Memorandum

To: Brad Johnson
Community Development Director
City of Burlington, WA

Date: February 7, 2025

From: Kat Klass
Staff Environmental Scientist
Maul Foster & Alongi

Project No.: M2736.02.001

Re: City of Burlington 2023 Greenhouse Gas Emissions Inventory

Background

Maul, Foster & Alongi (MFA) was engaged by the City of Burlington (the City) to assist with climate planning to inform development of a new Climate Element for the 2025 Comprehensive Plan periodic update cycle. House Bill 1181, signed into law in 2023, requires Washington cities and counties to add a Climate Element to their Comprehensive Plans to increase resilience and reduce greenhouse gas (GHG) emissions. For 11 counties (including Skagit County) and the cities within, creating a GHG emissions sub-element is a mandatory part of their next Comprehensive Plan update. This GHG emissions inventory supports the City's comprehensive planning by identifying and estimating the magnitude of current emissions, which is a key step in understanding the City's largest emissions sources and finding areas where reductions can be made. This report summarizes 2023 community-wide emissions and includes potential strategies for consideration in the Climate Element to reduce GHG emissions.

Methods

To determine the methods for Burlington's GHG inventory, the project team used the following guiding principles:

- Replicability and transparency, which ensures that inventories can be conducted for Burlington in future years and compared to this baseline inventory.
- Consistency, which allows for comparison with the Skagit County 2022 Greenhouse Gas Emissions Analysis.
- Accuracy, which ensures inclusion of relevant emission sources and use of locally specific data.

GHG Emissions Inventory Protocols

This GHG inventory was conducted according to the following protocols:

- ICLEI's U.S. Community Protocol for Accounting and Reporting of GHG Emissions (USCP). This protocol provides a standardized method for quantifying GHG emissions at the community level.

- ICLEI's Local Government Operations Protocol for the Quantification and Reporting of GHG Emissions Inventories (LGOP). This protocol provides a standardized method for quantifying GHG emissions from local government operations.

These protocols address the six internationally recognized GHGs:

- Carbon dioxide (CO_2),
- Methane (CH_4),
- Nitrous oxide (N_2O),
- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs), and
- Sulfur hexafluoride (SF_6).

In this inventory, GHGs are reported collectively as carbon dioxide equivalents (CO_2e). CO_2e is a measure that standardizes each GHG according to its global warming potential (GWP). GWP values quantify the relative impact of different climate-related pollutants, expressed as the amount of potential climate warming a pollutant may cause over a 100-year period relative to CO_2.

Burlington's emissions were calculated for the 2023 calendar year, and all data is from 2023 unless specifically noted. Emissions calculations and analysis were performed in Microsoft Excel.

Emissions Sources

The GHG emissions inventory includes sources listed in Table 1. Sources were selected and categorized to align with the Skagit County 2022 Greenhouse Gas Emissions Analysis conducted by the Washington State Department of Commerce.

Table 1: Emissions Sources for the 2023 GHG Emissions Inventory

Category	Sources
Built Environment	Electricity Natural gas Propane Fuel oil
Transportation	City fleet vehicles Communitywide on-road vehicles
Wastewater	Treatment processes
Solid Waste	Landfilled waste general and disposal Compost generation and disposal

Methods and data considerations for each emissions source are provided in Attachment A.

GHG Emissions Inventory Findings

In 2023, the Burlington community produced an estimated 273,973 metric tons (MT) CO_2e. This is approximately 29.9 MT CO_2e per capita. The community's largest sources of emissions were natural gas use (39% of total emissions), wastewater (28% of total emissions) and electricity (25% of total emissions). Figure 1 and Table 2 summarize 2023 community-wide emissions by category and source.

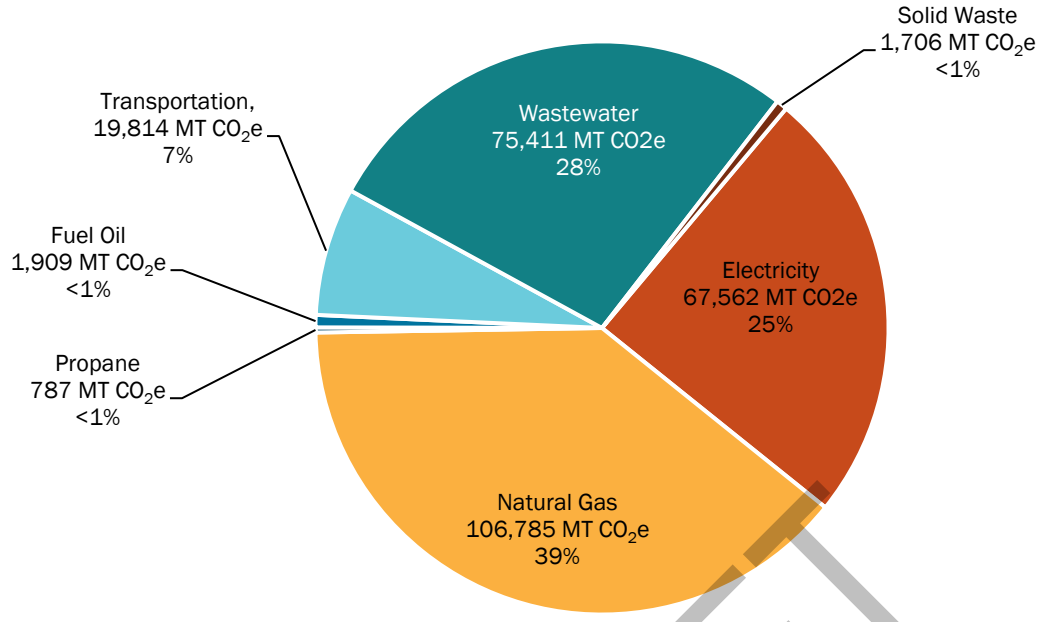

Figure 1: Total Emissions, by Category

Table 2: Total and Per-capita GHG Emissions, by Category

Category	Total Emissions (MT CO_2e)	Per-capita Emissions (MT CO_2e)	Percent of Total Emissions
Built Environment	**177,042**	**19.3**	**65%**
Electricity	**67,562**	**7.38**	**25%**
Residential	13,459	1.47	5%
Local Government	1,240	0.14	<1%
Commercial	47,892	5.23	17%
Industrial	4,972	0.54	2%
Natural Gas	**106,785**	**11.7**	**39%**
Residential	17,042	1.86	6%
Local Government	671	0.073	<1%
Commercial	50,427	5.51	18%
Industrial	38,645	4.22	14%
Propane	**787**	**0.086**	**<1%**
Residential	161	0.018	<1%
Commercial	290	0.032	<1%
Industrial	336	0.037	<1%
Fuel Oil	**1,909**	**0.21**	**<1%**
Commercial	470	0.051	<1%
Industrial	1,439	0.16	<1%
Transportation	**19,814**	**2.17**	**7%**
City Fleet Vehicles	**434**	**0.047**	**<1%**

Category	Total Emissions (MT CO_2e)	Per-capita Emissions (MT CO_2e)	Percent of Total Emissions
Community On-Road Vehicles	19,380	2.12	7%
Wastewater	75,411	8.24	28%
Solid Waste	1,706	0.19	<1%
Total Emissions	273,970	29.9	100%

Built Environment

The built environment category accounted for 65% of Burlington's 2023 emissions, contributing 177,042 MT CO_2e. This category includes emissions from the use of electricity, natural gas, propane, and fuel oil to heat, cool, and power buildings.

Figure 2 summarizes Burlington's 2023 emissions from the built environment by category and source. Approximately 25% and 39% of Burlington's total emissions came from electricity and natural gas consumption, respectively. Propane and fuel oil consumption contributed <1% and <1%, respectively.

Residential energy use (electricity, natural gas, and propane) accounted for 11% of total emissions, while energy use in local government facilities (electricity and natural gas) accounted for 1% of total emissions. Commercial and industrial energy use (electricity, natural gas, propane, and fuel oil) accounted for 36% and 17%, respectively, of total emissions.

Emissions calculated from electricity were calculated using utility-specific emission factors which were obtained from Puget Sound Energy (PSE). For informational purposes, emissions from electricity were also calculated using EPA Emissions & Generation Resource Integrated Database (eGRID) emission factors which represent regional electric power mixes. When calculated using this location-based method, Burlington's electricity emissions were approximately 46,651 MT CO_2e, compared to 67,562 MT CO_2e when estimated using a utility-specific approach. This indicates that PSE's fuel mix for electricity generation is more emissions-intensive than the regional electric power mix.

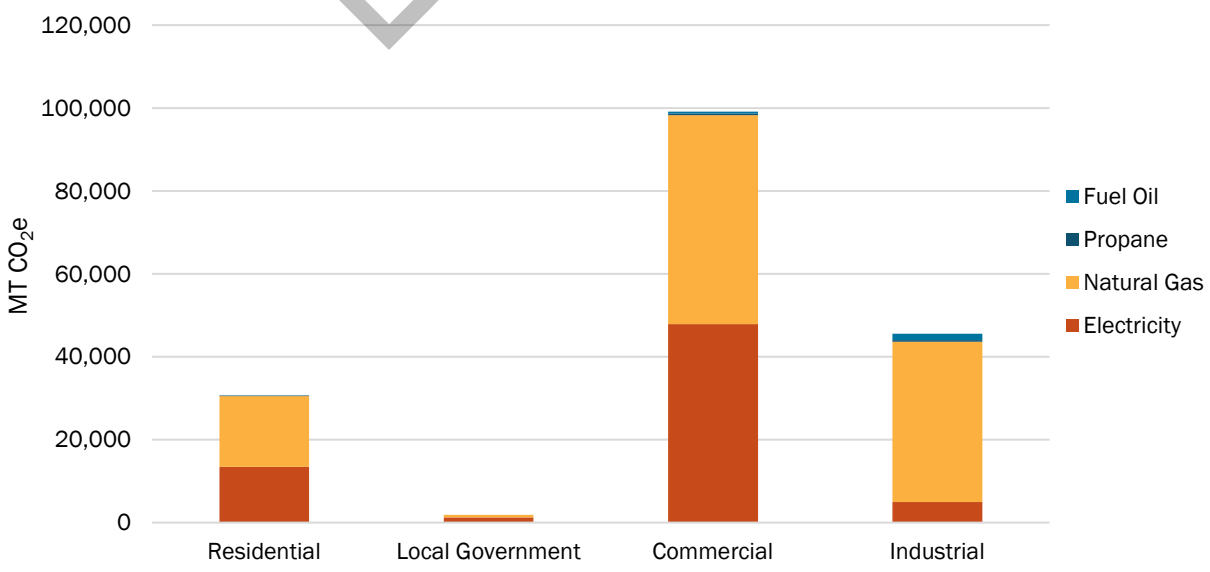

Figure 2: Built Environment GHG Emissions by Category and Source

Transportation

The transportation category made up 7% of Burlington's 2023 community-wide emissions, emitting an estimated 19,814 MT CO_2e (see Figure 1 and Table 2). This sector includes emissions from the use of City fleet vehicles and communitywide on-road vehicles.

In 2023, City fleet vehicles collectively traveled an estimated 788,904 miles. According to Washington State Department of Transportation's Highway Performance Monitoring System data, on-road vehicles traveled approximately 42,732,000 miles on city-owned roadways in Burlington. City fleet vehicles accounted for 434 MT CO_2e, while community on-road vehicles accounted for 19,380 MT CO_2e.

Wastewater

The wastewater category made up 28% of Burlington's 2023 emissions, contributing an estimated 75,411 MT CO_2e (see Figure 1 and Table 2). This category includes emissions from the treatment of wastewater produced within the Burlington wastewater treatment plant service area, which serves approximately 11,920 people, according to wastewater treatment plant staff.

Almost all (99.96%) of the wastewater treatment plant emissions were attributed to process N_2O emissions from effluent discharge. Process N_2O emissions from treating wastewater without nitrification/denitrification and stationary CH_4 emissions from incomplete combustion of anaerobic digester gas accounted for the remaining fraction of wastewater emissions.

The wastewater treatment plant in Burlington also produces emissions from energy used to power wastewater treatment processes; these emissions are accounted for in the commercial energy category to avoid double-counting between categories.

Solid Waste

The solid waste category made up <1% of Burlington's 2023 emissions, contributing an estimated 1,706 MT CO_2e (see Figure 1 and Table 2). This category includes emissions from the generation and disposal of solid waste and commercially processed compost.

The EPA Waste Reduction Model (WARM) adjusts methane emissions from the generation and disposal of solid waste and compost based on the landfill's characteristics and methane capture technology. According to the Skagit County Solid Waste Management Plan, most of the waste generated in Skagit County is sent to the Roosevelt Regional Landfill in Klickitat County. The Roosevelt Regional Landfill has a system that recovers landfill gas to be used for energy, which decreases the magnitude of Burlington's solid waste emissions.

Emissions Reduction Opportunities

This section highlights emission reduction opportunities for each category that could be included in the Climate Element, based on the results of this inventory. Many of the example goals and policies were selected from the Department of Commerce's Climate Policy Explorer, which offers model climate goals and policies as a starting point for communities developing a Climate Element. Climate

Policy Explorer goals and policies are indicated by a bolded ID before the text of the goal or policy. A comprehensive list of potential strategies can be reviewed by consulting the Climate Policy Explorer[1].

Built Environment

Natural gas use was Burlington's largest source of emissions within the scope of the inventory. Commercial and industrial natural gas use present the largest opportunities for emissions reduction from natural gas, accounting for 18% and 14% of total emissions, respectively.

Electricity use was Burlington's third-largest source of emissions within the scope of the inventory, In 2023, PSE's electricity fuel mix consisted of approximately 30% natural gas, 18% coal, 30% hydroelectric, and 22% wind, with the remaining <1% from nuclear, solar, and unspecified sources.[2] Washington State's Clean Energy Transformation Act (CETA), enacted in 2019, aims to transition the State to 100% clean electricity by 2045 and requires utilities to develop plans for achieving clean energy targets. PSE and other utilities are required to reduce the carbon intensity of electricity supplied to customers.

Propane and fuel oil use each accounted for <1% of total emissions. While propane and fuel oil use represent a smaller percentage of total emissions, there may still be feasible opportunities for action that could help reduce emissions from these sources.

With this context in mind, goals and policies aimed at reducing emissions from natural gas, electricity, propane, and fuel oil could include the examples in Table 3.

Table 3: Goals and Policies to Consider for Built Environment GHG Emissions Reduction

Goal/Policy	Notes
Goal E: Ensure that buildings use renewable energy, conservation, and efficiency technologies and practices to reduce greenhouse gas emissions.	The City is currently undergoing Capital Program Energy Audit to identify emissions reduction opportunities that will inform the feasibility of this goal for City-managed buildings.
Policy E.01: Require additional net-zero greenhouse gas emission features of all new residential and commercial structures.	Residential and commercial buildings use large amounts of electricity. Jurisdictions can amend land use regulations to require new residential and commercial buildings to utilize renewable energy sources, reducing GHG emissions and mitigating climate change.
Policy E.02: Maximize renewable energy sources for the supply of electricity and heat to new and existing buildings.	See note above.
Policy E.03: Retrofit buildings for energy efficiency.	Develop requirements for updated insulation and replacement of back-up generators that rely on fossil fuels. Replace with onsite solar and storage systems, where feasible.

[1] Climate Policy Explorer, https://experience.arcgis.com/experience/dd012fae9fad4a309b0d89e3c13016e5/
[2] https://www.pse.com/en/pages/energy-supply/electric-supply. Accessed February 4, 2025.

Goal/Policy	Notes
Policy E.04: Develop local microgrid solar and battery storage facilities in low-impact sites.	Integrating small-scale renewable energy production throughout a jurisdiction can reduce transmission losses and provide an alternative to fossil fuel energy sources. Jurisdictions can do this by amending land use regulations to require new structures to have solar orientation. Jurisdictions can also waive or reduce fees for uses that include local renewable energy generation to incentivize developers to include these features in land use proposals. Low impacts could include: roofs, parking lots, brownfield sites, and former fossil fuel facilities that have access to the electrical grid. Distributed power can also increase resilience to power grid disruption during storms if it can be used directly by sources.
Policy E.05: Phase out natural gas use in existing publicly owned facilities by [target year] and retrofit with electric heat pumps.	Replacing natural gas power and heat systems with electric heat pumps in public facilities can make the facilities carbon-neutral and reduce GHG emissions. Note: I-2066, approved by Washington voters in November 2024, prevents counties, cities, and towns from restricting access to natural gas in buildings. It also prevents the State Building Code Council from discouraging or penalizing the use of natural gas in any building. This initiative applies to all buildings (e.g., commercial and residential structures, publicly owned buildings).
Policy E.06: Require all publicly owned buildings to be powered completely by renewable energy by [target year].	See note about I-2066 above.
Policy E.07: Incentivize green building certification to improve energy and environmental performance.	Cities and counties could provide structural and financial incentives (e.g., density bonuses and tax credits) to developers to certify projects under a third-party standard (e.g., the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification standard).
Goal G: Maximize solar access of site design, where practicable, for new solar-ready residential and commercial buildings.	Solar access, a fundamental aspect of sustainable building design, refers to a building's ability to efficiently utilize sunlight for lighting, heating, and renewable energy generation. Solar access is determined by sunlight availability and potential shading from nearby structures, among other factors.
Policy G.03: Require solar panels on buildings with large rooftops, as well as within or over parking areas.	Cities and counties could require new distribution warehouses and parking lots to be pre-wired for solar panels and electric delivery truck chargers.

Transportation

Transportation was Burlington's fourth-largest source of emissions within the scope of this inventory, accounting for 7% of total emissions. According to City staff, detailed assessment of vehicle-related GHG emissions and development of monitoring tools for vehicle-related GHG will be handled through a separate transportation project. This project will likely provide more insight into emissions sources within the transportation category which can inform the selection of goals and policies to reduce transportation emissions.

Goals and policies aimed at reducing emissions from transportation could include the examples in Table 4.

Table 4: Goals and Policies to Consider for Transportation GHG Emissions Reduction

Goal/Policy	Notes
Goal H: Convert public fleets to zero-emission vehicles by [target year] and develop supporting infrastructure and programs (e.g., charging stations and dedicated lanes for electric cars and buses).	The City is currently undergoing a fleet audit for emissions reduction opportunities that will inform the feasibility of this goal.
Policy H.03: Implement multimodal transportation planning to reduce single-occupancy vehicle dependence and greenhouse gas emissions.	Develop mode-specific plans, such as bicycle and pedestrian plans, adopt complete streets policies and ordinances, and a multimodal transportation concurrency program.
Goal I: Reduce vehicle miles traveled to achieve GHG reduction goals.	
Policy I.01: Implement travel demand management (TDM) programs and strategies.	Commute trip reduction (CTR) programs and strategies are required for large employers (100+ employees). These programs can be scaled to fit smaller businesses in different jurisdictions and circumstances.
Policy I.04: Increase multimodal capacity in coordination with the location of higher-density housing and commercial centers.	Transportation and multimodal improvement considerations should be part of the permitting process beyond housing and road impact fee assessments. Transit-supportive residential densities are impactful to provide shorter trips and increase transit and nonmotorized usage.
Policy I.14: Create a safe, well-connected, and attractive bicycle and pedestrian transportation network to encourage active transportation.	Implementation of this policy could include a strategy to reduce pedestrian or bicycle and car collisions, beginning with overburdened communities with the highest rate of injury or death. Key to the success of this policy is to establish a safe and welcoming environment that includes lighting, visibility, landscaping, and active uses.
Policy I.16: Prioritize, develop, and maintain mobility hubs in transportation-efficient locations — especially in overburdened communities experiencing a scarcity of transportation alternatives.	Mobility hubs are centralized locations where people can access multiple transportation modes (e.g., car share, bike share, transit, and micromobility devices). Mobility hubs need to be adapted to specific contexts and settings both in terms of the type of components and their scale.
Policy I.24: Prioritize permitting for transit-oriented development (TOD) proposals.	This is an enabling policy that should reduce future VMT.
Goal AD: Expand electric vehicle infrastructure.	Jurisdictions can reduce GHG emissions by making ownership and use of electric vehicles convenient and affordable. Jurisdictions should examine their neighborhoods, commercial centers, and transportation systems to determine the optimal locations for charging infrastructure. Update comprehensive plan land use elements to allow and support EV charging infrastructure.

Wastewater

Although wastewater treatment is the second largest source of GHG emissions in Burlington within the scope of this inventory, mitigating these emissions is challenging due to the essential nature and long lifespan of the wastewater treatment plant.

However, several opportunities to reduce emissions could include the examples in Table 5.

Table 5: Policies to Consider for Wastewater GHG Emissions Reduction

Goal/Policy	Notes
Policy X.08: Develop a local pollution surcharge for large producers of air pollutants, wastewater, and solid waste.	The surcharge budget could help subsidize low-income homes converting to solar and heat pumps.
Policy: Implement measures to reduce the total volume of wastewater needing treatment.	This policy could potentially align with water conservation initiatives.
Policy: Research and consider implementing technologies to decrease nitrous oxide emissions from wastewater treatment plant effluent.	

Solid Waste

Solid waste accounted for <1% of total emissions within the scope of this inventory. These emissions are relatively low compared to the rest of the inventory categories due to the recovery of landfill gas for energy at the Roosevelt Regional Landfill.

Goals and policies to enhance emissions reduction from solid waste generation and disposal could include the examples in Table 6.

Table 6: Policies to Consider for Solid Waste GHG Emissions Reduction

Goal/Policy	Notes
Goal D: Develop targeted campaigns for recycling material with highest GHG reduction impact (e.g., paper, metal, food waste).	
Policy D.01: Incentivize recycling of construction and demolition debris.	Reusing and recycling existing construction and demolition debris avoids carbon emissions associated with depositing construction waste in landfills. Jurisdictions can incentivize recycling of demolition debris by waiving or reducing fees associated with recycling.
Policy D.02: Create and sustain a business technical assistance program to increase recycling and reduce waste.	Policies in a comprehensive plan can initiate an outreach and education program that could facilitate recycling of solid waste from commercial businesses. One model to consider could include creating an exchange or encouraging industrial and commercial companies to reach out to each other to share residuals or discarded materials that may be able to be used for other purposes.
Policy D.03: Use recycled materials in the construction of transportation and other infrastructure facilities.	Jurisdictions can reduce GHG emissions from solid waste by requiring contracts to include language that recycled materials be used for the construction of transportation infrastructure and facilities.

Public Engagement to Prioritize Emissions Reduction Strategies

The International Association for Public Participation (IAP2) Spectrum of Public Participation provides a framework for cities to determine the level of engagement needed for different projects.[3] The spectrum ranges from informing the public to empowering them in decision-making processes. In the context of emissions reduction opportunities for Burlington's greenhouse gas reduction sub-element, the City must first determine its specific public participation goals—whether it is aiming to inform, consult, involve, collaborate with, or empower the public. This decision will influence the overall approach, messaging, types of engagement, and strategies used. For instance, a goal of informing would rely on providing the public with information to allow them to understand why the City is interested in emissions reduction opportunities, while empowering the public might involve co-designing solutions or allowing them to have direct input into decision-making.

Several strategies can be employed to foster public engagement in emissions reduction efforts. A public open house provides a direct, face-to-face opportunity for residents to learn about proposed actions, ask questions, and offer feedback. Complementing this, material posted on the city's website, including fact sheets, infographics, and draft documents, can allow the public to access information at their convenience. To encourage broader participation, the City could collect public comments on emissions reduction opportunities through an online survey or comment period. Additionally, social media platforms can help reach a wider audience by allowing the City to post updates and gather feedback. These combined strategies can create a multi-faceted approach to public engagement for Burlington's emissions reduction activities.

Conclusion

Burlington's 2023 GHG emissions inventory identifies the significant areas where focused efforts can drive meaningful emissions reduction. The built environment and transportation categories stand out as key areas for improvement through emissions reduction initiatives that increase buildings' energy efficiency, increase the use of renewable energy, decrease energy consumption, and decrease vehicle miles traveled. The City is already making progress and has begun work on a Capital Program Energy Audit to assess opportunities for energy efficiency, renewable energy use, and emissions reduction within City-managed buildings and the City fleet. Using the example goals and policies from the Department of Commerce's Climate Policy Explorer, Burlington can continue to develop a robust strategy to reduce its emissions and contribute to regional and statewide climate action.

Attachments

Limitations

A—Greenhouse Gas Inventory Methods

[3] International Association for Public Participation, https://iap2.org.au/wp-content/uploads/2020/01/2018_IAP2_Spectrum.pdf. Accessed February 4, 2025.

Limitations

The services undertaken in completing this technical memorandum were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This technical memorandum is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this technical memorandum apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this technical memorandum.

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Attachment A

Greenhouse Gas Inventory Methods

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Greenhouse Gas Emissions Inventory Methods

Methods and Data Sources

Calculating Burlington's GHG inventory involved collecting activity data from various sources, identifying relevant emissions factors, and applying these emissions factors to the activity data.

Table A-1 summarizes the following:

- Activity data, which quantify levels of GHG-generating activities, such as kWh of electricity consumed, vehicle miles traveled, or the amount of waste landfilled.
- Emission factors (e.g., MT CO_2e per kWh) convert activity levels into emissions.

Activity data sources and emission factor sources are fully documented in the City of Burlington 2023 GHG Emissions Inventory spreadsheet.

Table A-1: Activity Data and Emissions Factors for Burlington GHG Emissions Inventory

Category	Activity Data	Emission Factors
Built Environment		
Electricity	Consumption within city limits provided by Puget Sound Energy (PSE)	1) PSE-specific emission factor from PSE 2023 GHG reporting 2) Emissions & Generation Resource Integrated Database (eGRID) emission factors (for informational purposes only)
Natural Gas	Consumption within city limits provided by Cascade Natural Gas (CNG)	U.S. EPA Emission Factors Hub
Propane	WA propane consumption by sector from U.S. Energy Information Administration (EIA)	U.S. EPA Emission Factors Hub
Fuel Oil	WA propane consumption by sector from U.S. EIA	U.S. EPA Emission Factors Hub
Transportation		
City Fleet Vehicles	Vehicle miles traveled (VMT) from City staff estimates	U.S. EPA Emission Factors Hub
Community On-Road Vehicles	VMT data from Washington State Department of Transportation (WSDOT) Highway Performance Monitoring System (HPMS)	U.S. EPA Emission Factors Hub
Wastewater		

Category	Activity Data	Emission Factors
Treatment Processes	Wastewater treatment data from City staff	U.S. Local Government Operations Protocol default emission factors, customized based on data available from wastewater treatment plant
Solid Waste		
Generation and Disposal	City tonnage for municipal solid waste and organics from Waste Management	EPA Waste Reduction Model version 16 (WARM v16) emission factors, customized for landfill characteristics (e.g., landfill gas recovery)

Built Environment

Electricity

Emissions from electricity consumption were calculated using the amount of electricity consumed within Burlington city limits in 2023, multiplied by PSE's 2023 emission factor. PSE supplied residential, commercial, and industrial electricity consumption data. Burlington city staff provided data for electricity use at city buildings and facilities, which was subtracted from total commercial electricity use to avoid double-counting emissions.

Natural Gas

Emissions from natural gas consumption were calculated using the amount of natural gas consumed within Burlington city limits in 2023, multiplied by U.S. EPA emission factors. CNG provided residential, commercial, and industrial natural gas consumption data. Burlington city staff provided data for natural gas use at city buildings and facilities, which was subtracted from total commercial natural gas use to avoid double-counting emissions.

Propane and Fuel Oil

Residential propane emissions were calculated using 2020 (most recent available data) U.S. EIA average residential propane consumption data for Washington state. Average residential propane consumption was multiplied by U.S. Census American Community Survey (ACS) home heating fuel data for Burlington and then multiplied by U.S. EPA emission factors.

For commercial and industrial propane and fuel oil, U.S. EIA statewide consumption data for 2023 were not available at the time of this analysis, so data from 2022 were used. Commercial and industrial propane and fuel oil emissions were calculated using statewide fuel consumption estimates downscaled by the number of commercial and industrial employees within Skagit County as compared to total state employment. County-level estimates were further downscaled using the ratio of Burlington population to Skagit County population. Employment data were collected from the Washington Employment Security Department, which provides data on the number of employees across industries. Propane and fuel oil emissions were calculated using U.S. EPA emissions factors.

Transportation

City Fleet Vehicles

City staff provided estimates of 2023 mileage for each vehicle in the city fleet, along with each vehicle's year, make, model and Vehicle Identification Number. These data were entered into the Dashboard for Rapid Vehicle Electrification (DRVE) Tool. The DRVE Tool generated an assumed fuel type, city road fuel economy, and highway fuel economy for each vehicle. Based on the uses of city fleet vehicles, it was assumed that vehicles traveled 75% of the estimated annual mileage on city roads and 25% on highways, which was used to create an average fuel economy and estimated fuel consumption for 2023 based on mileage estimates. Vehicles were also categorized as passenger cars, light trucks (includes vans, pickup trucks, SUVs), or heavy-duty vehicles based on vehicle weight class. Estimated fuel consumption and mileage data were multiplied by fuel- and vehicle-type-specific U.S. EPA emission factors to estimate city fleet vehicle emissions.

Community On-road Vehicles

On-road emissions were developed using 2023 VMT activity data from WSDOT's HPMS, which provides estimated annual VMT for all public roadways by county and city. The data used for calculations only includes estimated VMT on city-owned roads in Burlington and does not include VMT within Burlington city limits on roads that are not city-owned (e.g., Interstate 5, State Route 20). VMT was split into freight/service vehicles and passenger vehicles VMT based on WSDOT HPMS statewide freight percentages. For freight/service vehicle emissions, VMT was multiplied by U.S. EPA vehicle-specific emissions factors. For passenger vehicles, 2023 vehicle registration data from Skagit County was used to estimate VMT by vehicle type, which was then multiplied by U.S. EPA vehicle-specific emissions factors.

Wastewater

Wastewater treatment process emissions produced in the Burlington service area were estimated based on 2023 data provided by city staff. Emissions were estimated based on the type of processes occurring at the plant (e.g., combustion of anaerobic digester biogas, wastewater treatment in aerated basins) as well as the population served. Based on the data provided by city staff, emissions were calculated using U.S. Local Government Operations Protocol default equations.

Solid Waste

Emissions from the generation and disposal of landfilled and composted solid waste were estimated by multiplying the tons of waste generated in 2023 by material type-specific emissions factors using the US EPA Waste Reduction Model (WARM) v16. Waste Management provided waste and compost generation data for customers within Burlington city limits. The WARM v16 calculations were customized to estimate methane emissions based on the landfill's characteristics and methane capture technology. Emissions from transportation of waste to landfills were estimated using default travel distances from EPA WARM v16.

Data Limitations

For some categories, data availability was limited and/or it was necessary to scale regional or state data to estimate emissions. Data limitations and the local relevance of data sources for each category are summarized below.

Built Environment

Electricity

- No notable limitations of data sources or approach.
- Electricity data reflect local conditions.

Natural Gas

- No notable limitations of data sources or approach.
- Natural gas data reflect local conditions.

Propane and Fuel Oil

- At the time of analysis, 2023 EIA data for statewide commercial and industrial propane and fuel oil use were not available, so 2022 data were used in calculations.
- At the time of analysis, 2023 EIA data for statewide average household residential propane consumption were not available, so 2020 data (most recent available data) were used in calculations.
- Data for average residential fuel oil use in Washington state were withheld because either the relative standard error was greater than 50% or there were fewer than 10 households in the reporting sample.
- Residential, commercial, and industrial propane and fuel oil data are based on scaled regional and state data.

Transportation

City Fleet Vehicles

- City staff provided estimates of 2023 fleet vehicle mileage by vehicle.
- City fleet vehicle data reflect local conditions.

Community On-road Vehicles

- City staff requested that emissions from City fleet vehicles and community on-road VMT be included in the scope of this inventory to produce a high-level estimate of the percentage of Burlington's total GHG emissions that are attributable to vehicle travel. Detailed assessment of community-wide vehicle-related GHG emissions and development of monitoring tools for community-wide vehicle-related GHG will be handled through a separate transportation project and are not included in the scope of work for this GHG emissions inventory.
- The VMT data used for calculations only include estimated VMT on city-owned roads in Burlington and does not include VMT within Burlington city limits on roads that are not city-owned (e.g.,

Interstate 5, State Route 20). Information about VMT within city limits on non-city-owned roads is not available from WSDOT HPMS. Community on-road vehicle emissions quantified in this inventory are likely underestimated due to limited data availability.

- WSDOT HPMS data reflect local conditions, with some exceptions.

Wastewater

- No notable limitations of data sources or approach.
- Wastewater data reflects local conditions.

Solid Waste

- No notable limitations of data sources or approach.
- Waste characterization data reflect local conditions, with some exceptions.