methodologies and assumptions reflect building emissions and energy models for Ontario municipalities, increasing energy demands and population growth driving increase demand for municipal operations and services, and follows best practices.

Figure 8 below shows the BAU scenario of forecasted corporate energy and emissions to 2050 and indicates increasing emissions up to 1,374 tCO2e from a baseline of 729 tCO2e , or an 88% increase in emissions. The BAP forecast is not an absolute picture of future energy and emissions but instead serves as a guidance to decision making on energy and emissions mitigation strategies and actions.

Included in Figure 8 below are other emission scenarios that include the Corporate Township (noted as Corporate Targets) aligning with current established and proposed GHG emission reductions targets by Grey Country, the Government of Canada, and the Government of Ontario (noted as Fed/ON) and global emission reduction targets by the Intergovernmental Panel on Climate Change (noted as IPCC). Table 5 indicates what these established reduction targets scenarios are. These scenario paths provide possibilities of emission reduction pathways for the Township to establish corporate reduction targets.

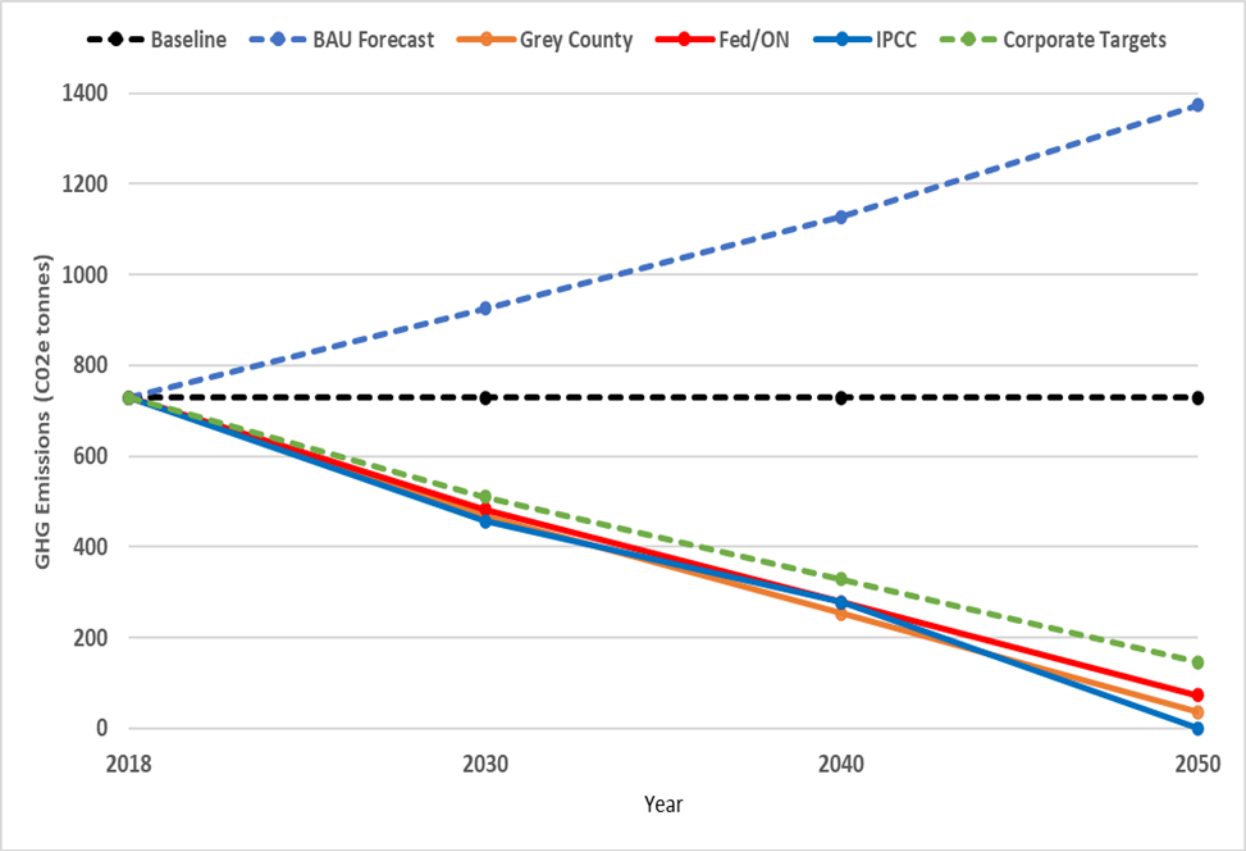

Figure 8: Projected BAU and Emission Target Scenarios 2018 - 2050

	2030 GHG Reduction Target (%)	2040 GHG Reduction Target (%)	2050 GHG Reduction Target (%)
COUNTY OF GREY (Region)	**40**	**70**	**90-100**
GOVERNMENT OF ONTARIO (Province)	**30**	**60**	**90**
GOVERNMENT OF CANADA (Canada)	**40**	**70**	**90-100**
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Global)	**45**	**70**	**90- 100**

Table 5: GHG Reduction Targets 2030 to 2050

As indicted, the BAU scenario is not an absolute picture of future energy and emissions but instead serves as a guidance to decision making on energy and emissions mitigation strategies. However, changes that occur outside the influence of the municipality, such as actions from higher levels of government and technological changes driven by broader economic trends will also influence the energy consumption and emissions of the corporate municipality operations and assets in the future. Examples include increasing interest in incorporating alternative energy (solar) into the regional and provincial energy grid, the uptake and demand for electric powered vehicles over traditional fossil fuel vehicles, increased energy efficiency in vehicle fleets, increasing energy efficiency in buildings and building code requirements.

If the Township were to meet its corporate GHG emissions target of 80% reduction by 2050, the Township would need to reduce its GHG emissions to 146 tCO2e.

Progress on Reducing Corporate GHG Emissions (2018 – 2021)

From 2018 to 2021, the Township reduced corporate GHG emissions from 729 tonnes of carbon dioxide equivalent (tCO2e) to 571 tCO2e (see Table 6). This is a reduction of approximately 22% over a period of 4 years or 5% per year.

Figures 9 and 10 highlight the reductions of each municipal corporate category and by energy source over the period of 2018 to 2021. Significant emission reductions can be seen in municipal corporate buildings due to fuel switching (moving from Fuel Oil 1&2 to electricity which lowered emissions), reduction in the use of propane, and the reduction of energy consumption by streetlights and in water and sewage treatment.

CATEGORY	2018 - CO_2e Produced (Tonnes)	2021 - CO_2e Produced (Tonnes)	Percentage Change (%)
CORPORATE BUILDINGS	261	132	-49%
CORPORATE FLEET	375	358	-0.04%
STREETLIGHTS	2	1	-50%
WASTE	36	36	0
WATER & SEWAGE	55	43	-22%
TOTAL	729	570	-22%

Table 6: Township of Georgian Bluffs Corporate Emissions Change by Category, 2018 and 2021

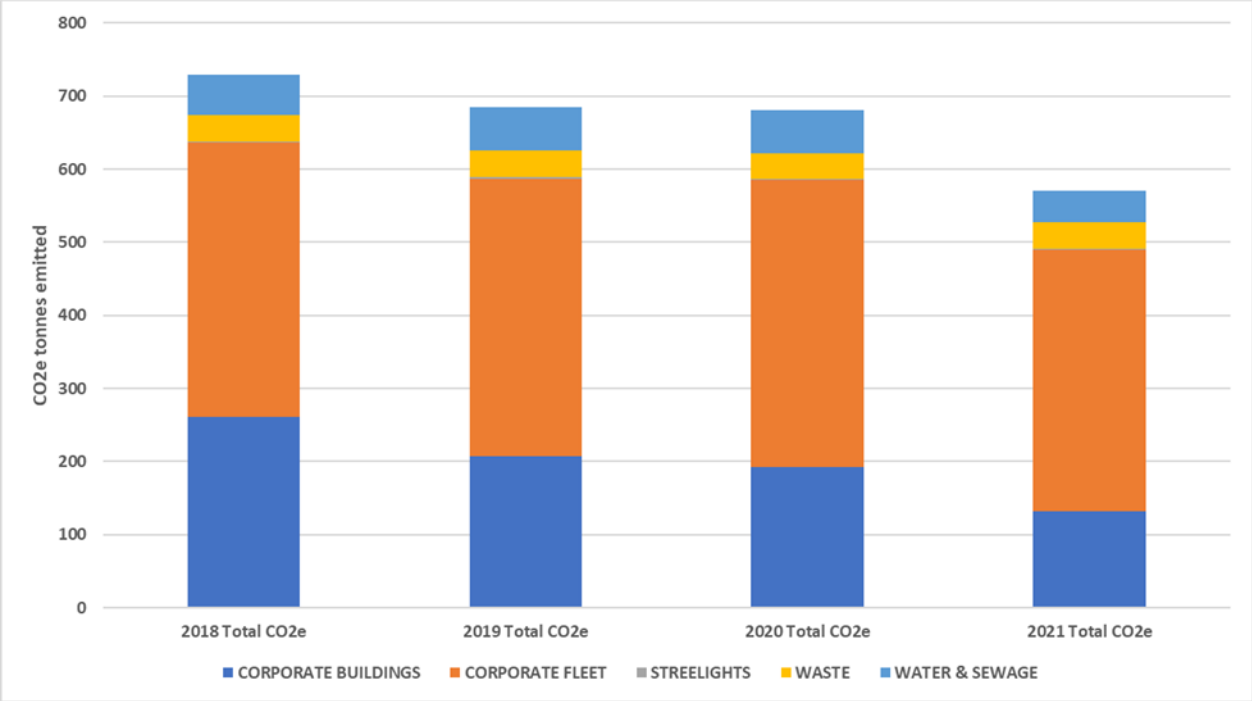

Figure 9: Total Corporate GHG (tCO2e) by source 2018-2021

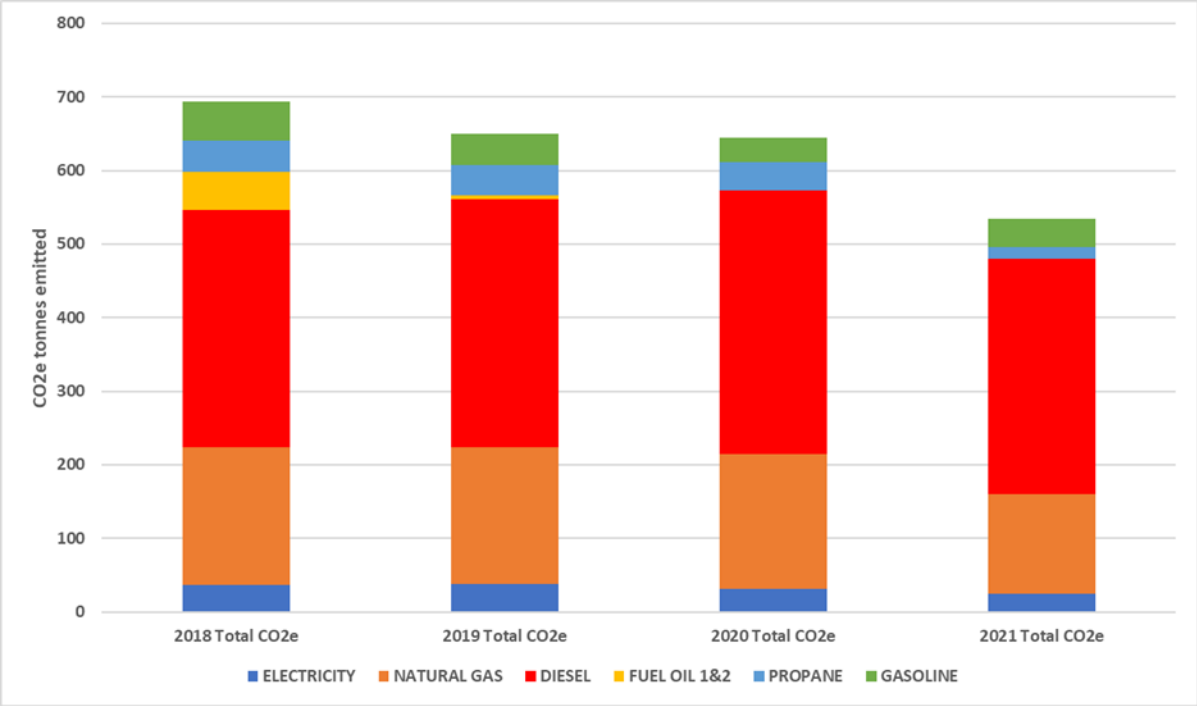

Figure 10: Total Corporate GHG Emissions (tCO2e) by energy type 2018 - 2021

Corporate Energy Consumption 2018 to 2021

In tandem, the Township reduced corporate energy consumption from 14,908 Gigajoules (GJ) to 11,561 Gigajoules (GJ) (see Tables 7 and 8) from fossil fuel combustion by 22.5% over a period of the same 4 years or 5.6% per year

Figures 11 and 12 highlights the reductions of each category and by energy source over the period of 2018 to 2021. As noted, significant emission reductions can be seen in fuel switching (moving from higher GHG emissions generating energy sources to lower ones) from Fuel Oil 1&2 and Propane with a movement towards Electricity.

CATEGORY	2018 – Consumption (GJ)	2021 – Consumption (GJ)	Percentage Change (%)
CORPORATE BUILDINGS	6831	4169	-39%
CORPORATE FLEET	5304	5053	-0.05%
STREETLIGHTS	199	199	0
WASTE	0	0	0
WATER & SEWAGE	2574	2140	-17%
TOTAL	14908	11561	-22.5%

Table 7: Total Corporate Energy Consumption (GJ) Change by Source, 2018 - 2021

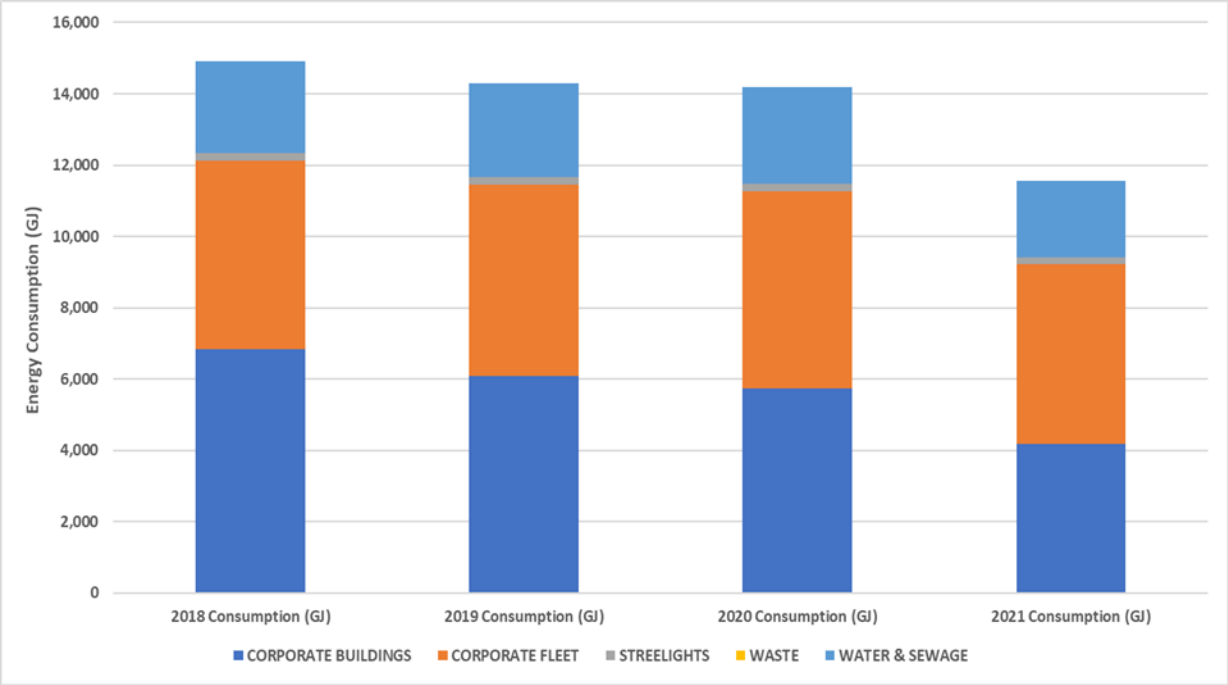

Figure 11: Total Corporate Energy Consumption (GJ) by Source 2018 - 2021

CATEGORY	2018 – Consumption (GJ)	2021 – Consumption (GJ)	Percentage Change (%)
ELECTRICITY	4376	3557	-19%
NATURAL GAS	3801	2685	-29%
DIESEL	4509	4485	-0.01%
FUEL OIL 1&2	726	0	-100%
PROPANE	701	266	-62%
GASOLINE	795	568	-28.5
TOTAL	14908	11561	-22.5%

Table 8: Total Corporate Energy Consumption (GJ) Change by Energy Source 2018 - 2021

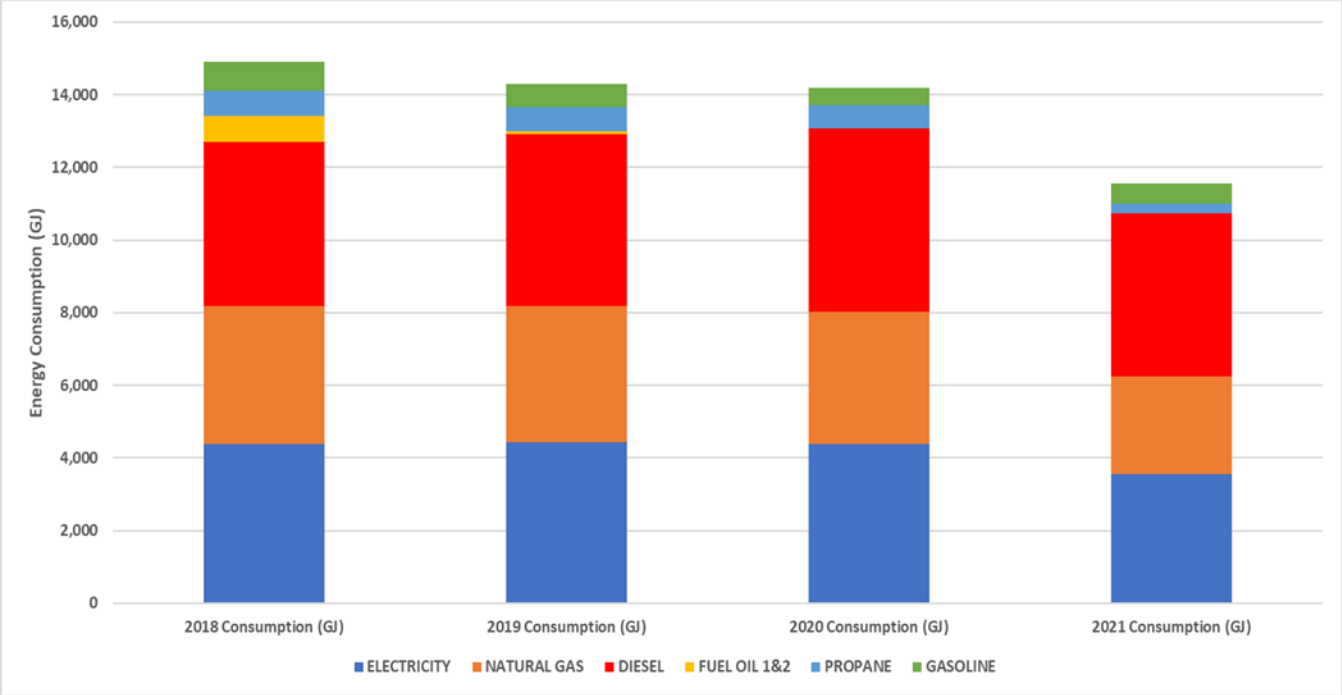

Figure 12: Total Corporate Energy Consumption (GJ) by Energy Source from 2018 to 2021

As noted in the trends of the municipal corporate emissions and energy consumption from 2018 to 2021, the municipal corporate Township of Georgian Bluffs has been reducing energy consumption and the resulting GHG emission reductions from Township operations and services has started the path towards meeting the corporate emissions targets. This Corporate Climate Action Plan (CorCAP) outlines further actions the corporate Township can undertake to meet the established emissions targets and reduce the risks of climate impacts to their assets.

Climate Risk and Impacts- Climate Change Risk Assessment (Adaptation Milestone 1 & 2)

A changing climate leads to increasing risk of extreme weather events (temperature increases, increase extreme precipitation events, flooding, drought).

A Climate Change Risk Assessment (CCRA) was undertaken following the ICLEI (International Council of Local Environmental Initiatives) Canada Building Adaptive & Resilient Communities (BARC) Framework and Engineer Canada's PIEVC (Public Infrastructure Engineering Vulnerability Committee) Engineering Protocol. The purpose of the assessment was to identify changing climate variables and parameters (temperature, precipitation, etc.) and help assess the potential infrastructural vulnerabilities to future climate-related changes and extreme weather.

The overall approach for the climate risk assessment can be summed up in Figure 13

Figure 13: Methodology for determining climate risks for the Township of Georgian Bluffs Assets

The climate variables and parameters that were assessed are outlined in Table 9 below:

Climate Variable	Climate Parameter	Measured by
Temperature	Heat Wave	A meteorological heat wave is defined using the Environment Canada definition as three or more consecutive days in which the maximum temperature is greater than or equal to 30°C. For the purposes of the assessment, the mean number of heat wave occurrences within a given year was considered.
	Freeze-Thaw Cycles	Days where the maximum daily temperature > 0°C and the minimum daily temperature < 0°C. Number of mean occurrences per year.
Precipitation	Heavy Rain/Daily Total Rain	2-year 24-hour duration event total depth of rainfall.
		100-year 24-hour duration event total depth of rainfall.
		50-year 24-hour duration event total depth of rainfall.
		20-year 24-hour duration event total depth of rainfall.
	Freezing Rain	Mean annual freezing precipitation (includes freezing rain and freezing drizzle) hours (mm) per year.
		Mean number of hours with freezing rain (mm) per year.
Extreme Events	High Winds	Mean number of days a year having wind gusts >63 km/h per year.
		Mean number of days a year having wind gusts >90 km/h per year.
	Drought/Dry Period	Mean number of days with less than 0.2 mm of rain (Dry Day) per year.
		Mean annual SPEI (Standardized Precipitation Evapotranspiration Index) values. (Negative = Drier, Positive = Wetter).
	Thunderstorms/ Lightning	Thunderstorm frequency. Mean number of days a year (averaged) at least 1 CG flash (cloud-to-ground discharge) occurred per 20 km by 20 km grid.
Hydrological	Lakeshore/River Flooding/Storm Surge	Determination of flood implications to custodial infrastructure and public infrastructure from flood mapping. Riverine/lakeshore flooding was determined by looking at the water levels/discharge variability of rivers/lakes surrounding Georgian Bluffs site locations.

Table 9: Climate Parameter Definitions

Selection of a climate parameter was based on the climate parameter's potential to affect the vulnerability of the infrastructure and Township assets due to an extreme or persistent occurrence.

Baseline, Current and Future Climate

Climatic and meteorological data (both existing / historic data, as well as future projected climate data) were identified and collected information from readily available existing sources such as local weather stations, Environment Canada, and the Climate Atlas. The climate information is not based on generated

climate analysis. The climate information presented in here is a review of this readily available information.

Climate data for both baseline (historic) information and for three time periods (current, medium-term, and long-term, (i.e., 2022 to 2075 to 2100) were collected and recorded for each climate parameter and identified trends as either increasing, decreasing, no change as presented in Table 10. In summary heatwaves, extreme precipitation rainfall, freezing rain, high winds, thunderstorms/lightning, and flooding show an increasing trend towards the future. Freeze-thaw cycles show a decreasing trend towards the future, and dry days/drought shows no change in the future.

Table 10: Baseline and Future Climate Projections

Climate Change Variable	Climate Change Hazard	Climate Trend	Baseline [1]	Climate Projections[2]
Temperature	**Heat Waves**	**Increasing** ▲	12 per year	Projected to increase from 12 per year to 14- 18 a year by 2040s, 15-20 per by 2070s and 16- 21 by 2100 under RCP 4.5 conditions Projected to increase from 12 per year to 15- 18 a year by 2040s, 16-22 per by 2070s and 18- 23 by 2100 under RCP 8.5 conditions.
	Freeze Thaw Cycles	**Decreasing** ▼	65 days/year	Projected to decrease to 35-55 days a year under both RCP 8.5 & 4.5 conditions.
Precipitation	**Intense Precipitation (5-year 24-hour duration event)**	**Increasing**	63.9 mm	Projected to increase from 63.9 mm to 72.6 – 79.4 (RCP4.5-8.5) mm by 2071-2100.

[1] Baseline data and information were collected from Environment Canada and weather stations in the area of the Township of Georgian Bluffs. Climate projections data was gathered from the Pacific Climate Impacts Consortium (PCIC)/ Climate Atlas, The Climate Atlas uses 24 global climate models for two emissions scenarios (RCP4.5 and RCP8.5). Further details can be obtained here: https://climateatlas.ca/data-sources-and- methods

[2] The climate change projections and risks were undertaken using Representative Concentration Pathways (RCP) 4.5 (Low carbon pathway scenario) and RCP 8.5 (High carbon pathway scenario) for future projections of greenhouse gas emissions and climate hazards. The impacts under RCP 4.5 (Low carbon) and RCP 8.5 (High carbon) were evaluated.

Climate Change Variable	Climate Change Hazard	Climate Trend	Baseline [1]	Climate Projections[2]
		▲		Therefore, becoming a 20-year event from historical baseline.
	Intense Precipitation (100-year 24-hour duration)	**Increasing** ▲	97.1 mm	Projected to increase from 97.1 mm to 110.6 – 123.6 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming an almost 200-year event from historical baseline.
	Intense Precipitation (50-year 24-hour duration)	**Increasing** ▲	90.2 mm	Projected to increase from 90.2 mm to 102.6 – 114.3 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming a 100-year event from historical baseline.
	Intense Precipitation (20-year 24-hour duration)	**Increasing** ▲	80.4 mm	Projected to increase from 80.4 mm to 91.6 – 101.5 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming a 50-year event from historical baseline.
	Freezing Rain	**Increasing** ▲	26.4 mm	Some studies have found that freezing rain could occur more often from an increase in near-freezing temperatures. Additional studies (Cheung et al. 2011) found a projected increase of 10-50% in freezing rain events in Southern Ontario during the coldest month (Jan) no change in Dec & Feb and a decrease of 5-20% during shoulder seasons (Nov, Apr, Mar) for three future time periods (2016–2035, 2046–2065, 2081–2100) and for 3 durations (>1hr, >4hr, >6hr).

Climate Change Variable	Climate Change Hazard	Climate Trend	Baseline [1]	Climate Projections[2]
Extreme Events	**High Winds**	**Increasing** ▲	21.6 days for wind gusts >63 km/h per year 1.3 days for wind gusts >90 km/h per year	Daily wind gust events are projected to increase by 2080 to 2100 period. A study done by Cheung et al. 2014, predicts that there will be a 10-30% increase for Spring, and 30-50% increase for winter, summer and fall, in the number of gust events with wind gusts exceeding 70 km/hour by 2080-2100, under RCP 8.5 for Wiarton area. It should be noted that wind projections tend to be more uncertain than precipitation and temperature projections as there is a 15% uncertainty on percentage increase in frequency of future daily winds gust >70 km/h for Southern Ontario.
	Thunderstorms/Lightning	**Increasing** ▲	25 – 30 days	A warmer climate means that there is more energy available for thunderstorm development. Some studies have projected an increase in both convective available potential energy and increase in cloud vertical depth under RCP 8.5 scenarios). These components impact thunderstorm development and make it more likely for them in the future, however there is no scientific evidence on the frequency or intensity of thunderstorms for future projections.
	Drought/Dry Periods	**No change** o	191 Dry Days/year SPEI* Value = 0.6	No significant change

Climate Change Variable	Climate Change Hazard	Climate Trend	Baseline [1]	Climate Projections[2]
Hydrological	**Lakeshore/River Flooding/Storm Surge**	**Increasing** ▲	Georgian Bay Historical 100-Year CMIP6 (Climate Projection Data) Flood Event – 2.13 m	Expected to increase to 2.47 m under RCP 8.5 conditions.

Table 10: Baseline and Future Climate Projections

*Standardized Precipitation Evapotranspiration Index

Climate Impacts and Risks to Township Assets

For many municipal assets and services, climate change makes it more difficult to deliver desired levels of service. It amplifies risks and increases costs required to manage these risks. The greatest potential impacts can be seen to transportation systems (roads and bridges), buildings, water and wastewater management systems. These assets represent the majority of local government infrastructure assets.

Climate change introduces impacts that may:

- Amplify the risk of asset failure and reduce asset service life through added and/or compounding stress on existing infrastructure or cascading impacts of other infrastructure systems.
- Reduce the level of service existing infrastructure systems can provide.
- Increase the cost of managing risks and delivering the same level of service.

In addition, one of the most notable impacts of climate change over recent years has been the number and impact of severe weather events. Summer storms with intense rainfall, and strong high winds have had an increasing impact in Ontario damaging trees, causing flooding and damaging buildings. Increasing warm weather and temperatures have occurred causing excessive and rapid winter melting and freeze-thaw. These weather events demand an immediate response by the Township to reopen roads, make safe public spaces and ensure public services can be accessed. The scale and nature of these events is demanding that normal operations are ceased, while a response is mounted, frequently extending over several weeks, during which time normal operations seeking to proactively address infrastructure maintenance are delayed or deferred. This pressure increasing diminishes the resource availability to proactively address future climate change impacts and maintain resilient infrastructure.

Proactive risk management, adequate maintenance of municipal assets, and timely asset improvements or renewal can improve the overall resilience of asset systems to impacts of climate change, whereas not keeping up with these requirements can make systems more vulnerable to climate change.

The following identifies potential risks and hazards to corporate municipal Township assets as a result of the climate change projections and the high-level climate risk assessment. Further investigation of the hazards and risks of a changing climate need to be refined and incorporated into the Township's Asset Management Plan as required under Ontario Regulation 588/17.

Roads

Climate hazards of Heat waves, Freeze-thaw cycles, extreme precipitation events, freezing rain, and lakeshore flooding and storm surges present increasing impacts and risks to roads and road maintenance. These impacts may include:

- Increased frequency/severity of thermal cracking, buckling, rutting, increasing potholes frost heave, and thaw weakening of roads.
- Extreme precipitation leading to road drainage issues, potentially leading to flooding on the roads, water infiltration into cracks and through asphalt on the roads.
- Freezing rain leading to slippery conditions on roads, leading to increased use of salt or sand on roadways to maintain traction.

- Increased risk of flooding from storm surges on roads near shoreline areas including potential risk of soil instability and slope instability, leading to road damage from erosion or embankment failure.

Bridges & Culverts

Climate hazards of Extreme precipitation events, freezing rain, high winds, and lakeshore flooding and storm surges present increasing impacts and risks to bridges, culverts and their maintenance. These impacts may include:

- Extreme precipitation leading to flooding events as design standards are for past climate events and not extremes,
- Drainage issues, water flowing over in culverts, blockage of culverts, debris and water volume increase flowing under bridges, potential for embankment erosion.
- Bridges, and low-lying roads have a high risk of being inundated or damaged by high water flows.
- High winds leading to wind swept debris causing blockage in culverts or in waterways under bridges.

Water and Wastewater

Climate hazards of Heat waves, Extreme precipitation events, freezing rain, drought, and lakeshore and river flooding and storm surges present increasing impacts and risks to water and wastewater treatment, service connections and maintenance. These impacts may include:

- Increased water demands leading to system capacity issues and stress on water sources.
- Increased energy costs due to increased pumping demands.
- Increased inflow and infiltration leading to system capacity more frequently exceeded (leading to surface surcharging and basement flooding).
- Buildings, tankage, housed process equipment affected by flooding caused by extreme rainfall or by lakeshore and river flooding.
- Drought leading to loss of reliable water sources . Reduced source water quality and loss of potable water.
- Changes to wastewater effluent characteristics from heat waves and intense precipitation.

Buildings

The Township of Georgian Bluffs operates and maintains eleven facilities and buildings that consist of the main Township administration centre and office, three water treatment plants, three road depots, three community and recreational centres, and an emergency service building.

A PIEVC Climate Risk and Vulnerability Assessment (CRVA) was undertaken on several building assets to determine the impact of climate hazards on these facilities through impacts on the buildings and associated infrastructure of the locations including landscape.

Near-term (2022 to 2040) high climate risks were identified for climate hazards of extreme precipitation - 1:5 Yr/24 Hour depth Rainfall events and 1:50 Yr/15 min depth Rainfall events, increased thunderstorms and lighting, and flooding. Extreme precipitation events and intense rainfall can lead to risks of increase land flooding as landscaped and drainage areas get saturated with water infiltration and water flowing

towards buildings and entering building foundations. Water can infiltrate into building windows and facades through broken or cracked seals and into roofs that do not drain properly and lead to water pooling on roofs.

Infrastructural risks identified in the CCRA were found to be risks to drainage, landscape with roadways and parking areas, and building envelope and structure (roofs, cladding, windows, doors).

Potential risk of shoreline flooding and was identified for two facilities located under 1 kilometer away from the Georgian Bay shorelines and in floodplain areas. These facilities should be examined further as to their flooding potential in consultation with the Grey Sauble Conservation Authority who maintains flood maps and control in floodplain areas.

Health & Safety and Operations

Climate events such as extreme heat with increasing heatwaves, increasing extreme rainfall events, freezing rain and precipitation, high winds, thunderstorms and lightning can lead to increased health and safety risks for Township outside workers and contractors, and potential power outages to facilities that depend on power to operate and maintain comfortable temperatures for inside Township workers and the public that uses recreational facilities and community centers.

Adaptation and Asset Management Actions – Moving to Milestone 3

The Township is undertaking an Asset Management Review to meet the requirements of Ontario Regulation 588/17 and has been provided an Asset Management Risk Framework with a Climate hazard component to help collect on-going data and service levels regarding their assets and determine the climate risk and impacts on specific assets classes and meeting levels of service for each asset class.

By using the Asset Management Risk Framework with the Climate Hazards component, the Township will be able to determine specific actions to address climate risks and move from Milestone 2 to Milestone 3 of the ICLEI BARC program to address climate risks and prepare Adaptation actions.

Corporate Climate Change Plan Actions

The following are actions that the Township will undertake in the near-term 2024 to 2040) to continue to reduce emissions and energy consumption to meet emissions targets and adapt to a changing climate

Focus Area 1: Buildings

1. Complete Energy Audits at all buildings by 2030 to identify operational changes that can be implemented to reduce energy consumption in facilities.
2. Implement operational changes and technological changes to reduce energy consumption where possible.
3. Develop and implementation energy management plans for assets and buildings with energy targets and include reactive, preventative, and predictive maintenance to prevent common sources of energy waste in building energy by 2030.
4. Complete transition to low energy LED lighting in all buildings by 2030.
5. Review all Township buildings and facilities with a Climate Change lens through a Facilities Review to identify potential renewal, replacement and retrofit projects.
6. Continue to update and replace building heating systems with an aim of eliminating Natural Gas and Propane as a primary heating fuel source use in all facilities by 2035.
7. Increase roof and, where appropriate, ground mounted solar to reduce dependence on grid supplied electricity with an objective to install at least 50kw of solar panels (solar photovoltaic) by 2035 offsetting electricity consumption equivalent to a building.
8. Incorporate electric vehicle changing where possible at Township buildings to support a transition to green fleet.
9. Any new building built by the Township should be built at least be Net Zero standards.
10. Complete a Corporate Asset Management Plan that includes Climate Change considerations by 2026.
11. Implement Climate Change Adaptive measures with a particular focus on the Inter Township Fire Office, Shallow Lake Arena, Derby Community Centre, and Derby Roads Shop through Asset Management Planning, developing a 10-year capital budget, a Facilities Improvement and Maintenance Plan and Fire Master Plan.
12. Implement, where possible, Low Impact Design(LID) principles on building retrofits and new builds including LID landscaping, drainage, and permeable pavement types

Cumulative emission reduction estimates for these actions are estimated to be approximately 230 tonnes CO2e.

Focus Area 2: Corporate Fleet and Equipment

1. Undertake a Green Fleet and Equipment Strategy by end of 2024 to inform the procurement and replacement of vehicles toward at least a 25 percent reduction in fleet related GHGs by 2028. The Green Fleet and Equipment Strategy should include a comprehensive fleet and equipment inventory and identify alternative equipment and fuel sources and forecast realistic availability.
2. Complete a Corporate Asset Management Plan that includes Climate Change considerations by 2026.
3. Continue to implement best management practices in fleet management and maintenance to ensure vehicles perform at optimum levels and efficiency.
4. Implement an Anti-Idling policy for Township staff by 2025.
5. Consider the development of energy efficiency standards or the use of low carbon equipment in contracted services and operations.

Cumulative emission reduction estimates for these actions are estimated to be approximately 197 tonnes CO2e.

Focus Area 3: Corporate Actions

1. Update the Corporate Climate Action Plan in 2028 and every 5 years thereafter with GHG and energy emissions updates included.
2. Consider how to integrate a Climate Change Lens into all decisions of Council.
3. Offer educational opportunities to inform and educate staff on Corporate Actions to address Climate Change.
4. Integrate an Introduction to Climate Change to all new staff on boarding processes.
5. Assess training and information needs for staff to ensure informed response to extreme weather events.
6. Consider development of an extreme weather policy that identifies the weather conditions that will close municipal facilities.
7. Encourage active transportation, mode shifting, ride sharing by employees and in the community.

Emission reduction estimates not applicable for these actions.

Focus Area 4: Streetlights

1. Undertake an updated review of Municipally support street lighting and perform any remaining upgrades to Dark Sky approved low energy LED lighting types by 2028.
2. Develop a street lighting standard for any new development implementing street lighting that will be managed by the Township to low energy, dark sky approved LED lighting.

Cumulative emission reduction estimates for these actions are estimated to be 1 tonnes CO2e.

Focus Area 5: Waste

1. Undertake a Comprehensive Corporate Waste Review to include a Corporate Waste Recycling and Diversion Program in 2025.
2. Implement recommendations from the Waste Review to reduce waste generated from operations.

Cumulative emission reduction estimates for these actions are estimated to be 20 tonnes CO2e.

Focus Area 6: Water and Sewage

1. Develop and implementation energy management plans for assets and buildings with energy targets and include reactive, preventative, and predictive maintenance to prevent common sources of energy waste in building energy.
2. Complete transition to low energy LED lighting in all buildings by 2030.
3. Review all Township facilities with a Climate Change lens through a Facilities Review to identify potential renewal, replacement and retrofit projects.
4. Complete a Corporate Asset Management Plan that includes Climate Change considerations by 2026.
5. Encourage water conservation by employees and in the community and water metering of corporate facilities.

Cumulative emission reduction estimates for these actions are estimated to be 21 tonnes CO2e.

The Cumulative Impacts of Energy and Emissions Reductions for the Township of Georgian Bluffs

It is estimated that the combined impact of these actions result in approximately 470 Tonnes CO2e/year cumulative reductions as shown in Figure 14.

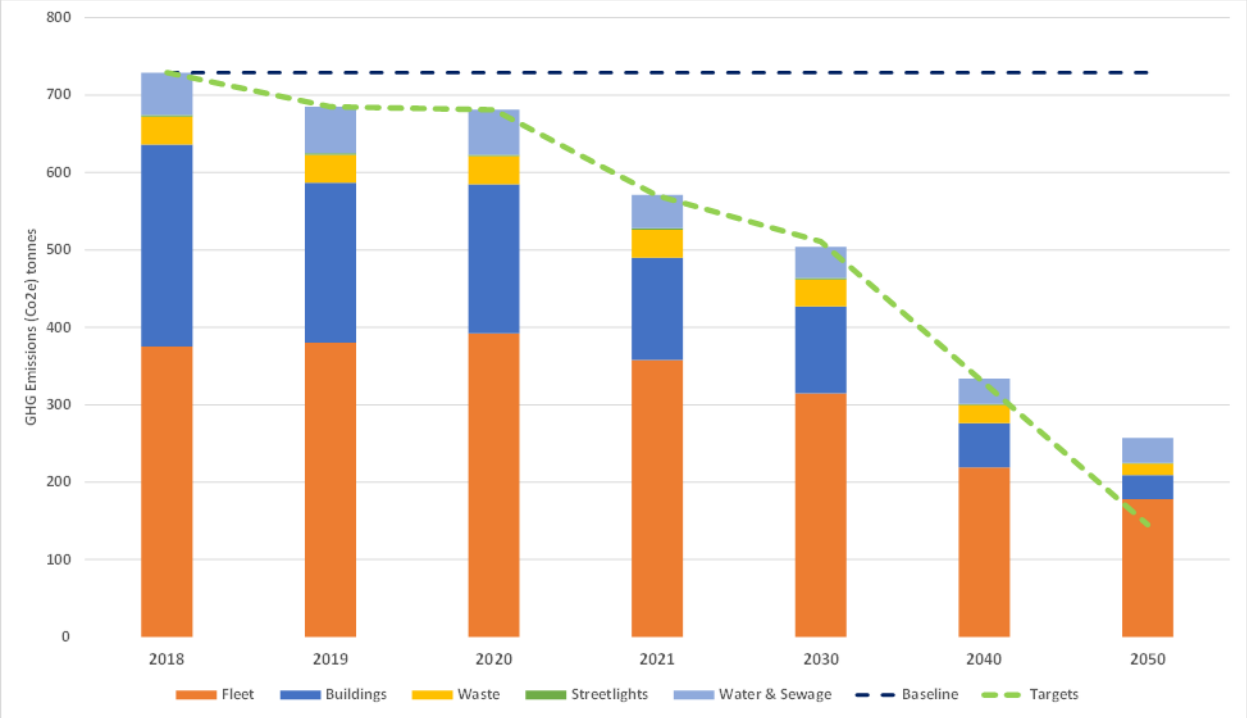

Figure 14: Cumulative emissions reductions from Identified Corporate Climate Change Actions 2018-2050

Implementation

The Corporate actions laid out in the Corporate Climate Action Plan are specific to the Township, and therefore, implementation will be carried out by the Township and staff.

As the Township of Georgian Bluffs is committed to supporting community actions laid out in Grey County's Climate Change Action Plan, the Township will refer to Grey County's implementation plan for community actions.

Implementation of these climate and energy actions requires Corporate leadership, integration into Corporate planning, operations and services, staff effort, staff education and innovation, current and new technology (some still emerging), and resources including time, financing and staff, and partnerships within and outside of the township and Grey County to achieve and surpass the Corporate targets.

An implementation plan for the corporate actions can be found in Table 11. The implementation plan includes the following items:

Timeframe: Length to begin implementation of the action:

- Ongoing/Near Term: Already underway, will be continued/expanded with existing resources
- Immediate term: Start working now (2023)
- Short-term: Start work in 1-3 years (2024-2026)
- Medium term: Start work in 3-5 years (2026- 2028)
- Long term: Start work beyond 5 years (2028 +)

Relative Cost: Estimated cost range for implementing each action:

- N/A: Cost is covered by existing staff capacity or operating budgets
- Low Cost: $0 - $100,000
- Medium Cost: $100,000 - $500,000
- High Cost: $500,000+

Relative GHG Impact: Where actions have quantifiable emission reduction associated, the relative impact in respect to all other actions is identified by a range. The following values were used to assign the range based on an action's cumulative reduction potential:

- Low Impact: < 25 tCO2e
- Medium Impact: 25 – 100 tCO2e
- High Impact: > 100 tCO2e

Focus Area	Action	Timeframe	Relative Cost	Relative emissions Impact	Mitigation (M) or Adaptation (A)
Buildings	Complete Energy Audits at all buildings	Ongoing/Near Term	Low	Low	M
	Implement operational changes and technological changes to reduce energy consumption where possible	Ongoing/Near Term	Low	Medium	M
	Develop and implementation energy management plans for assets and buildings	Short-term	Low	Medium	M
	Transition to low energy LED building lighting	Short-term	Low	Low	M
	Review all Township buildings and facilities with a Climate Change lens	Medium term	Low	N/A	M
	Continue to update and replace building heating systems with an aim of eliminating Natural Gas and Propane	Medium term	Low to Medium	High	M
	Increase roof and, where appropriate, ground mounted solar	Medium term	Medium	Medium	M
	Incorporate electric vehicle changing where possible	Medium term	Low to Medium	Low	M

Focus Area	Action	Timeframe	Relative Cost	Relative emissions Impact	Mitigation (M) or Adaptation (A)
	Any new building built by the Township should be built at least be Net Zero standards.	Long term	Medium to High	High	M
	Complete a Corporate Asset Management Plan that includes Climate Change	Short term	Low	N/A	M/A
	Implement Climate Change Adaptive measures	Medium term	Low to Medium	N/A	A
	Implement, where possible, low impact design principle on building retrofits and new builds	Medium term	Low	N/A	A
Corporate Fleet and Equipment	Undertake a Green Fleet and Equipment Strategy	Short term	Low	Low to Medium	M
	Complete a Corporate Asset Management Plan that includes Climate Change	Short term	Low	N/A	M/A
	Continue to implement best management practices in fleet management and maintenance	Ongoing/Near Term	Low	Low	M
	Implement an Anti-Idling policy for Township	Short term	Low	Low	M
	Analyze fuel usage on a per vehicle basis	Short term	Low	Low	M

Focus Area	Action	Timeframe	Relative Cost	Relative emissions Impact	Mitigation (M) or Adaptation (A)
	Consider the development of energy efficiency standards or the use of low carbon equipment in contracted services and operations.	Medium term	Low to Medium	Low	M
Corporate Actions	Update the Corporate Climate Action Plan in 2028 and every 5 years	Medium term	Low	N/A	M/A
	Consider how to integrate a Climate Change Lens into all decisions of Council	Medium term	Low	N/A	M/A
	Offer educational opportunities to inform and educate staff on Corporate Actions to address Climate Change.	Short term	Low	Low	M/A
	Integrate an Introduction to Climate Change to all new staff on boarding processes	Short term	Low	Low	M/A
	Assess training and information needs for staff to ensure informed response to extreme weather events.	Short term	Low	N/A	A
	Consider development of	Short term	Low	N/A	A

Focus Area	Action	Timeframe	Relative Cost	Relative emissions Impact	Mitigation (M) or Adaptation (A)
	an extreme weather policy				
	Encourage active transportation, mode shifting, ride sharing by employees	Short term	Low	Low	M
Streetlights	Undertake an updated review of Municipally support street lighting	Short term	Low	Low	M
	Develop a street lighting standard for any new development	Medium term	Low	Low	M
Waste	Undertake a Comprehensive Corporate Waste Review	Short term	Low	Low	M
	Implement recommendations from the Waste Review to reduce waste	Short term	Low	Low	M

Table 11: Climate Change Implementation Plan

Funding Opportunities

Funding for actions identified in the Corporate Climate Action Plan will be sought through grants and applications including, but not limited to

The Federation of Canadian Municipalities (FCM) through their Green Municipal Fund (GMF) provides grants and loans and covers municipal environmental projects focused on five priority sectors: energy, transportation, water, waste and land use and covers projects at all stages, from plans and studies, to pilot projects, to capital projects.

Infrastructure Canada ‘s Investing in Canada Infrastructure Program contains both Green Infrastructure Stream and a Community, Culture and Recreation Infrastructure stream that can provide funding and support for climate change mitigation, adaptation, resilience and disaster mitigation, and environmental quality.

The funding environment and requirements for environmental quality improvements and addressing climate action change based on Federal and Provincial priorities, current funding opportunities require investments to meet climate change objectives that meet the highest emissions benefits including Net Zero. These requirements must be considered at a minimum for projects from new builds to retrofits, and the requirements for such benefits appear to be increasing soon.

Township staff will identify opportunities for funding of climate actions that can reduce emissions, save energy, reduce operation costs and prepare Township infrastructure for the impacts of climate change.

Monitoring Progress and Reporting

Monitoring and evaluating the implementation of the Corporate Climate Action Plan is critical in ensuring its effectiveness and recording progress and results.

Table 12 and 13 below provides a set of performance indicators that will help the Corporation monitor progress over time. The indicators below are based on best practices and uses readily available data sources.

Key Performance Indicator	Measurement
Building Energy Intensity	GJ/m^2
Building Emissions Intensity	GHG/m^2
Fleet Fuel Efficiency	Unit fuel/km
Fleet Total Fuel Used	Total L of fuel types used
Number of Vehicles in Different Classes in the Fleet	# of vehicles with greater fuel efficiency, hybrid, Electric etc. introduced in fleet
Water Efficiency	GJ/L
Wastewater Efficiency	GJ/L
Renewable Energy Generation	KWh produced
Renewable Energy Generation Percentage	% of energy demand from renewable energy
Carbon Offsets	Amount GHG (tCO2) offset

Table 12: Key Performance Indicators for Mitigation/Reduction Actions

Key Performance Indicator	Measurement
Building Damage	# of reported damage to buildings from extreme weather events
Infrastructure Damage	# of reported damage to infrastructure from extreme weather events
Service disruptions	# service disruptions Backup power installed (yes/no) # Service disruptions due to equipment failure
Flooding Events	# of reported buildings, roads experiencing flooding Vulnerable bridges and embankment identified (yes/no)
Freeze-Thaw Damage	# of reported damage to infrastructure from freeze and thaw cycles
Extreme precipitation	Water management infrastructure upgraded (yes/no) Stormwater management infrastructure upgraded (yes/no)

Table 13: Key Performance Indicators for Adaptation Actions (Reducing Risk)

The CorCAP is considered a living document that can be updated and adapted to changing provincial and federal legislative initiatives and changing actions of the Grey County Climate Action Plan.

Energy and emissions tracking and adaptation actions should continue and implemented through corporate asset management and reporting. The energy and emission inventory should be reviewed and revised at most every 5 years to ensure that categories and activities reflect the operations of the municipal corporate Township of Georgian Bluffs and ensure that actions remain on track to meet the emission reduction targets. Updates to the Plan will be updated based on the current context, Council priorities and new opportunities.

Conclusion

By implementing this Corporate Climate Action Plan, the Township of Georgian Bluffs is fulfilling its responsibility to work in the best interests of the community. The knowledge contained in this plan will enable the Township to make informed decisions to limit GHG emissions that are contributing to climate change and minimize the impacts that climate change will have on Township operations and services. By implementing this plan, the Township will take climate change into consideration as part of ongoing municipal operations and services and continually strive to reduce its environmental footprint by reducing energy consumption and greenhouse gas emissions to minimize climate change.

Appendix A – Definitions

Adaptation: Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the effects of climate change on built, natural, and social systems.

Anthropogenic: Environmental change caused or influenced by people, either directly or indirectly.

Baseline: Estimation of the current (2018) energy use and greenhouse gas emissions.

Building Retrofit: Upgrades to a building's envelope (walls, floor, ceiling), windows, doors, HVAC (heating, ventilation, and air conditioning) systems, and lighting that reduces the heating and cooling needs of a building and operate with greater energy efficiency.

Business-as-Usual (BAU): The Business-as-Usual (BAU) scenario is developed to understand future energy consumption, energy costs and emissions for the Township of Georgian Bluffs, assuming no action is taken to reduce energy or emissions.

Carbon Capture: the process of trapping, capturing, removing or storing carbon dioxide (CO2) produced by burning fossil fuels or other chemical or biological processes and storing it in such a way that it is unable to affect the atmosphere, with the aim of mitigating the effects of climate change.

Carbon Offsets: Any activity that leads to either a reduction in GHG emissions (e.g. renewable energy, energy efficiency) or an increase in carbon storage (e.g. through land restoration, agricultural practices or the planting of trees) – that is used to compensate or balance for a GHG emission that occurs elsewhere.

Climate Change: Changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the buildup greenhouse gases which trap heat and reflect it back to the earth's surface.

Climate Change Lens: The main goal of the Climate Lens is to raise awareness of climate change risks and impacts associated with projects and encourage improved choices by project planners, designers and decision-makers. Has two components: GHG Emissions and Mitigation, which looks at the anticipated greenhouse gas (GHG) emissions impact of an infrastructure project; and Climate Resiliency, which employs a risk management approach to anticipate, prevent, withstand, respond to, and recover and adapt from climate change related disruptions or impacts.

Climate Projections: Projections of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols. These projections depend upon the climate change (or emissions) scenario used, which are based on assumptions concerning future socioeconomic and technological developments that may or may not be realized and are therefore subject to uncertainty.

Climate Change Risk Assessment (CCRA): A formal analysis of the vulnerabilities, exposure and climate change hazards and the consequences, likelihoods, and responses to the impacts of climate change. They can help organisations identify their climate change related risks or to test their existing risk management strategies under climate change and therefore identify areas where new strategies are needed.

Cloud to Ground Discharge (CG flash): Lightning that occurs between the cloud and the ground. Commonly refereed to as a lightning strike.

Corporate Climate Change Action Plan (CorCAP): A corporate-wide plan framework document for measuring, tracking, energy and reducing greenhouse gas emissions from municipal corporate operations and adopting climate adaptation measures.

Dark Sky Lighting: Dark Sky lighting is designed to direct light to the ground, not up into the sky where it can contribute to light pollution.

Gigajoule (GJ): A derived unit of energy in the International System of Units. It equals one billion Joules.

Greenhouse Gas (GHG) Emissions: Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation, emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and chlorofluorocarbons (CFCs) are the six primary greenhouse gases in the Earth's atmosphere in order of abundance. Greenhouse gas emissions are measured in tonnes of carbon dioxide equivalent (tCO_2e).

Intergovernmental Panel on Climate Change (IPCC): An intersectional body established under the United Nations to assess the science, impacts, and response options to climate change.

Kilowatt-Hour (kWh): A kilowatt-hour is a unit of electrical energy used as the basic billing unit and equals the use of one thousand watts of electricity in one hour.

LED (light-emitting diode): An electric light that produces light using light-emitting diodes (LEDs) instead of a heated filament wire. An LED light produces LED lighting products produce light up to 90% more efficiently than incandescent light bulbs.

Low Impact Design/Development (LID): A land planning and engineering design approach to manage stormwater runoff and maintain the natural or pre-development hydrology of a site or area. The basic principle of LID to use nature as a model and manage rainfall at the source – where rain falls, to mimic the natural water balance by focusing on practices that promote increased evapotranspiration, infiltration and groundwater recharge, and lower surface runoff volumes and flow rate. This is accomplished through sequenced implementation of runoff prevention strategies, runoff mitigation strategies, and finally, treatment controls to remove pollutants.

Mitigation: The promotion of policy, regulatory, and project based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere.

Net Zero: Achieved through the reduction of anthropogenic emissions of greenhouse gases with the goal of balancing emissions produced and emissions removed from the atmosphere. It is important to note net zero emphasizes a commitment to reducing greenhouse gas emissions as much as possible.

Relative Concentration Pathway (RCP): a greenhouse gas concentration trajectory adopted by the IPCC. They are dependent trajectories of future greenhouse gas concentrations and different pollutants caused by different human activities. RCPs quantify future greenhouse gas concentrations and the radiative forcing (additional energy taken up by the Earth system), due to increases in climate change pollution.

Each RCP is associated with plausible combinations of projected population growth, economic activity, energy intensity, and socio-economic development.

Resilience: The capacity of a system, community, or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

Solar Photovoltaic: The use of solar cells to convert energy from the sun into electric energy, either with on-site solar panels or offset site generation distributed through the electricity grid.

SPEI (Standardized Precipitation Evapotranspiration Index): designed to measure drought conditions through precipitation and potential evapotranspiration. SPEI has an intensity scale in which both positive and negative values are calculated, identifying wet and dry events.

Sustainable Development: A principle that aims to meet human development goals while also enabling natural systems to provide necessary natural resources and ecosystem services to humans. The desired result is a society where living conditions and resources meet human needs without undermining the planetary integrity and stability of the natural system. Sustainable development is considered to have three pillars - the environment, economy and society.

Tonnes of Carbon Dioxide Equivalent (tCO2e): The standard unit for counting greenhouse gas (GHG) emissions.

Vulnerability: The sensitivity of predisposition to be adversely affected by climate change. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Weather: The day-to-day state of the atmosphere, and its short-term variation in minutes to weeks.

Appendix B – GHG Inventory and Sources

Gas	100-Year GWP
CO_2	1
CH_4	25
N_2O	298

Table 14: Global Warming Potential Factors

Inventory Year	Coefficient (kg CO_2e / kWh)	Coefficient (t CO_2e / kWh)	Coefficient (kg CO_2 / kWh)	Coefficient (t CO_2 / kWh)	Coefficient (kg CH4 / kWh)	Coefficient (t CH4 / kWh)	Coefficient (kg N2O / kWh)	Coefficient (t N2O / kWh)
1990	0.2	0.0002	0.2	0.0002	0.000002	0.000000002	0.000003	0.000000003
2000	0.3	0.0003	0.3	0.0003	0.000011	0.000000011	0.000005	0.000000005
2017	0.02	0.00002	0.02	0.00002	0.000004	0.000000004	0.000001	0.000000001
2018	0.03	0.00003	0.029	0.000029	0.000001	0.000000001	0.000001	0.000000001
2019	0.03	0.00003	0.03	0.00003	0.000001	0.000000001	0.000001	0.000000001
2020	0.03	0.00003	0.03	0.00003	0.000001	0.000000001	0.000001	0.000000001
2021	0.03	0.00003	0.03	0.00003	0.000001	0.000000001	0.000001	0.000000001

Table 15:Electricity Coefficient for Ontario Year-over-Year

Root Source: National Inventory Report 1990 - 2019, Electricity Generation and GHG Emission Details for Ontario 2019

Data presented includes emissions, generation and intensity for public utilities

Fuel Type	Factor	g/m3	Emission Factor (t/m3)
Natural Gas	CO_2	1888	0.001888
	CH_4	0.037	0.000000037
	N_2O	0.035	0.000000035
Propane	CO_2	1515	0.001515
	CH_4	0.024	0.000000024
	N_2O	0.108	0.000000108
Fuel Oil	CO_2	2753	0.002753
	CH_4	0.026	0.000000026
	N_2O	0.006	0.000000006

Table 16: Stationary Combustion Emission Factors by Fuel Type

Root Source: National Inventory Report 1990 - 2019, Sources and Sinks in Canada

Fuel Type	CO2 (kg/L)	CH4 (g/L)	CH4 (kg/L)	N20 (g/L)	N20 (kg/L)
Motor Gasoline	2.307	0.140	0.00014	0.022	0.000022
Diesel Fuel	2.681	0.068	0.000068	0.21	0.00021
Natural Gas	0.0019	0.0090	0.000009	0.000060	0.00000006
Propane	1.515	0.640	0.00064	0.028	0.000028
Ethanol	1.508				
Biodiesel	2.472				
Electric	0	0	0	0	0

Table 17: Mobile Fuel Combustion Factors

Root Source: National Inventory Report 1990 - 2019, Sources and Sinks in Canada, The Climate Registry 2021 - Default Emission Factors

Vehicle Type	Fuel Type	CO2 (kg/L)	CH4 (g/L)	CH4 (kg/L)	N20 (g/L)	N20 (kg/L)
Light Duty Vehicle	Motor Gasoline	2.307	0.140	0.00014	0.022	0.000022
Light Duty Vehicle	Diesel Fuel	2.681	0.068	0.000068	0.21	0.00021
Heavy Duty Vehicle	Motor Gasoline	2.307	0.290	0.00029	0.047	0.000047
Heavy Duty Vehicle	Diesel Fuel	2.681	0.068	0.000068	0.21	0.00021

Table 18: Mobile Combustion Vehicle Type Factors

Root Source: National Inventory Report 1990 - 2019, Sources and Sinks in Canada, The Climate Registry 2021 - Default Emission Factors

Appendix C – Climate Hazards – Climate Data

Introduction

This technical brief presents a set of climate parameters describing the climatic and meteorological phenomena relevant to Georgian Bluffs Assets and provides input into the broader Climate Change Risk Assessment The climate analysis is not meant to be exhaustive. The climate information presented in this brief is not based on analyses generated through this project, but rather a review of readily available information from existing sources. As climate science is continually advancing, this review should not be construed as a comprehensive and permanent characterization of historic or future climate projections and should be reviewed and revised periodically.

The overall approach for this climate risk assessment can be summed up in Figure 15.

Figure 15: Methodology for Steps required to determine Climate Risks for Georgian Bluffs assets.

List of Climate Variables

Once the designated sites were grouped a preliminary "long" list of climate variables was developed based on climate events and change factors identified in Appendix A of the PIEVC Protocol.

The list was refined based on climatic and meteorological phenomena deemed relevant to the Georgian Bluffs Region and its Assets. Justification for selection of a climate parameter was based on the parameter's potential to affect vulnerability to the infrastructure and its components due to an extreme or persistent occurrence.

The "Short" list of climate variables assessed is outlined below:

1. Drought/Dry Days
2. Thunderstorms/Lightning
3. Heat Waves
4. High Winds
5. Freeze Thaw Cycles
6. Heavy Rain/Daily Total Rain (IDF)
7. Freezing Rain

Once parameters were selected and shortlisted, they were then defined below in (Table 19)

Parameter	Measured by
Heat Wave	A meteorological heat wave is defined using the Environment Canada definition as three or more consecutive days in which the maximum temperature is greater than or equal to 30°C. For the purposes of the assessment, the mean number of heat wave occurrences within a given year was considered.

Freeze-Thaw Cycles	Days where the maximum daily temperature > 0°C and the minimum daily temperature < 0°C. Number of mean occurrences per year.
Heavy Rain/Daily Total Rain (IDF)	2-year 24-hour duration event total depth of rainfall.
	100-year 24-hour duration event total depth of rainfall.
	50-year 24-hour duration event total depth of rainfall.
	20-year 24-hour duration event total depth of rainfall.
Freezing Rain	Mean annual freezing precipitation (includes freezing rain and freezing drizzle) hours (mm) per year.
	Mean number of hours with freezing rain (mm) per year.
High Winds	Mean number of days a year having wind gusts >63 km/h per year.
	Mean number of days a year having wind gusts >90 km/h per year.
Drought/Dry Period	Mean number of days with less than 0.2 mm of rain (Dry Day) per year.
	Mean annual SPEI (Standardized Precipitation Evapotranspiration Index) values. (Negative = Drier, Positive = Wetter).
Thunderstorms/Lightning	Thunderstorm frequency. Mean number of days a year (averaged) at least 1 CG flash (cloud-to-ground discharge) occurred per 20 km by 20 km grid.
Lakeshore/River Flooding/Storm Surge	Determination of flood implications to custodial infrastructure and public infrastructure from flood mapping.

Table 19: Climate Parameter Definitions

Climate Data Sources

Historical

The high-level analysis of historical information for the study area was based on data from a variety of sources, including:

- Adjusted and Homogenized Canadian Climate Data (AHCCD) (Available at https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/adjusted-homogenized-canadian-data.html)
- Environment and Climate Change Canada's Climate Normals (available at https://climate.weather.gc.ca/climate_normals/index_e.html)
- Environment and Climate Change Canada's Climate Data Online (available at https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data.html).
- Environment and Climate Change Canada's Canadian Daily Climate Data (available at https://climate-change.canada.ca/climate-data/#/daily-climate-data).
- Environment and Climate Change Canada's daily climate records (LTCE) (available at https://climate-change.canada.ca/climate-data/#/daily-climate-records).
- ECCC Canadian Gridded Temperature and Precipitation Anomalies (CANGRD) (available at https://climate-change.canada.ca/climate-data/#/historical-gridded-data).
- ECCC Regional Deterministic Precipitation Analysis (available at https://climate-change.canada.ca/climate-data/#/regional-deterministic-precipitation-analysis).

- Environment and Natural Recourses Historical Hydrometric Data (Available at https://wateroffice.ec.gc.ca/mainmenu/historical_data_index_e.html)
- Climate Atlas Canada, Version 2 (3 September 2019) using BCCAQv2 climate model data (Available at https://climateatlas.ca).
- Climate Data for a Resilient Canada, Version 1.8 (Available at https://climatedata.ca/).

Projections

Future publicly available datasets were consulted to establish a basis for the approach to improving resilience to climate change impacts. These datasets are:

- Climate Atlas of Canada Version 2 (10 July 2019) using BCCAQv2 climate model data –. (Available at https://climateatlas.ca)
- ECCC statistically downscaled climate scenarios based on global climate model projections from the Coupled Model Intercomparison Project Phase 5 (CMIP5) (available at https://climate-change.canada.ca/climate-data/#/downscaled-data).
- Simonovic, S.P., A. Schardong, D. Sandink, and R. Srivastav, (2016) "A Web-based Tool for the Development of Intensity Duration Frequency Curves under Changing Climate", Environmental Modelling & Software Journal, version 6, 81:136-153. (Available at http://www.idf-cc-uwo.ca).
- KNMI Climate Explorer. IPCC AR5 Atlas subset. (Available at https://climexp.knmi.nl).
- Pacific Climate Impacts Consortium, University of Victoria, (Jan. 2014). Statistically Downscaled Climate Scenarios (available at https://www.pacificclimate.org/data/statistically-downscaled-climate-scenarios)
- Climate Data for a Resilient Canada (available at https://climatedata.ca/)
- Mohanty, M. and S.P. Simonovic (2021) Canadian Flood Map, Western University, Natural Sciences and Engineering Research Council of Canada, (Available at https://www.floodmapviewer.com/)

Other readily available literature as documented in the climate summaries that follow was also reviewed and referenced.

Climate Models

As there is no single definitive Global Climate Model (GCM) design and/or configuration, it is necessary to consider a group of GCM projections, or an ensemble, when completing assessments. That it is unwise to consider a single or small subset of models for climate change projection is extensively documented within published literature. Statistical analyses of an ensemble of projections allows the presentation of a range of expected results. Hence, it is typical in climate research and analyses to consider the statistics of the ensemble mean or the median respectively of climate change projections (driven by a scenario) as a central estimate of the reaction of the climate system to this scenario. The climate data review completed for this resilience assessment has taken a preferential view to data sources which have based their underlying analyses on an ensemble approach comprising multiple climate models and emission scenarios.

The climate change projections and risks were undertaken using Representative Concentration Pathways (RCP) 4.5 (Low carbon pathway scenario) and RCP 8.5 (High carbon pathway scenario) for future

projections of greenhouse gas emissions and climate hazards. The impacts under RCP 4.5 (Low carbon) and RCP 8.5 (High carbon) were evaluated. (ref. Figure 16)

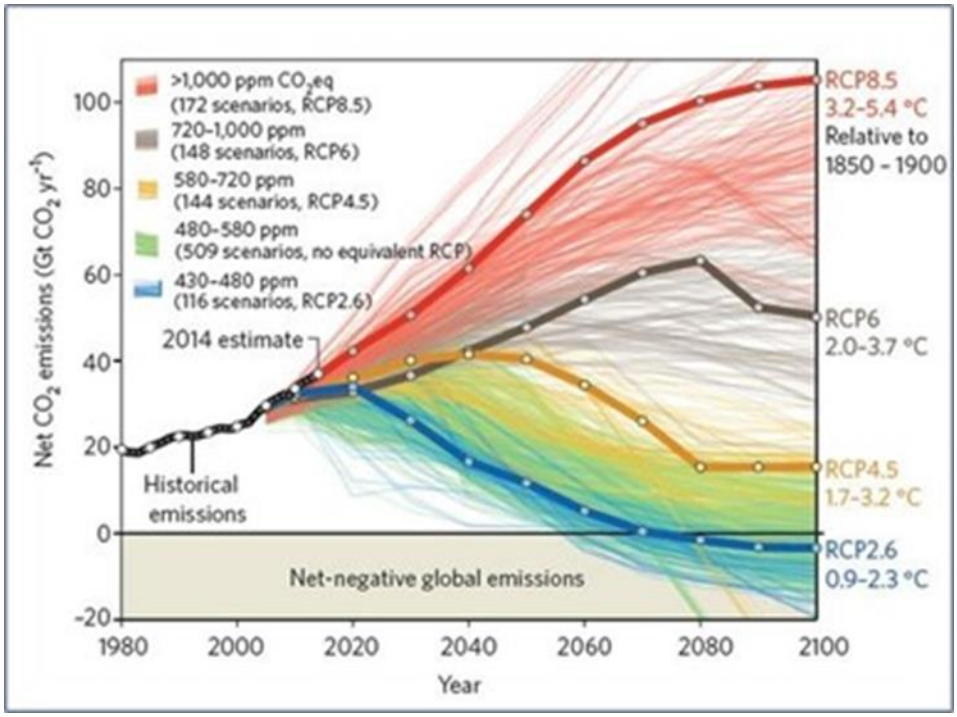

Figure 16: Representative Concentration Pathways (RCP's).

(Image source: https://policycommons.net/artifacts/1326754/time-to-cool-it/1930044/)

As it is unknown what greenhouse gas emissions will be in the future, GCM simulations are created for a range of possible emissions scenarios. The Intergovernmental Panel on Climate Change (IPCC) supported the development of four Representative Concentration Pathways (RCP) as part of a new initiative for the Fifth Assessment Report [1]. RCP 2.6, 4.5, 6.0, and 8.5 reflect various levels of climate change mitigation efforts with the numbers corresponding to potential radiative forcing levels reached by 2100. For example, RCP 8.5 results in an increase in radiative forcing to the global climate system reaching 8.5 W/m2 in 2100. Moreover, previous generations of GCMs have used the Special Report on Emissions Scenarios (SRES) GHG scenarios, such as A2 (upper mid-range which means economic growth and technological change are relatively slow) and B1 (low end of range which means moderate to low climate change over the next century) [2]. However recently there have been updated climate data projections. The 2021 IPCC AR6 features new state-of-the-art CMIP6 models. CMIP6 represents a substantial expansion over CMIP5, in terms of the number of modelling groups participating, the number of future scenarios examined, and the number of different experiments conducted. The energy modelling community has developed a new set of emissions scenarios driven by different socioeconomic assumptions (the SSPs, introduced above) [2]. A number of these SSP scenarios have been selected to drive climate models for CMIP6. These SSPs look at five different ways in which the world might evolve in the absence of climate policy and how different levels of climate change mitigation could be achieved

when the mitigation targets of AR5's Representative Concentration Pathways (RCPs) are combined with the SSPs [2]. The four RCPs that examined different possible future Greenhouse Gas (GHG) emissions included RCP2.6, RCP4.5, RCP6.0, and RCP8.5 – have new versions in CMIP6. These updated scenarios are called SSP1-2.6, SSP2-4.5, SSP4-6.0, and SSP5-8.5, each of which result in similar 2100 radiative forcing levels as their predecessor in AR5 models [2]. For the purpose of this report a combination of both CMIP5 and CIMP6 data was used where available for each parameter determined to be a risk for the Georgian Bluffs assets.

When an application requires information with a higher spatial and/or temporal resolution than that resolved by the dynamics of the GCM, downscaling the global climate model projections is necessary. This can take the form of dynamical or statistical downscaling. Dynamical downscaling utilizes a physically based regional climate model at high resolution over a limited area. Values from a "controlling" GCM are used as boundary conditions which the regional model then resolves over the prescribed subdomain. The regional climate models operate at the same level of complexity as a global model and ingrates the same physical processes and scientific understanding [3]. Alternately, statistical downscaling is based on estimating statistical relationships between a GCM simulation(s) and a specific set of observational records. This provides a computationally efficient approach to tailor analysis to specific sites/locals.

Note: For this report a lot of projection data was gathered from Pacific Climate Impacts Consortium (PCIC)/ Climate Atlas, where they used statistically downscaled data (Bias Correction with Constructed Analogues and Quantile mapping, Version 2; BCCAQv2) derived from 24 CMIP5 global climate models, for two emissions scenarios (RCP4.5 and RCP8.5). Further details can be obtained here: https://climateatlas.ca/data-sources-and-methods

For the purposes of this report climate normal for the range 1981 – 2010 were analyzed unless otherwise stated, due to limitations in available data sources as a baseline range to projected values.

Site Specific Climate Data

After the selection of climate parameters, grouping all assets into one group and determination of available data sources, both historical and projected, site-specific data was gathered. Historical data was gathered from Environment Canada and Climate Change (ECCC), which are point based stations, where proximity to a Georgian Bluff Asset was appropriate. If there were no proximity ECCC stations, then modelled gridded data was used from Pacific Climate Impacts Consortium (PCIC) instead (Figure 12). Note not all datasets were complete for historical data, however all data sets had efficient enough of available data (at least 20 years, preferable up to 30 years) to analyze and show adequate trends and magnitudes. Below is a Table 1–4 of site-specific data used and analyzed based on proximity to assets.

Source	**Historic** (ECCC - Site Specific)	**Projection** (small grid 1:50,000 /large grid 1:250,000)	**IDF** (Site specific)
	https://climate.weather.gc.ca/climate_normals/index_e.html	https://climateatlas.ca/find-local-data	https://www.idf-cc-uwo.ca/idfstation
Group 1	Owen Sound Moe & Wiarton Airport	Owen Sound	Wiarton Airport

Table 20: Site Specific Data Locations

Some climate parameters were further assessed and analyzed using data sets in the climate data sources section as well as secondary sources referenced in the reference section to determine trends, magnitudes, and risks both historically and in the future.

Climate Change Hazard	Climate Projections
Temperature	
Heat Waves	Heat waves are projected to increase from 12.0 per year to 3-6 a year by 2040s, 4-10 per by 2070s and 6-11 by 2100 under RCP 8.5 conditions. Heat waves are also expected to increase under RCP 4.5 conditions, from the baseline to 2-6 per year by 2040s, 3-8 per year by 2070s and 4-9 by 2100. [1] [2] [3] [4]
Freeze Thaw Cycles	As temperatures increase into the future, it can be expected that in the mid-century period freeze/thaw cycles may increase as the average general temperature profile approaches 0°C. The seasonal prevalence can also be expected to shift from the shoulder seasons toward the winter. However, continued increasing temperatures through to the end of the century would also suggest that average temperatures may begin to rise above 0°C which would result in a general decreasing trend for freeze/thaw cycles during shoulder seasons and an increase during winter. Freeze/thaw cycles are projected to decrease by 10 to 30 days from 65 days a year to 35-55 days a year under both RCP 8.5 & 4.5 conditions. [1] [2] [3] [4]
Precipitation	
Intense Precipitation (5-year 24-hour duration event)	Projected to increase from 63.9 mm to 72.6 – 79.4 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming a 20-year event from historical baseline. [5] [6] [7] [8] [9] [10] [11] [12]
Intense Precipitation (100-year 24-hour duration)	Projected to increase from 97.1 mm to 110.6 – 123.6 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming an almost 200-year event from historical baseline. [5] [6] [7] [8] [9] [10] [11] [12]
Intense Precipitation (50-year 24-hour duration)	Projected to increase from 90.2 mm to 102.6 – 114.3 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming a 100-year event from

Climate Change Hazard	Climate Projections
	historical baseline. [5] [6] [7] [8] [9] [10] [11] [12]
Intense Precipitation (20-year 24-hour duration)	Projected to increase from 80.4 mm to 91.6 – 101.5 (RCP4.5-8.5) mm by 2071-2100. Therefore, becoming a 50-year event from historical baseline. [5] [6] [7] [8] [9] [10] [11] [12]
Extreme Events	
Freezing Rain	Some studies have found that freezing rain could occur more often from an increase in near-freezing temperatures, in part due to a further northern extent of the 0°C temperature boundary, or location of the jet stream (Lambert and Hansen 2011, Matte et al. 2019, Francis and Vavrus 2012). Additional studies (Cheung et al. 2011) found a projected increase of 10-50% in freezing rain events in Southern Ontario during the coldest month (Jan) no change in Dec & Feb and a decrease of 5-20% during shoulder seasons (Nov, Apr, Mar) for three future time periods (2016–2035, 2046–2065, 2081–2100) and for 3 durations (>1hr, >4hr, >6hr). [12] [13] [14] [15] [16] [17] [19]
High Winds	Daily wind gust events are projected to increase by 2080 to 2100 period. A study done by Cheung et al. 2014, predicts that there will be a 10-30% increase for Spring, and 30-50% increase for winter, summer and fall, in the number of gust events with wind gusts exceeding 70 km/hour by 2080-2100, under high carbon scenario for Wiarton area. It should be noted that wind projections tend to be more uncertain than precipitation and temperature projections as there is a 15% uncertainty on percentage increase in frequency of future daily winds gust >70 km/h for Southern Ontario. [18]
Thunderstorms/Lightning	A warmer climate means that there is more energy available for thunderstorm development. Some studies have projected an increase in both convective available potential energy and increase in cloud vertical depth under RCP 8.5 scenarios (Agard and Emanuel 2017; Brooks, 2013; Huryn, 2020).

Climate Change Hazard	Climate Projections
	These components impact thunderstorm development and make it more likely for them in the future, however there is no scientific evidence on the frequency or intensity of thunderstorms for future projections. [19] [20] [21] [22] [23] [24]
Drought/Dry Periods	No significant change can be observed in number of projected dry days under both RCP 8.5 and 4.5 conditions. [1] [2] [26]
Hydrological	
Lakeshore/River Flooding/Storm Surge	Georgian Bay historical 100-year flood event from CMIP6 (climate model) data from 1980 – 2019 is 2.13 m. This value is expected to decrease under RCP 4.5 conditions to 1.61 m and increase to 2.47 m under RCP 8.5 conditions [28] [29] [30] [31]. Given the lack of progress globally in reducing greenhouse gas emissions (they are still increasing), the business-as-usual scenario may be more realistic, and it therefore might be expedient to plan for the extreme water level events that are predicted to arise under RCP 8.5.

Table 21: Climate Change Future Projections

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Lakeshore/River Flooding

Georgian Bluffs region has a surrounding coastline that encompasses the water body, Georgian Bay. Georgian Bay water levels averages around 176.5 m and fluctuates between 177.5 and 175.5 m month to month through a given year. This body of water has a primary driver that controls water levels called the Net Basin supply (NBS). The NBS represents the total contribution of water to a lake, excluding inflows from upstream lakes, outflows to downstream lakes, and diversions into or out of the lakes. In other words, NBS represents the net influence of precipitation over the lake, runoff from a lake's watershed into the lake, and evaporation from the lake's surface [6]. For the purpose of this report, it was determined that two site locations are impacted, potentially by Georgian Bay due to the proximity to the Bay.

Name	Location	Latitude	Longitude	Lakeshore Flooding	Distance from GB
Inter-Township Fire & Rescue Building	180 12th Street West, Owen Sound, ON N4K 3V2	44.57	-80.95	Yes	~0.2 km
Derby Roads Shop	062111 Sideroad 3	44.48	-80.99	No	~11.8 km
Keppel Road Shop	401295 Grey Road 17	44.72	-81.12	No	~2.4 km
Sarawak Roads Depot	323554 East Linton Sideroad W	44.65	-80.9	No	~1 km
Biodigester	062190 Sideroad 3 290	44.46	-81.14	No	~20.3 km
Township of Georgian Bluffs Administration Office	177964 Grey Road 18	44.56	-80.99	No	~5.1 km
East Linton Water Treatment Plant	RR 3 Stn Main, Owen Sound, ON N4K 5N5	44.58	-80.93	Yes	~0.1 km
Pottawatomi Water Treatment Plant	135 Atkins St	44.57	-80.97	No	~4.6 km
Shallow Lake Water Treatment Plant	719430 Highway #6	44.61	-81.08	No	~10.7 km
Kemble Community Centre	319897 Kemble Rock Road, Kemble, ON	44.72	-80.93	No	~3.0 km
Shallow Lake Community Centre	550 Princess St, Shallow Lake, ON N0H 2K0	44.62	-81.09	No	~12.2 km
Derby Community Centre	137534 Concession 7, Kilsyth, ON	44.51	-81.01	No	~9.8 km

Table 22: Lakeshore Flooding Building Asset Distance from Water

Climate Data Limitations

There are several factors to consider and weigh with respect to available, reliable, and consistent data sets both historically and for projections.

- Observational data across Canada has become less reliable and less extensive due to the automation of measurements. The termination of observation programs as well as the

abundance of incomplete datasets, erodes the confidence in the data and lack of establishment for a concrete baseline. Nonetheless, for regions with lack of data and observations, either gridded data or secondary research that used a regional approach was used. The use of these datasets, therefore, may not show the true picture of past or future climate for certain regions that need to be further downscaled.

- Projection data for most parameters, unless otherwise stated, is gridded data that is a really average data at either (Climate Atlas, Prairie Climate Center):
    - National Topographic Service (NTS) of Canada 1:250,000 topographic map areas.
    - NTS of Canada 1:50,000 topographic map areas.

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