RM of East St. Paul

2018 GREENHOUSE GAS EMISSIONS INVENTORY

June 2020

RM OF EAST ST. PAUL

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EXECUTIVE SUMMARY

The RM of East St. Paul (ESP) has achieved a Partner for Climate Protection community designation because of the work it has undertaken to inventory its greenhouse gas emissions and develop a Climate Action Plan to address them. Developed through a comprehensive community engagement process, Council endorsed ESP's *Climate Change Local Action Plan: Acting Today to Change Tomorrow* (Climate Action Plan) in 2017. The Plan identifies emissions reduction targets of -20% for corporate emissions and -6% for community emissions by 2027 in relation to a 2011 emissions baseline.

The 2018 East St. Paul Greenhouse Gas Inventory (2018 Inventory) reports emissions from the municipality for the 2018 calendar year to provide comparison to the 2011 baseline (2011 Inventory) that was used to frame ESP's Climate Action Plan. The 2018 emissions inventory report summarizes the current status of emissions in relation to the 2027 targets. This information supports discussions on how best to implement actions from the Plan and helps identify other opportunities.

The 2018 Inventory follows the requirements of the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC) for municipalities. Calculated emissions rates are based on energy use and other relevant data and emissions factors from reliable sources. Emissions are divided into corporate (municipal operations) and community sectors. Each sector includes multiple categories and sub-categories of emission sources reflecting the requirements of the GPC protocol.

Total emissions for the RM of East St. Paul in 2018 are estimated to be 57,200 tonnes CO_2e. 1058 tonnes CO_2e are attributed as 'corporate emissions' the remaining 56,142 tonnes CO_2e are 'community emissions.' The change in emissions from the 2011 Inventory to the 2018 Inventory are as follows:

- Overall, emissions increased by 28.5% (12,700 tonnes CO_2e); from 2011 (44,500 tonnes CO_2e) to 2018 (57,200 tonnes CO_2e).
- Corporate emissions increased by 15.9% (145 tonnes CO_2e); from 2011 (913 tonnes CO_2e) to 2018 (1058 tonnes CO_2e).
- Community emissions increased by 28.8% (12,555 tonnes CO_2e); from 2011 (43,587 tonnes CO_2e) to 2018 (56,142 tonnes CO_2e).

Increases in corporate building emissions reflect the addition of a new Operations Building and expansion of the Wastewater Treatment Plant and Water Treatment Plant. Emissions from RM vehicles and equipment showed no significant change as compared to the 2011 Inventory.

The increase in community emissions was primarily due to an increase in transportation emissions reflected in the number of vehicles registered in the RM. Community transportation accounts for over 60% of ESP's total greenhouse gas emissions. There was also a notable increase in building emissions compared the 2011 Inventory. The increase in the number of dwellings (6.9% since 2011) is the primary driver. Of particular note is the decrease in emissions from solid waste; despite an increase in population, the municipality sent less waste to the landfill in 2018 than in 2011 (a reduction of 236 tonnes) representing a 14% (161 tonnes CO_2e) drop in calculated emissions.

Looking forward, without concerted action emissions will continue to rise. At the corporate level integrating emissions reductions as part of infrastructure and planning decisions will support the RM in meeting its targets. In turn, many of these decisions will support reductions in emissions by the overall community. Linking these, where reasonable, to climate resilience will further enhance the business case for such decisions.

Within the context of ESPs Climate Action Plan, the 2018 inventory serves as a basis for reviewing and prioritizing measures to reduce corporate emissions over the next 10 years to meet identified targets. Targeting strategic initiatives and communications to encourage supporting behaviours and choices by the larger community will be key. With the commitments that the RM has made on climate action and the efforts that are being made to advance climate resiliency, increased available grants and other funding opportunities are available to the RM that will support these efforts.

1 INTRODUCTION

1.1 PURPOSE

The 2018 Greenhouse Gas Emissions Inventory (2018 Inventory) provides an overview of emissions generated by local ESP activities, both corporate and community driven. The 2018 Inventory updates the previously conducted 2011 Inventory that provided the basis for drafting ESP's *Climate Change Local Action Plan: Acting Today to Change Tomorrow* (Climate Action Plan). The findings of the 2018 Inventory provide a basis for considering the existing actions outlined in ESP's Climate Action Plan and evaluating further opportunities to reduce emissions in relation to the identified targets.

1.2 BACKGROUND

With support from the Federation of Canadian Municipalities (FCM) and assistance from Eco-West Canada, the RM of East St. Paul embarked on a process in 2016 that enabled the municipality to become a "Partner for Climate Protection" community. The process involved a comprehensive community engagement program that resulted in ESP's Climate Action Plan that was formally accepted by Council in 2017. Development of the Plan was framed in the context of a baseline emissions inventory for the year 2011[1], setting reduction targets and identifying a series of priorities for the municipality to help it achieve its emission reduction plans. The targets identified through the Climate Action Plan process include a 20% reduction in greenhouse gas emissions for RM operations and a 6% reduction in emissions for the broader community by 2027, measured against the emissions from 2011 baseline year.

The 2011 Inventory compiled available data on emissions sources for the year 2011 from RM operations ('corporate' emissions), and the rest of the municipality ('community' emissions). The categories included in the 2011 Inventory were corporate emissions from municipally operated buildings and fleet, as well as community buildings, solid waste, water and wastewater, and transportation.

[1] An emissions baseline measures emissions that occur in a specific year that future changes in emissions can be compared to (OECD, 2011). Establishing a baseline inventory is a prerequisite to setting emission reduction targets. An emissions baseline can be tracked to changes in emissions that have occurred over time and project future emissions. ESP's baseline year of 2011 was selected because of available census data.

1.3 INVENTORY SCOPE

The 2018 Greenhouse Gas Inventory reports ESP's greenhouse gas emissions in compliance with the *Global Protocol for Community-Scale Greenhouse Gas Emissions* (GPC). The GPC is the internationally recognized standard for municipal greenhouse gas reporting.

Emissions are reported in relation to the 2011 Inventory, in order to assess reductions necessary to achieve emission targets that ESP has established through its Climate Action Plan. One of the commitments in the Climate Action Plan is to monitor priority actions and other measures to assess progress on the 2027 targets. The 2018 Inventory enables the RM to understand the current emissions relative to the 2011 Inventory and consider how actions in the Plan and other measures will foster reductions in future emissions levels.

1.3.1 MUNICIPAL CONTEXT

ESP is located north of Winnipeg, adjacent to the TransCanada bypass with a total area of 42.1 km^2. The south portion of ESP is comprised primarily of urban residential neighbourhoods separated by future land tracks slated for future residential development. Restaurants, grocery store and other related services are clustered in nodes along the provincial highways. Commercial-industrial properties are scattered throughout the municipality. Rural residential properties and small-scale agricultural holdings comprise the northern portion of the municipality.

In the 2016 Census there were 9,372 permanent residents, an increase of 326 residents (3.6%) since 2011. The number of private dwellings increased by 6.9%, from 3,050 in 2011 to 3,263 in 2016. The majority of the residences (99.4%) are detached single family homes with 2.9 bedrooms on average and are owner occupied. Approximately 4% of these residences are in categorized as in need of major repairs (Statistics Canada, 2017).

The main mode of transportation for RM residents is private vehicle. There is no public transportation or car share service with the exception of a handy transit service that is accessed by less than 1% of the population. The active transportation system consists of pathways and sidewalks, although there is not a continuous network throughout the urban portion of the RM. The labour force 15 years of age and older represents 5,340 residents (57%) with 8% of these working from home. Of these, 89% commute in private vehicles, mostly to Winnipeg. The majority drive between 10-20km per day, with only 5.2% carpooling. Less than 5% commute via other methods such as active transportation or connect with City of Winnipeg transit (via drop off or park and ride) (Statistics Canada, 2017).

1.3.2 RM OPERATIONS

The RM is responsible for constructing, maintaining and operating municipal utilities such as water and wastewater treatment facilities. The RM provides emergency services from its Fire Hall and supports municipal operational activities such as street maintenance and clearing from its Operations Building. It manages and maintains the land drainage system in addition to parks, green spaces, pathways and recreation spaces. It also owns and/or operates recreational buildings such as the Arena as well as the Seniors Community Center and a Daycare. The Administration Building houses municipal administrative functions such as planning, finance, bylaw enforcement, recreational service and the Chief Administrative Officer.

Since the 2011 Inventory, the RM increased the number of buildings it owns and/or operates from eight to nine with the addition of the 1,843m^2 (19,838 ft^2) Operations Building. This building replaced the functions of the Public Works Building, which now serves as heated storage. The capacity of both the Water Treatment Plant and Wastewater Treatment Plant has also been expanded since 2011, resulting in increased energy use.

1.4 GHG EMISSIONS AND SCOPE OF INVENTORY

The three greenhouse gases included in this inventory are the three most common greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Standard units for reporting emissions are carbon dioxide equivalents (CO_2e), which accounts for the different global warming potential of each gas[2]. Emissions are also classified into three different scopes. For municipalities, scope 1 emissions are direct emissions occurring within the municipal boundary. Scope 2 emissions are from the generation of grid-supplied energy. Scope 3 emissions occur outside of the municipal boundary, but are influenced by activity within the municipal boundary (GPC, 2014).

1.4.1 GPC PROTOCOL INVENTORY

Under the GPC Protocol, there are three reporting level options for municipalities.[3] The reporting level used for the 2018 Inventory is **GPC BASIC** because it covers the primary sources of ESP emissions. These are the same sources quantified in the 2011 Inventory.

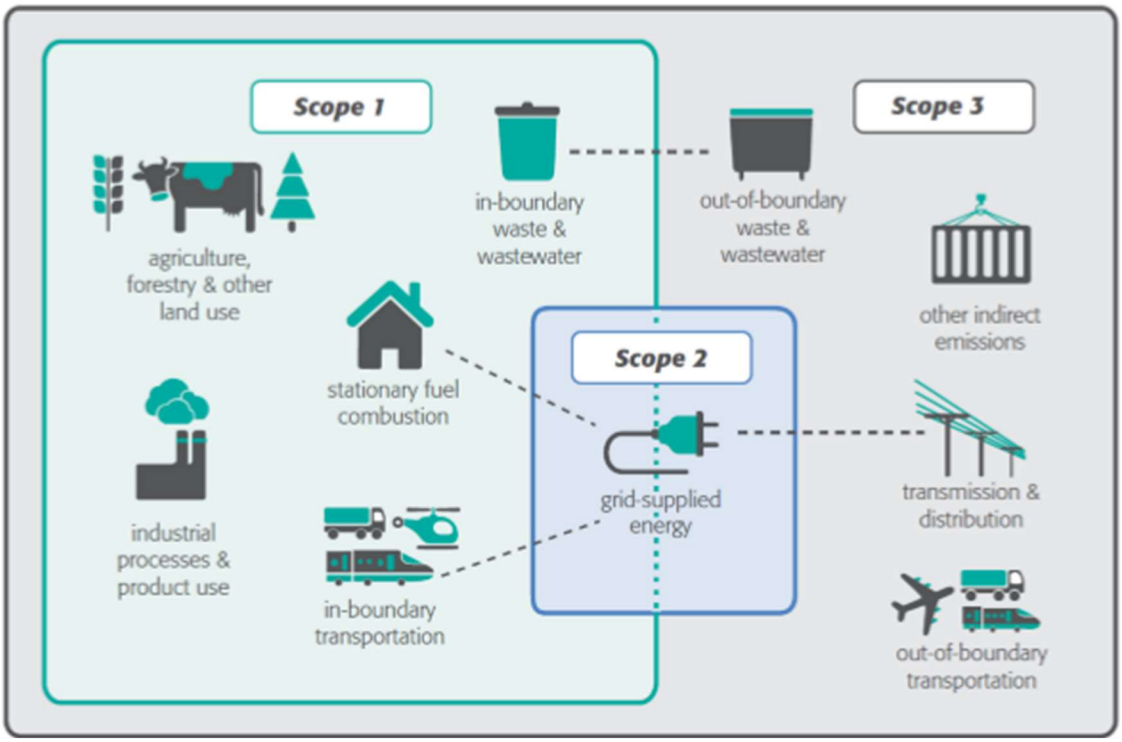
[2] Global warming potentials: CO_2=1, CH_4=28, N_2O=265 (GPC, 2014)

[3] **GPC BASIC:** This reporting level covers scope 1 and 2 emissions from stationary energy (eg. building heating) and transportation (eg. vehicle fuel combustion), as well as scope 1 and 3 emissions from waste.
GPC BASIC+: This level covers the same scopes as BASIC with more in-depth and data dependent methodologies. Specifically, it expands the reporting scope to include emissions from Industrial Process and Product Use (IPPU), Agriculture, Forestry, and Other Land-Use (AFOLU), and transboundary transportation.

The following are the required categories under the GPC BASIC reporting level, and account for the significant sources of greenhouse gas emissions in ESP.

- Scope 1 - emissions from stationary energy sources.
- Scope 1 - emissions from transportation sources.
- Scope 1 - emissions from waste sources.
- Scope 2 - emissions from stationary energy sources.
- Scope 2 - emissions from transportation.
- Scope 3 - emissions from treatment of exported waste.

Figure 1: Diagram of Emission Sources and Scopes



Source: GPC, 2014 https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

GPC BASIC+ Scope 3 (SC): This inventory extends beyond the GPC BASIC+ level to include scope 3 emissions, such as emissions from production and transportation of goods and services.

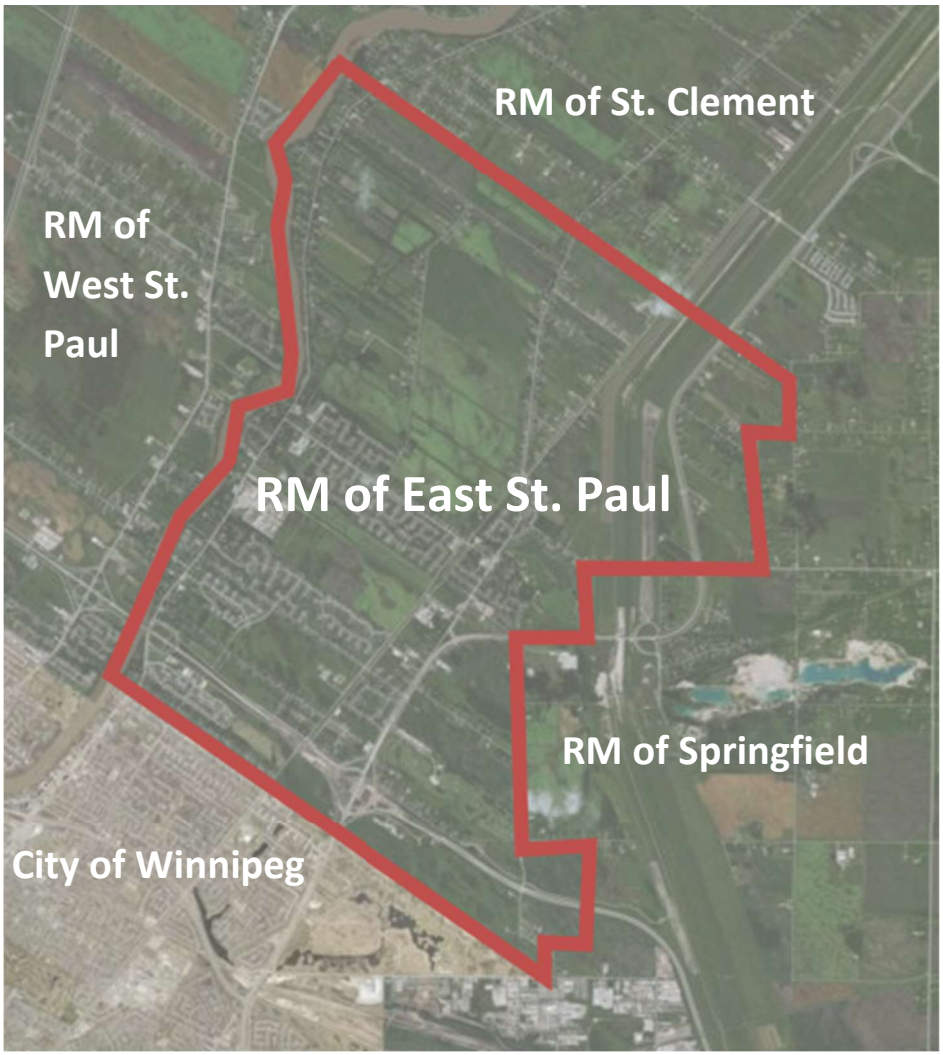
1.4.2 TEMPORAL BOUNDARIES

The 2018 Inventory covers GHG emissions for the 2018 reporting year. Whenever possible, data referenced is inclusive of January 1, 2018 to December 31, 2018. The 2011 Inventory serves as a baseline for ESP's updated emissions profile and reduction targets. To maintain consistency with current emission reporting protocols for municipalities, information used in the 2011 Inventory was updated where necessary to be compatible with the current GPC protocol to support comparison with the 2018 Inventory.

1.4.3 SPATIAL BOUNDARY

ESP is located northeast of the City of Winnipeg. It is bordered by the rural municipalities of West St. Paul to the west, St. Clements to the north, and Springfield to the east. The 2018 Inventory includes emissions sources within the municipal boundary, outlined in Figure 1.

Figure 2: RM of East St. Paul Municipal Boundary



2 METHODS, EMISSION SOURCES AND RESULTS

Information from several resources was used to define methodologies. The GPC provided the primary guidance, with supplemental reference to the Intergovernmental Panel on Climate Change (IPCC) and Canada's National Inventory Report (NIR). Eco-West Canada produced the 2011 Inventory database that was referenced for emissions factors and methodologies. Eco-West Canada also provided guidance on the production of 2018 inventory and conducted a review of the inventory and findings before finalization.

The categories included in the 2018 Inventory are consistent with the categories included in the 2011 Inventory.[4] The emission sources and specific methodology used to calculate greenhouse gas emissions for each category are outlined by Corporate and Community sectors. Emissions are presented as carbon dioxide equivalents (CO_2e). Emissions factors used for the 2011 Inventory were applied where current. Updated emissions factors were sourced from Manitoba Hydro for electricity and from CN Rail for railway operations.

Data on emissions sources for the various categories are multiplied by appropriate emission factors to calculate tonnes of CO_2e emitted. Aggregate data was obtained from various sources including Manitoba Hydro (energy use), Manitoba Public Insurance Corporation (vehicles registered), and ESP's operational and financial databases. ESP staff provided insight and observations on operational matters to confirm estimates. The total emissions for 2018 are stated at the end of each category and summarized in Tables 1 and 2.

2.1 2011 INVENTORY UPDATES

In specific instances, the methodologies used for the 2011 Inventory were updated to be consistent with current protocols or to reflect more robust information that had become available. These updates to the 2011 Inventory allow for comparison with 2018 emissions data. Additional data was also sourced that was not previously available to the consultant for the 2011 Inventory.

The emissions calculation methods and data used in the 2011 Inventory were evaluated and changes were made when necessary. Recalculation of base year emissions due to availability of improved data or methodology is encouraged by the GPC. The following is a tabulation of all changes made to the 2011 Inventory. If a category is not mentioned, no changes were made to that category.

[4] The absence of forestry in the municipality and relatively low level of agricultural activity support the exclusion of agriculture and forestry emissions from the Inventory. According to East St. Paul's Economic Profile, there were less than 10 jobs in the "Agriculture, Forestry, Fishing and Hunting" industry in ESP in 2017 (Government of Manitoba, 2017).

2.1.1 CHANGES TO CORPORATE BUILDINGS CATEGORY

Building energy use for corporate buildings in the 2011 Inventory was updated using weather normalized data from Manitoba Hydro, and retrieved from Energy Star Portfolio Manager. Additionally, the 2011 Inventory included building energy use emissions from water infrastructure buildings (i.e. the Water Treatment Plant and Wastewater Treatment Plant) in the Water and Wastewater section. These emissions were transferred into the Corporate Buildings section.

2.1.2 CHANGES TO WATER AND WASTEWATER CATEGORY

Water and wastewater emissions were calculated using building energy use for water infrastructure in the 2011 Inventory. These emissions were moved into the corporate building category. Wastewater emissions for 2011 and 2018 were calculated using the method recommended by the GPC, which estimates nitrous oxide (N_2O) emissions from wastewater treatment. The full methodology is outlined in section 2.6.2.

2.1.3 CHANGES TO COMMUNITY TRANSPORTATION CATEGORY

The method used to calculate community transportation emissions in the 2011 Inventory referenced GIS traffic count data to estimate vehicle-kilometers. With the RM having four provincial highways that pass through its boundaries, this created elevated results for transportation emissions and was not a good reflection of the emissions generated by the community. Data obtained from Manitoba Public Insurance on registered vehicles in ESP from provided a more accurate estimation of locally generated vehicle-kilometers, and thus community emissions, than the method referenced for the 2011 Inventory. Recalculating transportation emissions using this method significantly reduced the calculated level of transportation emissions from the community in the 2011 Inventory by approximately 40%.

2.2 BUILDINGS CATEGORY: METHODS AND RESULTS

2.2.1 EMISSION SOURCES

The energy sources for buildings in the municipality include hydroelectricity used primarily to power electronic equipment (i.e. air conditioners, lights etc.) with natural gas providing energy for heating systems. Electricity is also occasionally used to power heating systems, but its use is generally to augment natural gas systems.

- On-site natural gas combustion (scope 1 stationary energy)
- Grid-supplied electricity use (scope 2 stationary energy)

2.2.2 METHODOLOGY

Corporate and community sector building emissions were calculated using the same methodologies. Activity data for electricity and natural gas use from January 1st to December 31st, 2018 were obtained through Manitoba Hydro. Corporate use is tracked through Energy Star Portfolio Manager, where Manitoba Hydro meter data for municipally operated buildings is accessible. Weather normalized building energy use data was used to calculate emissions. A further explanation of weather normalized energy use data is found in Appendix B.

At the request of ESP, Manitoba Hydro provided the data for ESP community emissions sources, providing total annual aggregate data for residential, commercial and industrial facilities located within the municipality based on meter information. Because municipal building accounts are included in the aggregate data from Manitoba Hydro, corporate building energy use was subtracted from the commercial building energy used data. Information on the operation of the Imperial Oil facility was not available for 2011 or 2018.

Tonnes of CO_2e are computed by multiplying the correct unit (i.e. m^3 of natural gas, KWh of electricity) by the corresponding emission factor. For natural gas, an emission factor of 0.00189 tonnes CO_2e/m^3 was used in the 2011 Inventory. This factor was cross-referenced with *Manitoba Hydro Emission Factors*, and not changed. For the 2018 data, the electricity use emission factor was updated to 1.9×10^{-6} tonnes CO_2e/KWh. The 2011 emissions factor was 4.0×10^{-6} tonnes CO_2e/KWh.[5]

2.2.3 RESULTS

Corporate:

- **RM buildings** emitted a total of 740 tonnes CO_2e from electricity and natural gas use using weather normalized information in 2018. RM buildings emitted 597 tonnes CO_2e in 2011.

Community:

- **Residential community buildings** emitted 232 tonnes CO_2e from electricity and 17,728 tonnes from natural gas for a total of 17,959 tonnes CO_2e in 2018.
- **Commercial community buildings** emitted 23 tonnes CO_2e from electricity and 1,959 tonnes from natural gas for a total of 1,982 tonnes CO_2e in 2018.

[5] This emission factor notably decreased from 2011 due to the operational changes at the Brandon Generating Station that shifted from coal to natural gas and now operates on an emergency basis only.

- **Industrial community buildings** emitted 3 tonnes CO_2e from electricity and 406 tonnes from natural gas for a total of 409 tonnes CO_2e in 2018.

2.3 CORPORATE FLEET AND EQUIPMENT: METHODS AND RESULTS

2.3.1 EMISSION SOURCES

Gasoline and diesel fuel used to power vehicles and other equipment operated by the RM are categorized as a scope 1 emission under the GPC. The corporate fleet is comprised of gas-and diesel-powered crew vehicles (i.e. ½ tonne trucks) and heavy equipment (e.g. front-end loaders, tandems) used for construction, maintenance and operational activities such as snow clearing. Fuel for diesel generators to power various stationary and mobile equipment is also included in this category.

2.3.2 METHODOLOGY

Corporate fleet emissions were calculated using municipal data on the volume of gasoline and diesel fuel purchased. Fuel for private vehicles used on municipal business was calculated based on staff mileage claims. Average mid-sized SUV fuel consumption was applied to mileage to estimate total fuel used. This amount was added to total fuel purchases. Emission factors used in the 2011 Inventory of 0.002732 tonnes CO_2e/L for diesel and 0.002440 tonnes CO_2e/L for gasoline were carried forward for the 2018 Inventory. These factors were multiplied by litres of the respective fuel to obtain tonnes of CO_2e.

2.3.3 RESULTS

- **Corporate vehicles and equipment** including private vehicles used for municipal business emitted 114 tonnes CO_2e from gasoline use and 204 tonnes from diesel use for a total of 318 tonnes CO_2e in in 2018.

2.4 STREETLIGHTS: METHODS AND RESULTS

2.4.1 EMISSIONS SOURCES

Streetlights in ESP are powered by electricity sourced from Manitoba Hydro.

- Grid-supplied electricity use (scope 2 stationary energy)

2.4.2 METHODOLOGY

Specific data on streetlight energy use for 2018 was not available. Emissions from streetlights in 2018 were estimated based on the emissions from streetlights in the 2011 Inventory, which

were 1.2 tonnes CO_2e. Because the emissions factor for electricity generated by Manitoba Hydro in 2018 was considerably lower than in 2011, it was determined that emissions from streetlights in 2018 were less than this small value.

2.4.3 RESULTS

- **Streetlights in ESP** in 2018 emitted less than 1 tonne CO_2e.

2.5 COMMUNITY TRANSPORTATION: METHODS AND RESULTS

2.5.1 EMISSION SOURCES

This category estimates the emissions from fuel combustion in personal vehicles registered by residents of ESP. Emissions from recreational vehicles (i.e. snowmobiles, motorboats) registered in the RM are not estimated due to the absence of reliable data on usage. Emissions from fuel combustion to power trains operating within the municipal boundary have been calculated. The following are the emission sources included in this category:

- Fuel use from vehicles registered to citizens and business owners in the RM of East St. Paul (scope 1 transportation)
- Diesel combustion associated with rail transportation through the RM of East St. Paul (scope 1 transportation)

2.5.2 METHODOLOGY

PERSONAL VEHICLES

Emissions from personal vehicles were estimated using the resident activity method (GPC, 2014). Vehicle registration data for ESP was obtained from Manitoba Public Insurance (MPI). The number of registered vehicles was multiplied by the average annual distance travelled for all Manitoba vehicles (15,187 km).[6] Average fuel economy for passenger cars in Manitoba in 2015 was 13.4 L/100km and 14.7 L/100km for light trucks.[4] MPI vehicle registration data indicated that 77% of registered vehicles were passenger vehicles and 23% were light trucks. This breakdown was used to estimate total fuel used (14,168,700 L gasoline and 3,295 L diesel). These amounts were multiplied by the corresponding emission factors[7] to compute tonnes of CO_2e. Vehicles registered elsewhere and entering the RM for deliveries or passing through are not included in this method of calculation.

[6] Transportation in Canada 2018 Statistical Addendum.
[7] Diesel: 0.002732 tonnes CO_2e/L Gasoline: 0.002440 tonnes CO_2e/L

RAIL TRANSPORT

There is approximately 8 km of railway in ESP. Trains are estimated to move through the RM 10 times per week[8], this equates to 520 per year. The emission factor used was 15.2 g CO_2e/tonne-km.[9] Average carload was reported to weigh 70 tonnes.[10] The average train was estimated to have 30 cars, for a total of 2,100 tonnes/train. This was multiplied by the 8 km of railway and 520 trains per year to compute g CO_2e using the emission factor, which was then converted to tonnes.

2.5.3 RESULTS

- **Personal vehicles** are estimated to have emitted 9 tonnes CO_2e from diesel and 34,565 tonnes from gasoline for a total of 34,574 tonnes CO_2e in 2018.
- **Trains passing through ESP** are estimated to have emitted 133 tonnes of CO_2e from diesel combustion in 2018.

2.6 WASTE: METHODS AND RESULTS

2.6.1 EMISSION SOURCES

Emissions from waste includes both solid waste and wastewater. As solid waste breaks down in landfills it releases greenhouse gas emissions, primarily in the form of methane (CH_4). Although this does not occur within the municipal boundary, ESPs contribution is estimated based on the recorded tonnage of waste transported to landfill by the municipality's waste hauler. Emissions from recycling were not calculated in the 2011 Inventory and are not counted in this analysis.

Wastewater releases nitrous oxide (N_2O) during treatment as wastewater contains high amounts of nitrogen. These emissions are estimated based on the population that is connected to ESP's Wastewater Treatment Plant. Wastewater emissions for 2011 were also calculated using this method because data to do so was available. The emissions sources reported in this category are:

- Breakdown of waste exported from the RM of East St. Paul (scope 3 waste)
- Treatment of wastewater by the RM of East St. Paul (scope 1 waste and scope 3 waste)

[8] Estimates derived from observations by RM staff members
[9] CN Rail Carbon Calculator Emission Factors (2015).
[10] Railway Association of Canada Rail Trends (2017).

2.6.2 METHODOLOGY

SOLID WASTE

Solid waste generated by the municipality and sent to landfill is recorded by weight. The total for 2018 was multiplied by a conversion factor of 0.4817 tonnes CO_2e/tonne of waste. The same waste conversion factor was used in the 2011 Inventory. Recycling is not included in this total.

WASTEWATER

The East St. Paul Wastewater Treatment Plant (WWTP) is designed to treat wastewater using an aerobic digester. The process inhibits the production of methane (CH_4). CO_2 emissions from wastewater are considered biogenic and therefore outside of this scope (GPC, 2014).[11] Nitrous oxide (N_2O) emissions are calculated using the following formula[12]:

$$N_2O \text{ emissions} = [(P \times \text{Protein} \times F_{NPR} \times F_{NON\text{-}CON} \times F_{IND\text{-}COM}) - N_{SLUDGE}] \times EF_{EFFLUENT} \times 44/28 \times 10^{-3}$$

The population connected to the WWTP in 2011 was 8,003 and the factor of protein consumed per person was 25.342 kg. The calculated value of N_2O emissions is 0.351 tonnes, this equates to 92.90 tonnes of CO_2e.

The population served by the WWTP was derived from the East St. Paul Sewage Treatment Plant Upgrade Feasibility Study Draft Report (2018). The 2017 population estimate of 8,717 was used, as 2018 data was not reported. *The Canadian National Inventory Report to the UNFCCC* (NIR) reported average protein consumption of 67.74 g/person per day for Canadians in 2017. This factor was converted to 24.725 kg/person/year for use in the equation. The NIR used values of 1.1 for $F_{NON\text{-}CON}$ and 0 for N_{SLUDGE}, serving as a guide for the calculation. The calculated value of N_2O emissions was 0.373 tonnes, when multiplied by the Global Warming Potential of 265 this equates to 98.73 tonnes of CO_2e.

2.6.3 RESULTS

- **Solid waste** disposed at the regional landfill in 2018 is estimated to have emitted 986 tonnes of CO_2e.
- **Wastewater** is estimated to have emitted 99 tonnes of CO_2e from the release of nitrous oxide in 2018.

[11] Biogenic emissions are considered part of the natural carbon cycle and therefore not included in greenhouse gas emissions inventories.

[12] See Appendix A for definitions of variables.

2.7 SUMMARY OF RESULTS

Total emissions from both corporate and community sources were calculated to be **57,200 tonnes CO_2e**. A full summary of results by category is in Tables 1 and 2:

Table 1: Total emissions by category for 2018

Category	CO_2e Emissions (t)
Corporate buildings	740
Corporate fleet	318
Streetlights	<1
Community transportation	34,707
Community buildings	20,350
Wastewater	99
Waste (solid)	986
Total	**57,200**

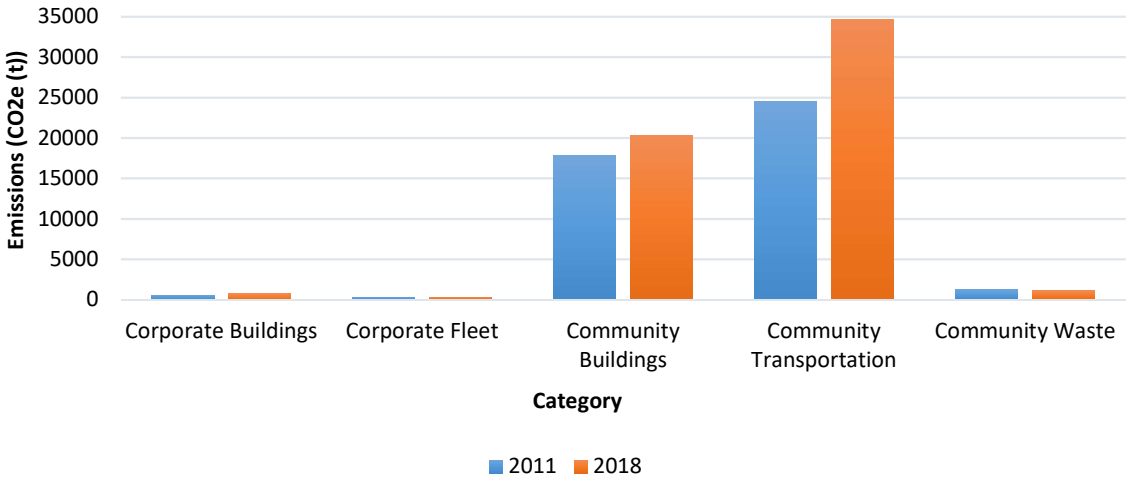
Table 2: Total emissions by sector for 2018

Sector	CO_2e Emissions (t)
Total Corporate	1058
Total Community	56,142
Total	**57,200**

2.7.1 EMISSIONS BREAKDOWN BY CATEGORY

The largest increases in emissions were found within the categories of community buildings and community transportation. Both of these increases are expected due to the population increase in the RM which has resulted in more residential and commercial structures being built. Increased development also typically comes hand in hand with increased vehicles and thus increased emissions from vehicles.

Figure 3: Emissions by Category 2011 vs. 2018



3 COMPARISON TO 2011 BASELINE

3.1 CORPORATE EMISSIONS

Corporate greenhouse gas emissions come from two main sources: buildings and fleet (vehicles and equipment). Table 3 shows the change in total corporate emissions by category for 2011 and 2018. A full breakdown of changes in emissions by building is included in Table 4 and Figure 3. Corporate building emissions increased by 143 tonnes since the 2011 Inventory (23.9% increase), while fleet emissions increased by 2 tonnes (0.6% increase). Since 2011, the RM has added a new Operations Building and expanded the capacity of the municipal Wastewater and Water Treatment plants.

Table 3: Corporate emissions by category, 2011 and 2018

Category	2011 CO_2e (t)	2018 CO_2e (t)	Change (2011-2018)	% Change (2011-2018)
Buildings	597	740	143	23.9%
Fleet	316	318	2	0.6%
Total*	**913**	**1058**	**145**	**15.9%**

*Streetlight emissions not included

3.1.1 CORPORATE BUILDINGS

Figure 3 compares 2011 and 2018 emissions from each municipal-operated building. The Operations Building opened in 2014. It replaced many of the functions of the old Public Works

Building, explaining its decrease in emissions. The increased capacity of the Water and Wastewater treatment plants underscore the change in energy use at these facilities.

Most municipal buildings decreased their emissions in 2018 as compared to 2011. This includes the Arena, which was the largest emitting building in 2011. The addition of the Operations Building and significant increases in emissions from the WWTP are the main reasons for the total increase in building emissions. Weather normalized energy use data for corporate buildings are included in Appendix B.

Table 4: Summary of corporate building floor areas and energy use

Building	Area (m^2)	Natural gas (m^3)*		Electricity (kWh)*		Emissions (CO2 (t))	
		2011	2018	2011	2018	2011	2018
Administration	1,840	59,083	56,783	320,517	345,770	101	105
Arena	4,659	123,348	109,984	655,374	598,556	212.8	200.8
Daycare	495	20,559	12,896	73,695	99,731	35.5	23
Firehall[1]	726	16,762	18,296	90,468	69,163	28.8	33.3
Operations[2]	1,843	n/a	40,366	n/a	200,805	n/a	75
Public Works	669	26,819	14,391	84,085	44,490	45.5	26.2
Senior Centre	431	9,255	7,640	27,694	34,108	15.9	13.6
Wastewater Treatment	1,690	91,155	145,316	782,965.30	914,537.50	157.6	263.2
Water Treatment[3]	720	n/a	n/a	132,624	214,045	0.3	0.4
Total	**13,073**	**346,981**	**405,672**	**2,167,422**	**2,521,206**	**597.4**	**740.5**

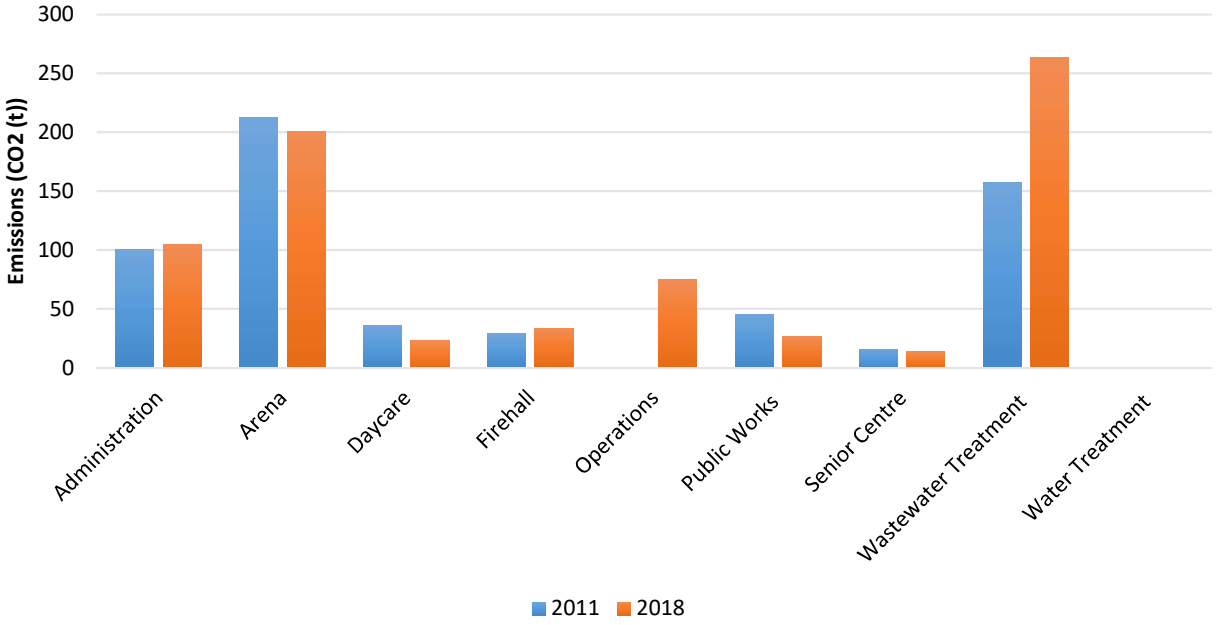
* weather normalized data

1. natural gas data estimated

2. constructed in 2016

3. energy source is electrictity only

Figure 4: Emissions by Corporate Building 2011 vs 2018



3.2 COMMUNITY EMISSIONS

Table 5 compares the total community emissions by category in 2018 to 2011. Community emissions increased across all categories except waste, with the largest increase occurring in transportation. The population of ESP increased 3.6% over this time from 9,046 (2011 Census) to 9,372 (2016 Census). Figures 4 and 5 compare the percentage breakdown of community emissions in 2011 and 2018. Transportation increased from 56% to 62% of total emissions, while buildings decreased from 41% to 36% of total emissions.

Table 5: Changes in community emissions by category, 2011 to 2018

Category	Sub-Category	2011 CO_2e (t)	2018 CO_2e (t)	Change (2011 to 2018)	% Change (2011 to 2018)
Buildings	Residential	16,023	17,959	+1,936	12.1%
	Commercial	1,437	1,982	+545	37.9%
	Industrial	350	409	+59	16.9%
Transportation	Personal Vehicles	24,537	34,574	+10,037	40.9%
	Rail	n/a	133	n/a	n/a
Waste	Wastewater	93	99	+6	6.5%
	Solid waste	1,147	986	-161	-14.0%
Total		**43,587**	**56,142**	**12,555**	**28.8%**

Figure 5: 2011 Percentage Breakdown of Community Emissions

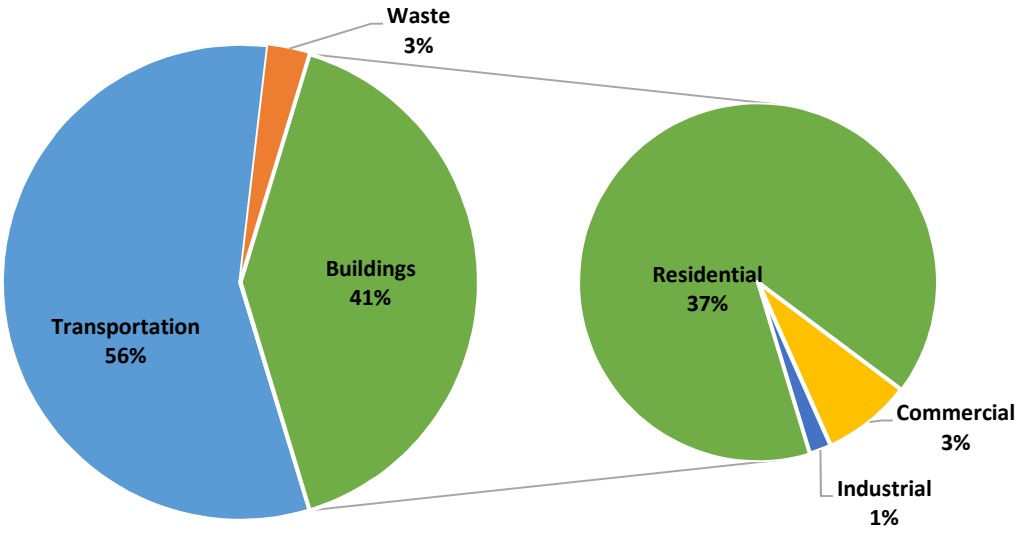
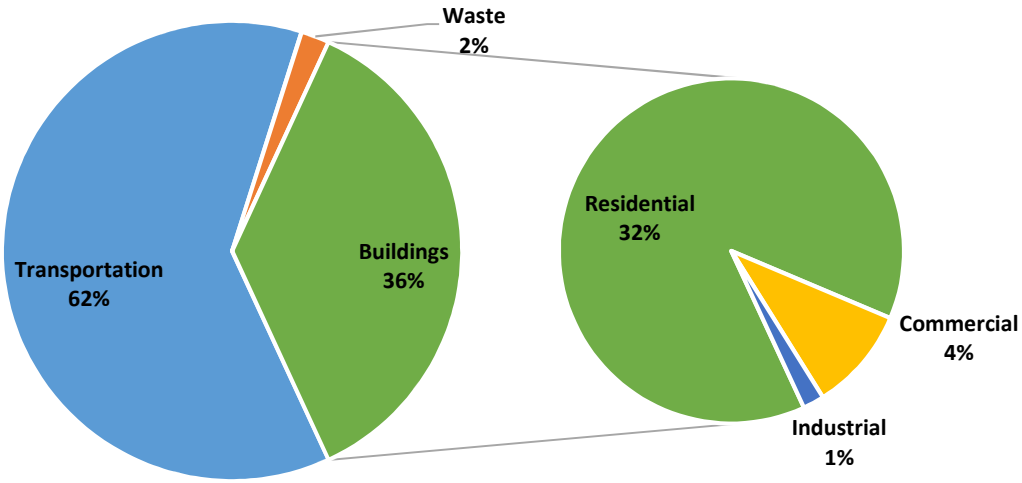


Figure 6: 2018 Percentage Breakdown of Community Emissions



4 EMISSIONS TARGETS

4.1 EMISSONS VERSUS TARGETS

ESP's Climate Action Plan identified a 20% reduction target of 2011 emissions for the corporate sector by 2027. This equates to an emissions level of 731 tonnes CO_2e per annum. For the community, a 6% reduction of 2011 emissions level was identified. This equates to an emissions level of 40,972 tonnes CO_2e per annum in community emissions by 2027. Corporate 2018 emissions exceed the 2027 target by 327 tonnes CO_2e (45%). Community emissions similarly exceeded the target by 15,170 tonnes CO_2e (37%). Table 6 shows 2018 emissions levels and 2027 targets for the corporate and community sectors.

Table 6: 2018 emissions and 2027 targets

Sector	2018 emissions CO_2e (T)	2027 target* CO_2e (T)	Difference in emissions from Target CO_2e (T)
Corporate	1058	731	327
Community	56,142	40,972	15,170
Total	**57,200**	**41,703**	**15,497**

*target reflects updated emissions data for 2011

4.2 FUTURE REDUCTION POTENTIAL

4.2.1 CORPORATE

For the corporate sector, emissions are unlikely to grow at the same rate that occurred between the 2011 and 2018 inventories. There are no current plans to add additional buildings although aging structures such as the Arena may be renovated or replaced during this time frame. A major renovation proposed for the Wastewater Treatment Plant would see aging and inefficient equipment and the building envelope replaced. If emissions reducing technologies and approaches are a priority, these will have a compounding effect on community-wide emissions from wastewater treatment that will offset the projected population growth for the municipality. These choices also increase the likelihood the RM will be successful with capital funding supports from grant programs that are increasingly requiring proven emissions reductions as a qualifying factor.

The corporate fleet is continually being refreshed as aging equipment and vehicles are replaced and while these are generally more efficient options, hydrocarbon fuel based equipment will still generate similar emissions. By 2023, electric vehicle (EV) and equipment options will be

readily available and the RM has expressed interest in considering these options as they complement the size of the municipality and the scope of the maintenance and operational activities. EV technologies will dramatically reduce the transportation emissions footprint in addition to operation and equipment maintenance costs.

4.2.2 COMMUNITY

Community sector emissions are generated from buildings and private vehicle use. The municipality has extensive land holdings available for future subdivisions and it continues to grow with additional residential and commercial development proposed. In light of this, community emission rates from buildings will continue to increase as more residential and commercial structures are added to the existing inventory. Canada is expected to release a new energy efficient building code in 2020 that, when adopted by Manitoba, will result in more efficient homes that produce fewer emissions. Renovations undertaken by homeowners that that improve energy efficiency can also serve to decrease emission rates.

Additional development will increase population in the RM and likely drive increased vehicle emissions. However, for the same reason that fleet vehicles will shift to electric options, so too will private vehicles. It is also forecasted that 15% of new vehicles procured by 2025 will be electric, creating the potential for reductions in emissions due to the choices around individual private vehicles.

4.2.3 OPPORTUNITIES TO FOSTER REDUCTIONS

The Climate Action Plan lays out a series of actions to support carbon reductions along with other measures. Reductions in building related emissions can be tackled through energy retrofits of existing infrastructure, higher standards for new construction and/or fuel switching from carbon intense energy to carbon neutral sources. Supporting ESP property owner knowledge of energy efficiency benefits and financing programs can help encourage behaviour shifts. Assisting commercial and industrial building owners understand available Manitoba building energy retrofit programs can encourage uptake. Currently Manitoba has limited program offerings for residential properties. However, a homeowner energy retrofit financing program is being launched through FCM so that municipalities can support homeowners with retrofits paid back through the energy savings achieved. This should be evaluated to assess application for ESP. ESP can also consider how its development policies can encourage or discourage energy conservation and emissions reduction strategies and make appropriate adjustments.

The RM can influence the reduction in community transportation related emissions through various infrastructure investments. Developing a connected active transportation network that

links neighbourhoods to local services and amenities as well as with adjacent communities such as Winnipeg encourages modal shifts and healthy lifestyles. Historically, the RM had public bus service offered by a private company, providing service to Winnipeg and Selkirk. Micro transit options are being trialed in small communities across Canada and may have application for ESP. Many of these use a handi-transit style of operation to meet the needs and demand flows of smaller centers. Charging infrastructure will be required for EV corporate fleet acquisitions, but the RM can more broadly influence emissions by promoting electric vehicle charging station infrastructure. Ensuring new construction includes adequate power to parking areas for charging infrastructure, avoids costly renovations later. The second and complimentary approach is to support public fast charging stations, the presence of which has been shown to positively influence the uptake of EV technology in a community.

5 SUMMARY

Total emissions for the RM of East St. Paul in 2018 were 57,200 tonnes CO_2e. The majority (56,142 tonnes CO_2e, 98%) are classified as community emissions. The remaining 1058 tonnes (2%) CO_2e were the direct result of municipal operations (corporate). Overall, emissions increased by 28.5% (12,700 tonnes) from the 2011 Inventory. All emissions categories increased from 2011 to 2018 except for solid waste emissions, which decreased 14% from 1,147 to 986 tonnes CO_2e.

The overall rise in greenhouse gas emissions for the municipality was influenced by several factors, primarily the increased number and expansion of municipal facilities. Renovations and replacements of aging buildings and systems are key to drive emissions rates to target levels. However, this will not occur without emissions reductions being a stated objective of these projects. The municipality can also reduce emissions by seeking efficiency improvements in its fleet operations. As alternative fuel (hybrid/electric) vehicles and equipment become more available and reliable, this technology will provide the option of low emission fleet operations, but its uptake is dependant on investments in charging infrastructure.

For the community sector new building units, as well as an increase in private vehicles per household, contributed to the rise in emissions. From 2011 to 2016 the population of ESP increased from 9,046 to 9,372 (3.6%). The largest source of emissions in ESP is personal vehicle transportation, which accounted for 62% of all municipal emissions. This category also increased the most since 2011 (40.9%), going from 24,537 tonnes CO_2e to 34,574 tonnes CO_2e. The number of vehicles registered in ESP in 2011 was 5,551. This increased 22% to 6,780 in 2018. The average number of vehicles per household increased from 1.82 in 2011 to 2.08 in 2018. High personal vehicle emissions are a consequence of ESP's geographic location as a

semi-rural municipality. Compounding this are a lack of alternatives: the active transportation pathway system is fragmented with limited connectivity to local services and amenities and to commuting destinations (Winnipeg); there are no public transportation options[13]; and the lack of electric charging infrastructure capacity discourages the uptake of EVs.

Community emissions are ultimately the responsibility of individual residents. However, municipalities can engage and influence resident behaviours through provision of information, targeted planning and development requirements, infrastructure choices and incentives. Since buildings and personal vehicles contribute so significantly to overall municipal emissions, strategies targeting reductions in these areas will be the most impactful. The structural limitations that currently inhibit community and corporate emissions reductions can be overcome with purposeful actions to raise local awareness and strategic investment and resourcing. Opportunities to combine these actions with climate resiliencies measures will further strengthen the business case for their uptake.

[13] Handi-Transit services are available but have marginal uptake in the community.

6 APPENDICES

6.1 APPENDIX A – DESCRIPTIONS OF VARIABLES FOR N_2O EMISSIONS FROM WASTEWATER

Table A-1: Descriptions of variables used to calculate nitrous oxide emissions from wastewater

Variable	Description	Value
N_2O emissions	Total N_2O emissions in tonnes	Computed
P	Total population served by the water treatment plant	User input
Protein	Annual per capita protein consumption, kg/person/yr	User input
$F_{NON-CON}$	Factor to adjust for non-consumed protein	1.1 for countries with no garbage disposals, 1.4 for countries with garbage disposals
F_{NPR}	Fraction of nitrogen in protein	0.16, kg N/kg protein
$F_{IND-COM}$	Factor for industrial and commercial co-discharged protein into the sewer system	1.25
N_{SLUDGE}	Nitrogen removed with sludge, kg N/yr	User input or default value: 0
$EF_{EFFLUENT}$	Emission factor for N_2O emissions from discharged wastewater in kg N_2O-N per kg N_2O	0.005
44/28	The conversion of kg N_2O-N into kg N_2O	

6.2 APPENDIX B – WEATHER NORMALIZED CORPORATE BUILDING ENERGY USE[14]

Energy Star Portfolio Manager provides weather normalized energy use calculations for buildings, in addition to actual energy use. Weather normalized energy is the estimated energy a building would have used under average climate conditions. This accounts for variation in weather when comparing a building's energy performance over time. Energy Star Portfolio Manager accesses data from weather stations from the Global Surface Summary of the Day dataset. The weather station used for Canadian buildings is determined based on the postal code entered for the building. The weather normalization process first determines the relationship between temperature and energy use for each individual fuel type (in this case electricity and natural gas) in each individual building. This involves plotting energy use and temperature and performing linear regressions to determine an R^2 value that calculates expected energy use based on temperature. A normalization ratio is computed; this is the ratio between expected energy use for an average year and expected energy use for the year being evaluated. Tables B-1 and B-2 show the difference between weather normalizing data versus actual 2018 for both electricity and natural gas. Electricity use, primarily used to power equipment and lighting, is not highly affected by weather.

Table B-1: Weather Normalized and Actual Natural Gas use, 2018

Building	2018 Weather Normalized Natural Gas use (m^3)	2018 Natural Gas use (m^3)	Difference (Weather normalized - actual use)	% Difference
Admin	56,783	55,086	1,696	2.99%
Arena	109,984	105,675	4,310	3.92%
Daycare	12,896	12,094	802	6.22%
Operations	40,366	39,334	1,032	2.56%
Public Works	14,391	13,808	583	4.05%
Senior Centre	7,640	7,175	465	6.09%
WWTP	145,316	138,309	7,007	4.82%
Total	**387,376**	**371,480**	**15,897**	**4.10%**

Firehall data not included

Water treatment plant does not use natural gas

[14] All information via https://portfoliomanager.energystar.gov/pdf/reference/Climate%20and%20Weather.pdf

Table B-2: Weather Normalized and Actual Electricity use, 2018

Building	2018 Weather Normalized Electricity use (KWh)	2018 Electricity use (KWh)	Difference (Weather normalized - actual use)	% Difference
Admin	345,770	345,770	0	0.0%
Arena	598,556	580,331	18,225	3.1%
Daycare	99,731	99,731	0	0.0%
Operations	199,675	200,805	-1,130	-0.6%
Public Works	44,470	44,470	0	0.0%
Senior Centre	34,108	34,108	0	0.0%
WWTP	911,676	914,538	-2,862	-0.3%
WTP	214,046	214,046	0	0.0%
Total	**2,518,247**	**2,502,962**	**15,285**	**0.6%**

Firehall data not included

6.3 APPENDIX C – EMISSIONS FACTORS

Table C-1: Values used to calculate emissions

Description of factor	Application	Emission Factor	Source*
Natural gas	Buildings	0.0019 tonnes CO_2e/m3	2011 Inventory, Manitoba Hydro
Electricity (Manitoba generated)	Buildings, stationary equipment	1.9×10^{-6} tonnes CO_2e/KWh	Manitoba Hydro
Gasoline	Vehicles	0.002440 tonnes CO_2e/L	2011 Inventory (via NIR)
Diesel	Vehicles, power generators	0.002732 tonnes CO_2e/L	2011 Inventory (via NIR)
Average Manitoba vehicle fuel consumption, 2015	Community personal vehicles	13.4 L/100 km (passenger cars) 14.7 L/100 KM (light trucks)	Transportation in Canada 2018 Statistical Addendum
Average Manitoba vehicle fuel consumption, 2011	Community personal vehicles	11.1 L/100 km (passenger cars) 14.7 L/100 km (light trucks)	National Resources Canada 2007 Vehicle Survey (via 2011 Inventory)
Rail emissions	Trains	15.2 g CO_2e/tonne-km	CN Rail
Solid waste	Landfilled waste	0.4817 tonnes CO_2e/tonne	2011 Inventory (via Solid Waste Association of North America)
Protein consumption, 2017	Wastewater	24.725 kg/person/year	Government of Canada NIR
Protein consumption, 2011	Wastewater	25.342 kg/person/year	Government of Canada NIR

* See References section for full citations of sources.

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