The Corporation of the City of Guelph

Solid Waste Management Master Plan

Future State and Growth Report

November 2021

CITY OF Guelph
Making a Difference

DILLON CONSULTING

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Executive Summary

The City of Guelph (City) is updating its Solid Waste Management Master Plan (SWMMP). This Future State Report (Report) is a sub-report for the SWMMP. The purpose of this report is to provide a long-term forecasting model to identify growth impacts across all waste service elements, including future needs, and potential changes and issues over the next 20 years. This report also includes discussions on future disposal strategies, legislative and regulatory changes at both the federal and provincial levels, and emerging issues in the waste management industry.

Overview

Guelph's population is expected to grow from 138,700 people in 2019 to 165,000 by 2031.[1] To accommodate the population growth, the City's high density housing stock (multi-residential) is anticipated to increase to 30% by 2031, up from 11% in 2011. The population growth will result in an increase in the amount of waste generated from 48,200 tonnes in 2019 to a projected 58,000 tonnes in 2031.

Based on internal data by the City, approximately 3,000 new households triggers the need for one new collection truck and driver. Additionally, city growth has an impact on other elements of waste services, such as organics processing, Public Drop-Off (PDO) use or residual waste disposal. For waste management in Guelph this means thinking about questions such as:

- How many new collection trucks and drivers may be needed?
- Given Guelph's landfill disposal contract with Waste Management Inc. expires in 2023, how will the City manage its garbage?
- What will be the impacts of the Blue Box Transition to individual producer responsibility?

[1] Please note that the report was written in 2020 and finalized in 2021. Some of the data, such as population projections and tonnage information is based on information available at the time of writing the report. Any modeling generated by the SWMMP is able to accommodate revised projections.

In addition, Ontario has limited landfill disposal capacity which is expected to be depleted by 2036. Future landfill capacity will be affected by:

- Approval of new or expanded landfill capacity
- Ability to meet diversion rate targets
- Availability of disposal options in the United States

Long-Term Tonnage Forecast

For the City to identify growth impacts and address future waste needs, a forecast of the anticipated tonnage by waste stream is required. The tonnage forecast was developed for the current waste management system based on discussions with staff and analysis of the historical tonnage information for the four WRIC facilities of OWPF, Transfer Station, MRF/PDO and MHSW (monthly and annual totals) from 2012 to 2019. These quantities formed the basis for generating an annual per capita rate for the various materials.

- The **Organic Waste Processing Facility (OWPF)** received approximately 31,000 tonnes of organic waste in 2020 which is expected to increase to 34,300 tonnes by 2041. The amount of organic waste received from Waterloo Region was forecasted to remain constant at 20,000 tonnes per year throughout the planning period. The total outgoing material is anticipated to increase by 11%, reaching approximately 9,500 tonnes by the end of the forecasted period (2020 to 2041).
- The **Transfer Station** receives residual waste (or mixed solid waste) from various sources including curbside collection, PDO, non-residential sources and residue from the MRF and OWPF. The majority of this residual waste comprise the outgoing materials from the Transfer Station which totalled 53,600 tonnes in 2020. It is anticipated that the total incoming quantities of waste will increase by 30% or approximately 16,000 tonnes and the total outgoing tonnes will increase by 30% in the forecast period (2020 to 2041) to approximately 70,100 tonnes in 2041.
- The **Material Recovery Facility (MRF)** receives recyclables collected through the City's Blue Cart program (approximately 10,100 tonnes) as well as other recyclables (cardboard and plastics) dropped off at the PDO. It is anticipated that tonnage will increase from 12,200 in 2020 to 16,000 tonnes in 2041. There is a combined total of approximately 11,600 tonnes of outgoing materials forecasted for 2020, which is forecasted to

grow to approximately 15,200 tonnes annually by 2041 based on the current waste management system. It is noted that responsibility for blue cart materials will transfer to producers as of January 1, 2025.

- The **Public Drop-Off (PDO)** received approximately 12,000 tonnes of construction material such as shingles, drywall and rubble, various recyclables, and electronics in 2020. It is expected to increase to 15,700 by 2041. Outgoing material quantities in 2020 were 11,600 tonnes and forecasting shows it is expected to increase to 15,200 by 2041.
- **Municipal Hazardous or Special Waste (MHSW) Depot:** The MHSW depot materials have been forecasted using the average per capita amount for each material from 2017 to 2019 which have been applied to the anticipated population in each year out to 2041. The customer count at the MHSW depot is anticipated to be about 760 in 2020 and is anticipated to grow to an annual customer count of 1,000 by 2041. Most of the source materials accepted at the depot that have existing diversion programs, with the exception of construction and demolition materials, are included in the current provincial IPR program.

The City is currently in a contract with Waste Management Inc. to haul and dispose of residual waste until 2023 with options to extend up to 2033. Although Guelph has a number of waste diversion programs in place, having sufficient long term disposal capacity is a core requirement of a municipal waste system.

Legislative and Regulatory Changes

The past five years have been a period of significant policy, program and legislative development across Canada in the solid waste area in general, and waste reduction and waste diversion in particular.

At a federal level, the Government of Canada is tackling the issue of plastic waste both through the Canadian Council of Ministers of the Environment and independently through Environment and Climate Change Canada (ECCC). In June 2019, Prime Minister Trudeau announced plans for European Union level action on waste plastics, singling out single-use plastics (SUPs). The following year in October 2020, ECCC announced the next steps in the Government of Canada's plan to achieve zero plastic waste by 2030.

At a provincial level, the Government of Ontario has been active on the waste legislation front with the passage of the **Waste-Free Ontario Act** in 2016. Ontario was one of the first provinces to begin framing its future waste policies and programs through the lens of circular economy thinking. The two provincial documents guiding waste legislation and resulting policies and programs are the Strategy for a Waste Free Ontario and the province's Made-in-Ontario Environment Plan. The three main areas of attention include:

- Extended Producer Responsibility (EPR), with a specific focus on Individual Producer Responsibility (IPR), as compared to collective responsibility programs for an increased range of materials
- Increased food and organic waste diversion and reduction (in part driven by greenhouse gas emission concerns)
- Plastic waste diversion and reduction, with a growing interest in single-use plastics, litter and plastic microbead pollution

With IPR programs transitioning into effect in Ontario, decisions need to be made by municipalities like the City of Guelph, regarding long-term roles and responsibilities in future waste management and waste diversion and reduction programs.

Emerging Trends

In addition to Guelph's waste management capacity and legislative and regularity changes, a variety of emerging trends will have to be considered to guide the City in their waste management goals and objectives for the next 20 years.

Some of these emerging trends and potential issues facing the waste management industry include the following and are highlighted throughout this report:

- Adapt to a Circular Economy;
- Reduce and divert more organic waste from disposal;
- Responsibility of the blue cart program switching from the City to producers of products and packaging;
- Manage the increase in single-use items, plastic and 'compostable' waste;
- Adapt to changes in the way people learn how to properly participate in waste diversion programs;
- Embracing new technology like artificial intelligence;

- Managing disruptive and problematic materials; and
- How to effectively measure performance.

As of January 1, 2025, the City will no longer be responsible to manage blue box material under the Blue Box Regulation. A Blue Box Transition Strategy was developed for the City as part of the SWMMP Update to assess the implications on the City's integrated waste management system when responsibilities for blue box services transitions from municipalities to producers through IPR. The Blue Box Transition Strategy provides a tool to assess the impacts on the rest of the City's solid waste management system and projected cost savings as a result of the IPR transition based on the tonnage and financial models.

Recommendations

Based on the information presented above, the following recommendations to address Guelph's long term disposal needs, transition of the Blue Box Program to individual producer responsibility and emerging issues are put forward as part of the SWMMP Update.

Residual Waste Management

- Explore approaches to identify alternatives to landfilling (e.g., feasibility study, request expressions of interest to provide alternative disposal capacity).

Blue Box Transition

- Implement the Blue Box Transition Strategy. The City continues to monitor developments to the Blue Box Regulation as details are made available and use the Blue Box Transition Strategy tool and financial model to evaluate the viability of providing services as a contractor to a Producer Responsibility Organization (PRO) in the new system and / or to determine the feasibility, costs and diversion impacts of providing services to non-eligible customers (IC&I, downtown).

Emerging Issues

- Update the SWMMP. With the anticipated major changes and issues facing waste management within the City, province and country, it is recommended that the City monitor progress and update the SWMMP every five years.

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Acronyms

AI	Artificial Intelligence
AMO	Association of Municipalities of Ontario
ATR	Advanced thermal recycling
BIA	Business improvement areas
CAD	Canadian dollar
CAO	Chief Administrative Officer
CEPA	Canadian Environmental Protection Act
CIF	Continuous Improvement Fund
COVID-19	Novel coronavirus disease-19
DC	District of Columbia
DPP	Development Priorities Planning
EA	Environmental Assessment
ECA	Environmental Compliance Approvals
ECCC	Environment and Climate Change Canada
EEE	Electrical and electronic equipment
EFW	Energy from waste
EOI	Expression of Interest
EPR	Extended Producer Responsibility
EU	European Union

GFA	Gross floor area
GHG	Greenhouse gas
GPS	Global Positioning System
GTA	Greater Toronto Area
HDPE	High density poly ethylene
HSP	Hazardous and Special Products
IC&I	Industrial, Commercial and Institutional
IFO	Industry funding organization
IFOs	Industry funding organizations
IPR	Individual Producer Responsibility
IT/AV	Information technology, telecommunications and audio-visual equipment
kg	kilogram
L	litre
M3RC	Municipal Resource Recovery and Research Collaborative
MBNC	Municipal Benchmarking Network Canada
MECP	Ministry of the Environment, Conservation and Parks
MHSW	Municipal Hazardous or Special Waste
MRF	Materials recovery facility
MRFs	Materials recovery facilities
MSW	Municipal solid waste

MWP	Mixed waste processing
NZWC	National Zero Waste Council
OCC	Old corrugated containers
OES	Ontario Electronic Stewardship
OTS	Ontario Tire Stewardship
ONP	Old newspapers
OWMA	Ontario Waste Management Association
OWPF	Organic Waste Processing Facility
P&E	Promotion and education
PAC	Public advisory committee
PCR	Post-consumer recycling content
PDO	Public drop-off
PET	Polyethylene terephthalate
PLA	Polylactide acid
PPP	Printed Paper and Packaging
PPU	Persons per unit
PRE	Plastics Recyclers Europe
PRO	Producer Responsibility Organization
PROs	Producer Responsibility Organizations
PVC	Polyvinyl chloride

RDF	Refuse derived fuels
RFID	Radio-frequency identification
RFP	Request for Proposal
RFQ	Request for Qualifications
RRCEA	Resource Recovery and Circular Economy Act
RPRA	Resource Productivity and Recovery Authority
RSM Canada	Canadian branch of RSM International (RSM is not an initialism and is derived from the initials of the founding member firms: Robson Rhodes, Salustro Royal and McGladrey)
SDG	Sustainable Development Goals
SO	Stewardship Ontario
SUI	Single-use items
SUP	Single Use Plastics
SWMMP	Solid Waste Management Master Plan
SWR	Solid Waste Resources
TCT	Thermo-chemical treatment
UK	United Kingdom
UN	United Nations
US	United States
WDTA	Waste Diversion Transition Act
WEEE	Waste electrical and electronic equipment

WFOA	Waste-Free Ontario Act
WRIC	Waste Resource Innovation Centre
WTE	Waste-to-energy
WWTP	Wastewater Treatment Plants

1.0 Introduction

1.1 Purpose

The ways in which waste has been managed and the types of wastes that municipalities have had to manage has changed drastically over the last 20 years. In the development of a long term Solid Waste Management Master Plan (SWMMP), it is prudent to consider the different facets of waste management that could impact the way the City of Guelph (City) currently manages solid wastes.

Through the Solid Waste Resources (SWR) Business Review, a need to develop a long-term forecasting model to identify growth impacts across all waste service elements was identified and is included as part of Task 4 of the SWMMP. In addition, this sub-report identifies the future needs and potential changes and issues that may be considered in the SWMMP planning period over the next 20 years including the potential impacts to the City under Individual Producer Responsibility (IPR). With an understanding of the potential impacts to the City's future solid waste management system, the next part of the SWMMP development will be to identify options to address the future needs (Task 5 of the SWMMP).

Please note that the report was written in 2020 and finalized in 2021. Some of the data, such as population projections and tonnage information is based on information available at the time of writing this report. Any modeling generated by the SWMMP is able to accommodate revised projections.

1.2 Background

At the time of writing this report, the City of Guelph is currently undertaking a Municipal Comprehensive Review which will update the City's growth forecasts to 2051. The growth in population, employment, housing, and non-residential development used in this analysis is based on the City's current growth forecast (which aligns with the City's Development Charges Background Study). The financial model developed for Task 7 of the SWMMP can be updated once the revised growth forecast is approved by Council and implemented in the Official Plan. The current growth forecast anticipates the City to grow to a population of 162,100 by 2031. As a result of growth and intensification targets, high density housing (multi-residential) is projected

to increase to 30% of the total housing stock by 2031, up from 23% in 2011. This report serves to proactively identify and address how the City's solid waste management system will adapt to meet the needs of the community growth targets.

Internal data analysis indicates that approximately 3,000 new households, equivalent to a waste volume or weight increase of six per cent based on current waste generation rates, triggers the need for one new collection truck and driver. However, this does not address the impact city growth has on other elements of waste services, such as organics processing, Public Drop-Off (PDO) use or residual waste disposal.

The Development Priorities Planning (DPP) process currently used at Water and Wastewater Services is an annual report process that sets out recommended dwelling unit targets for subdivision registration and draft plan approval. The targets are based on project readiness, related capital projects in the budget and available City services. Using this process and information will help SWR proactively identify growth impacts across all waste service elements.

A long-term forecasting model was developed by Watson & Associates Economists Ltd., discussed in **Section 2.0**, in line with the existing Development Charges and Development Priority Planning processes, internal Finance processes and the City's Asset Management policy, to proactively identify growth impacts across all waste service elements. The model is based on 2019 tonnage data for the City's waste management system and a set of assumptions on anticipated waste generation changes during the planning period as outlined in **Appendix A** (**Waste Management Forecasting Model Assumptions**). A sensitivity analysis was also undertaken to assess impacts of changes in waste generation resulting from IPR and other waste minimization initiatives.

In addition, **Section 4.1** addresses the Ontario Waste Management Association's (OWMA) recent report, State of Waste in Ontario: Landfill Report: 3rd Annual Landfill Report – January 2021. Specifically, the OWMA conclusions with respect to landfill capacity in Ontario were reviewed in the context of impacts to the City of Guelph's waste management system, and potential strategies and options for future disposal. This review includes a

review of potential alternatives and emerging technologies in **Section 4.2** and noted considerations with respect to risks and timing to plan and implement.

Discussion about the future state also required consideration of identifying and exploring strategic positioning for services and programs related to legislative changes and emerging issues. This included the transition to IPR in Ontario, and how the transition to a product steward-owned and operated system for various streams, including recycling, will impact the City's role, facilities and obligations in the future. The world pandemic of COVID-19 (novel coronavirus disease-19) in 2020 has disrupted waste generation patterns with more residential waste and less non-residential waste being generated given more people are working from home, increased demands on health care, and the slow-down of the world economy to only essential services for much of the year and into 2021. Although vaccines are now available, restrictions will continue until there is widespread access and as a result, there is uncertainty as to future waste generation patterns until the economy restarts and stabilizes as the "new-normal".

2.0 Long–Term Growth Forecasting Model

2.1 Methodology and Approach

An estimate of the future solid waste and waste diversion needs is required as part of the SWMMP. To estimate tonnage demands (provided in **Section 3.0**), a long-term growth forecast was prepared.

2.1.1 Model Description

In 2018, Watson & Associates Economists Ltd. (Watson) undertook a Development Charges (DC) Background Study with the City of Guelph. As part of this study, a growth forecast was prepared to estimate the population and unit growth for residential development and the employment and gross floor area (GFA) growth for non-residential development, or the Industrial, Commercial and Institutional (IC&I) sector. The growth forecast utilized for the SWMMP is based on this DC growth forecast, with required adjustments. The forecast varies from the DC forecast for two main reasons:

1. The 2018 DC forecast did not incorporate growth anticipated in the Clair-Maltby Secondary Plan area; and
2. The 2018 DC forecast included growth to approximately 2033 whereas the SWMMP is to analyze growth to 2041.

These items are discussed further in **Section 2.2**. The growth forecast provides the anticipated growth, on an annual basis, for the following categories:

- Population
- Housing Units (Low, Medium, and High-Density)
- Employment (IC&I)
- Gross Floor Area in square feet (IC&I)

2.2 Assumptions

The following subsections detail the assumptions used in preparing the residential and non-residential growth forecasts.

2.2.1 Population Growth

As this study is analysing needs to 2041, the Provincial Growth Plan target of 191,000 population was used. This number includes the Statistics Canada census undercount, which is an estimate for the number of people that did not respond to the Census survey. For the growth forecast, population estimates excluding the census undercount were used. To estimate the 2041 anticipated population excluding the undercount, the assumption in the DC study for the amount of the undercount (3.38%) was applied. As a result, the target population in 2041 is estimated to be 184,500.

As noted above, the DC background study forecasted growth to approximately 2033; however, the forecast required for the SWMMP extends to 2041. In the DC study, 5-year increments were provided from 2018 to 2033. These increments were used as presented in the DC study. For years between increments, linear interpolation was used to estimate the population in each year (i.e., equal annual increases in between increments).

As the growth for the Clair Maltby Secondary Plan area was not included in the DC forecast, it was assumed that this area would now be included and would account for the growth required for the City to meet the Provincial target of 184,500. The population estimates were added to the forecast and interpolated to 2041.

2.2.2 Household Density

In addition to population growth, the growth forecast provides estimates for the housing units anticipated to 2041. These units were provided by low, medium, and high-density categories. The Persons Per Unit (PPU) assumptions were based on the assumptions utilized in the 2018 DC study. Similar to estimating the anticipated population, the anticipated housing units were based on the DC study to 2033 with the addition of the Clair-Maltby Secondary Plan area assumed growth to 2041. **Table 1**: Persons per Unit Assumptions for Housing Categories provides for the types of housing units and PPU assumptions for each housing unit category.

Table 1: Persons per Unit Assumptions for Housing Categories

Density	Housing Types	PPU Assumption
Low	single-detached and semi-detached dwelling units	3.332
Medium	townhouses and apartments in duplexes	2.455
High	accessory apartments, bachelor, 1 bedroom, and 2 plus bedroom apartments	1.677

2.2.3 Non-Residential Growth

The non-residential growth forecast provides the anticipated employment and the Gross Floor Area (GFA) in square feet (sq.ft.) for non-residential buildings, separated by industrial, commercial, and institutional categories. For the employment and GFA estimates to 2028, the DC background study information was used. Similar to the estimates for population and units, 5-year increments from 2018 to 2028 were included. These figures were used in this forecast and linear interpolation was used for the years between increments.

The DC growth forecast utilizes activity rate assumptions to estimate employment. The activity rate measures the employment relative to the population in that year. For example, in 2020, the activity rate for industrial was anticipated to be 0.19526. This figure multiplied by the population of 141,000 provides an estimated industrial employment of 27,530. In 2028, the anticipated activity rates were as follows; 0.186001 for industrial, 0.183994 for commercial, and 0.140992 for institutional. It was assumed that these activity rates would remain constant for the remainder of the forecast (i.e., 2029 to 2041).

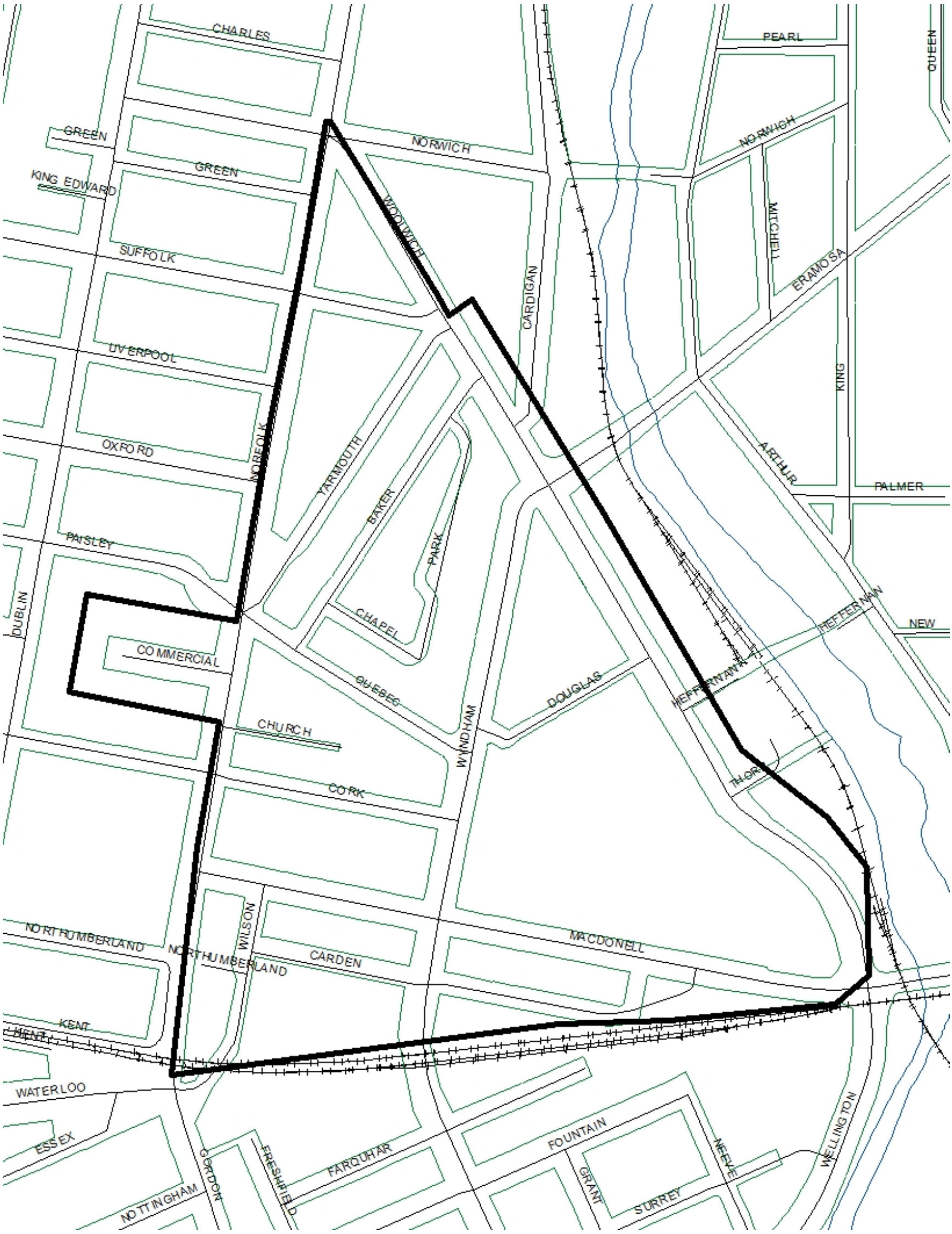
For the non-residential GFA by type, the average floor space per worker assumptions used in the DC study were applied. These assumptions are 1,200 sq.ft. per employee for industrial, 450 sq.ft. per employee for commercial, and 700 sq.ft. per employee for institutional.

These assumptions were applied to the anticipated employment in each year to estimate the GFA.

2.2.4 Downtown Waste Collection Service Area

The City provides waste collection service to a portion of the downtown area. This service area receives collection services 6 days per week, 52 weeks per year. This area is bordered along Woolwich Street, Macdonell Street, and Norfolk Street as provided in the following map:

Figure 1: Downtown Waste Collection Service Area



Source: City of Guelph, Downtown Waste Collection Service Area.

Please note that the numbers below represent the units receiving curbside service as part of the six day collection service. The numbers do not reflect some of the larger multi-residential units, as they are collected as part of the City's overall multi-residential collection program and are therefore not subject to the daily curbside service.

There are 334 total addresses and 884 total units in this service area. The following provides a summary of the property types in the Downtown Service Area:

Table 2: Downtown Service Area Properties by Type

Downtown Service Area Properties	Number of Addresses	Number of Units
Commercial	274	424
Residential	34	460
Mixed	26	N/A
Total	**334**	**884**

2.3 Growth Forecast Results

As noted above, the growth forecast is based on the 2018 DC background study, with necessary modifications. Based on the DC background study, it was anticipated that in 2020, the City would have a population of approximately 141,000 in 56,700 units. Additionally, the 2020 employment was estimated to be approximately 73,000 with 58.5 million sq.ft. of non-residential building area.

2.3.1 Residential Growth Forecast

It is anticipated that there will be population growth of 20,000 people by 2030 and 43,500 people by 2041.

The anticipated growth in housing units is as follows:

- Low density: 1,600 additional units by 2030 and 3,000 additional units by 2041;

- Medium density: 4,200 additional units by 2030 and 5,700 additional units by 2041; and
- High density: 4,200 additional units by 2030 and 5,700 additional units by 2041.

In total, it is anticipated that there will be an additional 10,500 units by 2030 and 20,000 units by 2041. **Table 3** summarizes the anticipated population and units forecasted on an annual basis. Note that the shaded years (e.g., 2011, 2016, 2018) represents the data provided by the City.

Table 3: Residential Growth Forecast (Rounded)

Year	Watson Adjusted Population Rounded (excluding undercount)	Low Housing Units	Medium Housing Units	High Housing Units	Total
2011	121,700	28,500	8,600	10,900	**48,100**
2012	123,700	28,600	9,000	11,200	**48,900**
2013	125,700	28,700	9,400	11,500	**49,600**
2014	127,800	28,700	9,800	11,800	**50,400**
2015	129,800	28,800	10,300	12,200	**51,200**
2016	131,800	28,900	10,700	12,500	**52,000**
2017	134,100	29,100	10,900	13,100	**53,100**
2018	136,400	29,200	11,100	13,900	**54,300**
2019	138,700	29,500	11,600	14,300	**55,500**
2020	141,000	29,800	12,100	14,700	**56,700**
2021	143,300	30,100	12,600	15,100	**57,800**
2022	145,600	30,400	13,000	15,500	**59,000**
2023	147,900	30,700	13,500	15,900	**60,200**
2024	150,100	30,800	13,900	16,400	**61,200**
2025	152,300	30,900	14,400	16,900	**62,200**
2026	154,500	31,000	14,800	17,400	**63,300**

Year	Watson Adjusted Population Rounded (excluding undercount)	Low Housing Units	Medium Housing Units	High Housing Units	Total
2027	156,700	31,100	15,200	17,900	**64,300**
2028	158,900	31,200	15,700	18,400	**65,300**
2029	160,000	31,300	16,100	18,900	**66,400**
2030	**161,000**	**31,500**	**16,200**	**19,400**	**67,100**
2031	162,100	31,600	16,400	20,400	**68,300**
2032	163,100	31,700	16,500	21,300	**69,500**
2033	164,100	31,800	16,700	22,200	**70,700**
2034	166,700	31,900	16,800	23,200	**71,900**
2035	169,200	32,100	16,900	24,100	**73,100**
2036	171,800	32,200	17,100	25,100	**74,400**
2037	174,300	32,300	17,200	25,300	**74,800**
2038	176,900	32,400	17,400	25,500	**75,300**
2039	179,400	32,600	17,500	25,700	**75,700**
2040	182,000	32,700	17,600	25,900	**76,200**
2041	**184,500**	**32,800**	**17,800**	**26,100**	**76,700**

Based on Watson & Associates Economists Ltd. Growth Forecast, as per 2018 DC Background Study with addition of Clair Maltby Estimated Growth from 2031 to 2041.

2.3.2 Non-Residential Growth Forecast

For non-residential growth, employment and GFA have been forecasted by industrial, commercial, and institutional categories. **Table 4** summarizes the 10-year estimated growth for the non-residential sector in terms of employment and GFA.

Table 4: Summary of Non-Residential Growth (2020 – 2041)

Growth Forecast Period	Industrial	Commercial	Institutional	Total
Employment Growth Increment: 2020 to 2030	2,400	4,200	2,700	9,300
Employment Growth Increment: 2020 to 2041	6,800	8,500	6,000	21,300
Non-Residential Building GFA Increment (sq.ft.): 2020 to 2030	2,905,000	1,880,000	1,892,000	6,678,000
Non-Residential Building GFA Increment (sq.ft.): 2020 to 2041	8,145,000	3,824,000	4,209,000	16,177,000

Table 5: Non-Residential Growth Forecast (Rounded)

Year	Industrial Non-Residential Employment	Commercial Non-Residential Employment	Institutional Non-Residential Employment	Total Employment	Industrial Non-Residential GFA (sq.ft.)	Commercial Non-Residential GFA (sq.ft.)	Institutional Non-Residential GFA (sq.ft.)	Total GFA
2011	25,500	22,100	17,000	**64,600**	30,630,600	9,929,500	11,911,700	**52,471,800**
2012	25,700	22,400	17,400	**65,500**	30,823,200	10,093,100	12,197,100	**53,113,300**
2013	25,800	22,800	17,800	**66,500**	31,015,800	10,256,700	12,482,400	**53,754,900**
2014	26,000	23,200	18,200	**67,400**	31,208,400	10,420,200	12,767,800	**54,396,400**
2015	26,200	23,500	18,600	**68,300**	31,401,000	10,583,800	13,053,100	**55,038,000**
2016	26,300	23,900	19,100	**69,300**	31,593,600	10,747,400	13,338,500	**55,679,500**
2017	26,600	24,200	19,200	**70,000**	31,966,800	10,879,500	13,434,800	**56,281,000**
2018	27,000	24,500	19,300	**70,800**	32,340,000	11,011,500	13,531,000	**56,882,500**
2019	27,200	25,000	19,700	**71,900**	32,688,000	11,232,000	13,765,500	**57,685,500**
2020	27,500	25,500	20,000	**73,000**	33,036,000	11,452,500	14,000,000	**58,488,500**
2021	27,800	25,900	20,300	**74,100**	33,384,000	11,673,000	14,234,500	**59,291,500**
2022	28,100	26,400	20,700	**75,200**	33,732,000	11,893,500	14,469,000	**60,094,500**
2023	28,400	26,900	21,000	**76,300**	34,080,000	12,114,000	14,703,500	**60,897,500**
2024	28,600	27,400	21,300	**77,300**	34,359,400	12,323,300	14,900,200	**61,582,800**
2025	28,900	27,900	21,600	**78,300**	34,638,700	12,532,500	15,096,900	**62,268,100**
2026	29,100	28,300	21,800	**79,300**	34,918,100	12,741,800	15,293,600	**62,953,500**
2027	29,300	28,800	22,100	**80,200**	35,197,400	12,951,000	15,490,300	**63,638,800**
2028	29,600	29,200	22,400	**81,200**	35,476,800	13,160,300	15,687,000	**64,324,100**
2029	29,800	29,400	22,600	**81,800**	35,709,000	13,246,400	15,789,700	**64,745,100**
2030	30,000	29,600	22,700	**82,300**	35,941,200	13,332,500	15,892,300	**65,166,100**

Year	Industrial Non-Residential Employment	Commercial Non-Residential Employment	Institutional Non-Residential Employment	Total Employment	Industrial Non-Residential GFA (sq.ft.)	Commercial Non-Residential GFA (sq.ft.)	Institutional Non-Residential GFA (sq.ft.)	Total GFA
2031	30,100	29,800	22,900	**82,800**	36,173,400	13,418,700	15,995,000	**65,587,100**
2032	30,300	30,000	23,000	**83,300**	36,405,600	13,504,800	16,097,700	**66,008,100**
2033	30,500	30,200	23,100	**83,900**	36,637,800	13,590,900	16,200,400	**66,429,100**
2034	31,000	30,700	23,500	**85,200**	37,205,600	13,801,600	16,451,500	**67,458,700**
2035	31,500	31,100	23,900	**86,500**	37,773,500	14,012,200	16,702,600	**68,488,300**
2036	32,000	31,600	24,200	**87,800**	38,341,400	14,222,900	16,953,600	**69,517,900**
2037	32,400	32,100	24,600	**89,100**	38,909,200	14,433,500	17,204,700	**70,547,500**
2038	32,900	32,500	24,900	**90,400**	39,477,100	14,644,200	17,455,800	**71,577,100**
2039	33,400	33,000	25,300	**91,700**	40,045,000	14,854,800	17,706,900	**72,606,800**
2040	33,800	33,500	25,700	**93,000**	40,612,900	15,065,500	17,958,000	**73,636,400**
2041	34,300	33,900	26,000	**94,300**	41,180,700	15,276,100	18,209,100	**74,666,000**

Employment excludes Primary, No Fixed Place of Work, and Work at Home. Non-res forecast post 2028 based on 2028 activity rates.

2.3.3 Downtown Waste Collection Service Area

As noted in **Section 2.2.4**, there is a total of 884 units in the Downtown Waste Collection Service Area. This area is primarily built-out; however, potential redevelopment may occur in the Baker Street parking area. At this time, it is unclear if the potential redevelopment would provide additional units that require collection services. As a result, no growth is forecasted in the downtown waste collection service area. However, this can be revisited as growth plans are firmed up.

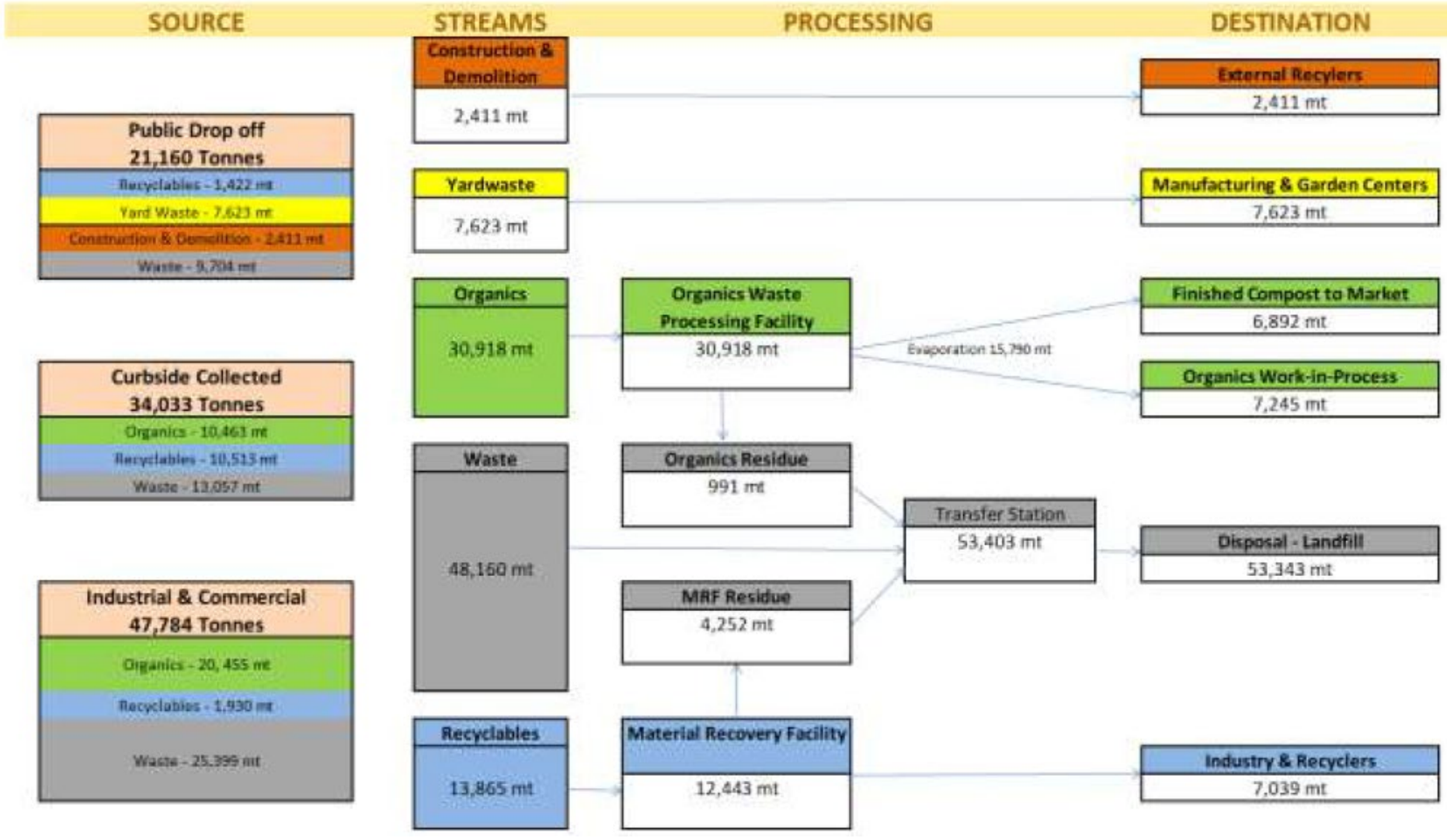
3.0 Long-Term Tonnage Forecast

3.1 City of Guelph Waste Facilities

The City of Guelph collects waste from its residential and eligible IC&I customers and transports to waste management facilities located at the Waste Resource Innovation Centre (WRIC). Acceptable waste is also delivered to the WRIC by Guelph residents and IC&I customers. Most of the waste is processed at the WRIC prior to being shipped for further processing/recycling aside from residual waste which is transported from the Transfer Station to a private sector landfill site for final disposal. To provide context on how the various materials are managed, a flow diagram of materials received and processed at the WRIC is provided in **Figure 2**[2]. Approximately 103,000 tonnes of material was received at the site in 2019.

[2] City of Guelph, 2019 Solid Waste Resources Update (IDE-2020-29), March 6, 2020

Figure 2: Breakdown of the Material Processed in 2019



Source: City of Guelph, 2019 Solid Waste Resources Update. Retrieved from: https://pub-guelph.escribemeetings.com/filestream.ashx?DocumentId=4277

18 | Long-Term Tonnage Forecast

The City collects data on the quantities (tonnes) of waste inbound and outbound at the WRIC (located at 110 Dunlop Drive), which comprises of these five major facilities:

1. Organic Waste Processing Facility (OWPF)
2. Transfer Station
3. Material Recovery Facility (MRF)
4. Public Drop-Off (PDO)
5. Municipal Hazardous or Special Waste (MHSW) Depot

The following provides a brief background on each of the facilities in the context of the waste tonnage forecasts and how historical data was used to develop the forecasts. More information about City facilities and historical data is provided in the Current State sub-report of the SWMMP.

3.1.1 Organic Waste Processing Facility (OWPF)

Organic waste received from City-collected green carts is sent to the OWPF. The City's organic waste accounts for approximately one-third (around 10,000 tonnes) of the total tonnes processed at the OWPF with the Region of Waterloo organic waste accounting for approximately two-thirds. The Region is in an agreement with the City to send 20,000 tonnes of green cart waste per year until October 2023. There are two 5-year options to extend the contract up to 2028 and 2033, if mutually agreed upon. The facility uses an aerobic, in-vessel composting technology to process the organic materials. The finished compost is then sold to gardening companies, landscapers, and greenhouses.

3.1.2 Transfer Station

The City's Transfer Station is utilized to temporarily store garbage collected by the City through the grey cart program, received at the public drop-off depot and from non-residential customers bringing waste to the WRIC. Some sorting of waste is done at the transfer station to divert waste from landfill; however, most of the material is loaded into transfer trailers and sent to a private sector landfill site. Residues from the OWPF and MRF are also received at the Transfer Station and sent to landfill.

3.1.3 Material Recovery Facility (MRF)

The City collects approximately 10,000 tonnes of recyclables through the blue cart collection program and receives recyclables at the City's MRF for processing. At the MRF, equipment and hand sorters are used to separate out the individual material streams (e.g., cardboard, plastic bottles, aluminum cans), which are then transported to markets for further processing. Residual waste (i.e., unacceptable blue cart materials or contaminants) is taken to the Transfer Station for transport to the landfill as previously noted.

3.1.4 Public Drop-Off (PDO)

The Public Drop-Off (PDO) accepts different waste types (e.g., garbage, appliances, construction and demolition waste, yard waste) from both residential and commercial customers. Vehicles are weighed through the scale and fees vary depending on the type of waste. Divertible waste is transferred for recycling or processing and residual waste is taken to the transfer station for disposal.

3.1.5 Municipal Hazardous or Special Waste Depot (MHSW)

The City of Guelph owns and operates a depot for Municipal Hazardous or Special Waste (MHSW) at the WRIC. City residents can drop off residential household MHSW such as propane tanks, paints, solvents, etc. Approximately 750 residents dropped off MHSW at the depot in 2019.

3.2 Overview of Tonnage Forecast

For the SWMMP, a forecast of the anticipated tonnage, by waste stream, is required. At a high-level, the forecast is based on average historical tonnage data provided by the City. These quantities formed the basis for generating an annual per capita amount. The historical information was analysed and reviewed with staff and it was determined that the most accurate data set was from 2017 to 2019 and for each material, a decision was made as to how the tonnage should be forecasted based on current trends relative to the anticipated growth in the City (discussed in **Section 2.0**). That said, the model is set up for staff to refine it, as needed in the future, to reflect changes in how programs are delivered and any changes in trends.

The tonnage forecast information will be used as an input into the Cost of Service model work (Task 7 of the SWMMP). The growth forecast and forecast tonnage will inform the continued operating costs, requirement for new capital costs (expansions, new facilities, etc.) and be the baseline (or denominator) for future rate calculations.

3.2.1 Methodology

The tonnage forecast is based on discussions with staff and analysis of the historical tonnage information for each facility (monthly and annual totals) from 2012 to 2019. The annual tonnage data for the materials was divided by the current population in each year to estimate the per capita tonnes produced for each material type. The average per capita amounts for 2012 to 2019 were then discussed with staff to determine the potential reliability in utilizing these amounts for the forecast. Refinements were made and each material has been forecasted on a basis most suitable for that material with rationale documented in **Appendix A**. For example, the "Mixed Organics" materials inbound to the OWPF can be broken down into three components; City of Guelph, Region of Waterloo, and compost process amendments such as brush. The forecast basis for each of these components is provided as follows:

- **City of Guelph**: forecasted based on the average per capita amount from 2017 to 2019. This average per capita was then multiplied by the anticipated population in each year of the forecast.
- **Region of Waterloo**: The Region has an agreement with the City whereby the City will accept up to 20,000 tonnes of organics materials each year[3]. The City has been accepting the full 20,000 tonnes for the past three years. As a result, the forecast assumed 20,000 tonnes per year.
- **Compost Process Amendments**: Wood materials such as brush and mulch are used to provide structure in the composting process and was

[3] It is noted that the contract with Waterloo Region expires in October 2023 and has two 5-year options to extend to 2028 and 2033. Task 7 will include a sensitivity analysis on the financial impact of the contract ending.

based on an average percentage (2017-2019) of the incoming mixed organics received at the facility.

Forecasts were completed by facility for applicable material streams with assumptions on the forecast basis and are presented in **Appendix A**. Generally, incoming materials were forecast based on the average per capita amount from 2017 to 2019 and outgoing tonnages were forecasted as a percentage of the incoming materials or matched directly with incoming materials on a one-to-one basis.

In preparing the analysis, a review of non-residential demands was undertaken. Additionally, a review of the relationship between residential and non-residential growth was undertaken. The activity rates (described in **Section 2.2.3**) provide the relationship between the level of employment relative to the population in each year. As there has been only marginal changes in the activity rate and the forecast assumes this continued trend, it is anticipated that the current amount of tonnage related to non-residential uses will remain proportional to the tonnage related to residential uses. As a result, utilizing the per capita methodology is an appropriate approach.

The following provides a summary of the activity rates for industrial, commercial, and institutional development anticipated in 2020, 2025, 2030, and 2041:

Table 6: Non-Residential Activity Rates

Activity Rates by Employment Type	Industrial	Commercial	Institutional	Total
2020	0.195	0.181	0.142	0.518
2025	0.190	0.183	0.142	0.514
2030	0.186	0.184	0.141	0.511
2041	0.186	0.184	0.141	0.511

3.3 Waste Quantity Forecasts

The waste forecasts for the four WRIC facilities (OWPF, Transfer Station, MRF/PDO and MHSW Depot) are provided in this section. The rationale or forecast basis for each material stream, by facility type, is provided in **Appendix A**. The methodology utilized to forecast the future waste quantities incorporated residential and non-residential amounts combined (except where data was available as identified).

3.3.1 Organic Waste Processing Facility (OWPF)

3.3.1.1 Incoming Materials

The OWPF receives mixed organics materials, brush, amendment, and mulch generated in Guelph and curbside collected green bin organics from the Region of Waterloo. As noted in **Section 3.2.1**, each component of the mixed organics materials is forecasted on a different basis. For brush, amendment and mulch, this amount was forecasted based on the historical (2017-2019) share of the materials as a proportion of the total mixed organics materials. This resulted in an average of 1.5% which was applied annually throughout the forecast.

At the time this section of the report was completed and presented to the PAC, it was estimated that the City will need to manage approximately 31,000 tonnes of organic waste in 2020 and this amount will increase to 34,300 tonnes by 2041. This equates to an increase of approximately 11% over the forecast period, assuming the contract with Waterloo continues until 2041 (or the City receives 20,000 tonnes per year).

3.3.1.2 Outgoing Materials

The materials leaving the OWPF include finished compost, overs, screened materials, residual waste, and organic rejected load. Each of these materials was forecasted based on their relative share of the total incoming mixed organics in each year over the period 2017 to 2019. The largest component was the finished compost which averaged about 22% of the total incoming mixed organics material.

In total, it is anticipated that the outgoing tonnage for all materials will increase by 11%, or approximately 900 tonnes by the end of forecast period.

3.3.2 Transfer Station

3.3.2.1 Incoming Materials

The largest amount of inbound materials (90% estimated in 2020) received at the Transfer Station was residual waste (or mixed solid waste) from various sources including the City's grey cart collection program, residential waste dropped off at the PDO, and non-residential waste dropped off at the WRIC. Curbside collected waste and the waste received at the PDO were forecasted based on the average per capita amounts from 2017 to 2019. For the non-residential component, these amounts averaged approximately 55%, by weight, of all mixed solid waste received from 2017 to 2019. This assumption has been utilized for the forecast.

In addition to mixed solid waste, a number of other items were received at the Transfer Station such as residues from the MRF and OWPF. The residues from the MRF were forecasted on a per capita basis while the residues from the OWPF (residual compost waste, screening waste, and organic rejected load) were forecasted to match the outgoing amounts from the organics facility.

In total, it is anticipated that over the forecast period (2020 to 2041), the incoming quantities of waste received at the Transfer Station will increase by 30%, or approximately 16,000 tonnes.

3.3.2.2 Outgoing Materials

The only outgoing materials from the Transfer Station are mixed solid waste materials. In 2020, it is anticipated that there would be an outgoing amount of approximately 53,600 tonnes. Mixed solid waste was forecasted based on their average historical (2017 to 2019) relative share of incoming materials. Between 2017 and 2019, outgoing mixed solid waste tonnes averaged 106%

of incoming mixed solid waste tonnes based on the City's data[4]. This amount was applied to the anticipated incoming tonnes in each year of the forecast.

Similar to the incoming forecast tonnes, the total outgoing tonnes for all materials are anticipated to increase by approximately 30%, or 16,500 tonnes.

3.3.3 Materials Recovery Facility (MRF)

3.3.3.1 Incoming Materials

Incoming materials at the MRF include recyclables collected through the City's blue cart program (categorized as single stream loose) as well as other recyclables (cardboard and plastics) dropped off at the facility. The facility received approximately 12,200 tonnes of material, 10,100 of which came from the blue cart recyclables. All incoming materials have been forecasted on a per capita basis, using the average per capita amounts from 2017 to 2019, applied to the anticipated population in each year.

In total, the incoming tonnage for all materials was anticipated to increase from approximately 12,200 in 2020 to approximately 16,000 in 2041. Scenario(s) will be considered as part of a sensitivity analysis in Task 7 to assess the impact of blue box materials being removed from the City's waste management system and processed by a producer responsibility organization.

3.3.3.2 Outgoing Materials

The MRF separates single stream recyclables into different material types that are then shipped to markets for processing. A variety of forecast methodologies have been used for these materials including using a percentage of inbound materials, matching to inbound quantities and on a per capita basis.

[4] The increase of outbound mixed solid waste was assumed to be attributed to the PDO having open top trailers that can be impacted by precipitation thus increasing the weight of materials.

There was a combined total of approximately 11,600 tonnes of outgoing materials forecasted for 2020 and is forecasted to grow to approximately 15,200 tonnes annually by 2041 (if the MRF continues to operate as noted for incoming materials).

3.3.4 Public Drop-Off (PDO)

3.3.4.1 Incoming Materials

Various materials are dropped off at the PDO. These include construction materials such as shingles, drywall, and rubble. as well as various recyclables and electronics. Note: Leaves are included in the PDO figures; however, this material is dropped off and removed by another City department. All incoming materials have been forecasted on a per capita basis, using the average per capita amounts from 2017 to 2019, applied to the anticipated population in each year.

The total anticipated incoming materials in 2020 was approximately 12,000 tonnes and is anticipated to grow to 15,700 by 2041.

3.3.4.2 Outgoing Materials

The materials collected at the PDO are managed in various ways. Construction materials are sent to private recyclers, brush and yard waste are collected by an external processor, clothing is donated to charity, and scrap metal is sold to market. Two forecast methodologies have been used for these materials as follows:

- a percentage of inbound materials for construction materials
- matching to inbound quantities for all other materials

There was a combined total of approximately 11,600 tonnes of outgoing materials forecasted for 2020. This is anticipated to increase over the forecast period and reach 15,200 tonnes in 2041.

3.3.5 Municipal Hazardous Waste Depot (MHSW)

3.3.5.1 Incoming Materials

The MHSW depot receives different materials such as paints/coatings, antifreeze, propane cylinders, motor oil, light bulbs, and batteries. These

materials have been forecasted using the average per capita amount for each material from 2017 to 2019 which have been applied to the anticipated population in each year out to 2041. The customer count at the MHSW depot was anticipated to be about 760 in 2020 and is anticipated to grow to 1,000 annual customer counts by 2041. Most of the source materials accepted at the depot that have existing diversion programs, with the exception of construction and demolition materials, are included in the current provincial IPR programs.

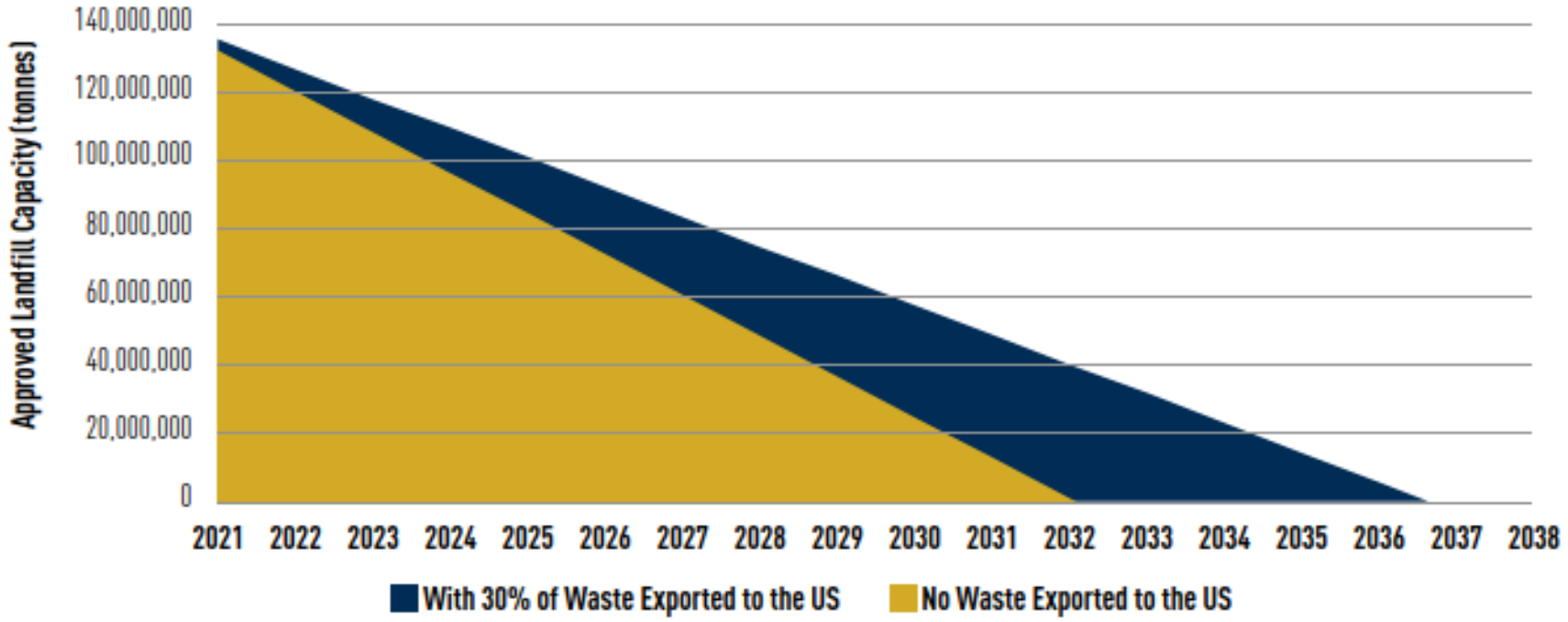
4.0 Future Disposal Strategies

4.1 Provincial Disposal Capacity

The availability of disposal capacity in Ontario is limited as demonstrated by the Ontario Waste Management Association's (OWMA) report[5] on the State of Waste in Ontario: Landfill Report (January 2021). This third Landfill Report is based on a dataset of over 800 public and private active landfill sites. Based on population growth, and assuming a constant waste generation rate per capita, the Province's remaining landfill capacity is expected to be depleted within 15 years, by 2036 (**Figure 3**). Should the United States border close to Ontario waste, this capacity is estimated to be depleted within 11 years by 2032. This forecast is anticipated to change as a result of the impacts of the COVID-19 pandemic on waste generation patterns, further discussed in **Section 6.9**, as well as by proposed provincial and federal actions which are discussed in **Section 5.0**. An increasing percentage of the remaining landfill capacity in Ontario is being concentrated in a small number of the largest landfill sites. Based on OWMA's database, about 60% of Ontario's remaining landfill capacity is held by only seven (7) landfill sites. The study suggests that as the smaller landfill sites close, more waste will need to be managed by larger landfill sites.

[5] 2018 State of Waste: 2nd Landfill Report

Figure 3: Ontario's Remaining Landfill Capacity



Source: Ontario Waste Management Association, State of Waste in Ontario: Landfill Report (January 2021). Retrieved from: https://www.owma.org/cpages/landfills

Since the OWMA Landfill Report came out, there have been several major waste disposal sites in Southwestern Ontario that are in the process of preparing an Environmental Assessment (EA). Although the service areas and/or types of wastes received at these facilities may not be applicable to the City of Guelph, it will increase the overall provincial disposal capacity which could potentially 'free up' other sites that are approved to take the City's residual waste.

- The Twin Creeks Landfill owned by Waste Management Inc., where the City currently sends its residual waste, initiated the Terms of Reference in November 2020 to expand the landfill and extend the landfill life by approximately 12 years (from 2032 to 2044). No changes to the annual fill rate are being proposed.
- The City of London's W12A landfill site has received approval for the Terms of Reference to expand. If approved, the site will provide 500,000 tonnes of disposal capacity per year for an additional 25 years. The proposed service area is one of a regional nature including the City of London and the Counties of Huron, Perth, Elgin, Lambton and Middlesex. The approval of the W12A landfill site means that the above mentioned municipalities may not be competing for private landfill capacity.
- A new landfill in Zorra Township, located in Oxford County, has been proposed by Walker Environmental, with an annual capacity of 850,000 tonnes of waste over a 20-year operating period and servicing the Province. A draft EA for the proposed Southwestern Landfill[6] has been completed. Public consultation was delayed due to the COVID-19 pandemic and was extended until late August 2020.

4.1.1 Quantity of Waste Disposed of beyond Ontario's Borders

Currently, there is a reliance on the export of several million tonnes per year of waste generated in Ontario across the US border for disposal. Ontario has relied on this practice for many years. The export of residential waste to Michigan from the GTA was significantly reduced in 2010 as a result of political pressure in Michigan, and the border was temporarily shut down

[6] Southwestern Ontario Landfill Information

entirely in the aftermath of September 11, 2001. There can be no assurance that the landfills in US will continue to be available in the future for Ontario waste. As of the end of 2017, 30% of the province's total waste stream was exported[7]. Based on available data, within the last 10 years, US landfills located in Michigan, New York State and Ohio have received, on average, 3 million tonnes per year of Canadian waste[2].

Exporting of waste also contributes to greenhouse gas emissions. Long distance transportation of over 3 million tonnes of Ontario IC&I waste to Michigan and New York disposal facilities contributes additional GHG emissions to the atmosphere.

4.1.2 Potential Impacts to Guelph

The City is currently in a 10-year contract with Waste Management Inc. for the haulage and disposal of residual waste at the Twin Creeks Landfill in Watford, Ontario (approximately two hours southwest of Guelph). The contract started in October 2013, expires in October 2023 and includes options to extend for two additional successive 5-year periods (i.e., to 2028 and 2033).

An aerial photo of the Landfill is provided in **Figure 4**. As noted in the previous section, Waste Management has recently initiated a Terms of Reference to expand the landfill and extend the life until 2044.

Reliance on private sector disposal capacity is a key consideration for the City in the SWMMP to ensure that waste requiring disposal is minimized and there is ongoing capacity. Reducing reliance on private sector capacity will help to manage costs for transportation and future increases as disposal options become scarce. Alternative disposal options will need to be considered during the planning period. Transportation and energy costs may make local options more affordable should they be available. Partnerships with other municipalities are also a consideration.

[7] OWMA Landfill Capacity Report (December 2018)

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Peel Region and York Region are large municipalities that rely on waste disposal facilities outside of their municipal borders and are thus competitors for the limited remaining disposal capacity. Peel Region currently sends its residual waste to the same Waste Management landfill and is currently exploring mixed waste processing to reduce the amount of future residual waste requiring final disposal. Peel is interested in partnering with other municipalities for the mixed waste processing facility. York Region has disposal contracts with multiple incineration and landfill disposal facilities.

As further discussed in **Section 5.0**, there are several new or proposed provincial and federal actions that will have an impact on future residual waste quantities generated in the City such as disposal bans on organic waste, a harmonized provincial Blue Box program and bans on certain single-use plastics.

Currently the City receives approximately 48,000 tonnes per year (2019) of solid waste at its Transfer Station, which is sent to landfill along with residual waste from the MRF and OWPF. Approximately 55% of the solid waste is from IC&I sources with the remaining 45% from grey cart collection and the PDO. Although the IC&I tonnage projections have been forecasted to continue at the same rate over the planning period, the amount can vary with the availability and costs for private sector recycling and disposal options. Balancing affordable options for small businesses with waste management system capacity and costs is also an important consideration in forecasting long term disposal capacity requirements.

Figure 4: Twin Creeks Landfill Facility

Source: Air photo courtesy of Waste Management Inc.

4.2 Alternative Disposal Technologies Review[8]

The intent of this section is to provide an overview of alternative residual disposal technologies to landfill, along with noted considerations to implement these alternatives. The technologies explored replace 'traditional' disposal methods such as landfilling with technologies that recover recyclables, energy and/or fuels from the residual waste stream (i.e., grey carts) that are not diverted at-source.

Planning and approval processes for these technologies are complex and lengthy, and timelines and considerations are provided in **Section 4.2.7**.

4.2.1 Mass Burn Incineration

Mass burn incineration, or the use of traditional combustion, is a technology used to manage waste (typically municipal solid waste, including hazardous waste) and generate heat that can be converted to electricity, steam and/or hot water. Limited pre-processing of inbound waste is required.

The complete oxidation of a fuel at high temperatures is referred to as direct combustion (also referred to as waste-to-energy (WTE), energy from waste (EFW), or advanced thermal recycling (ATR). The mass incineration occurs under controlled conditions and yields a significant net energy production. Temperatures in the combustion zone of the units are generally in the range of 800°C to 1650°C. Actual temperatures depend upon the type of fuel used, stoichiometric conditions (i.e., ratio of air to fuel), heat losses, and design of the combustion unit. Heat is recovered from the hot gases produced and converted to electricity, steam, or both from the direct combustion process. The end result of the combustion process also produces fly ash and bottom ash. Both types of ash are then disposed of at a landfill, with fly ash typically

[8] The following technology highlights are sourced from HDR, Technical Memorandum #5 – Waste Management Technologies and Approaches (January 2020):Waste Management Technologies and Approaches Report

being hazardous due to concentrations of heavy metals and other pollutants and disposed of at a hazardous waste landfill.

4.2.2 Gasification

Gasification involves converting solid or liquid carbon-based wastes into gas form at high temperature without combustion. Technology types include - updraft fixed bed; downdraft fixed bed; bubbling fluidized bed; circulating fluidized bed; and entrained flow. Municipal solid waste can be handled, however, pre-processing is required to prepare a uniform feedstock source, such as refuse derived fuel (RDF) often in the form of fuel pellets. It is noted that these technologies have traditionally handled a more homogenous feedstock (i.e., not municipal solid waste).

Gasification is a process that converts solid organic material under controlled conditions of partial oxidation into fuel gases and other by-products. The process can be used during the production of chemicals such as methanol and liquid fuels, in addition to producing fuel gases for direct conversion into energy. Partial oxidation is achieved by utilizing less oxygen than required for complete combustion of the material. Heating temperatures range from 750°C to 1,650°C. The fuel gas that is produced is known as syngas. Syngas primarily consists of carbon monoxide, hydrogen, methane, and other hydrocarbons. In some gasification processes, carbon dioxide and nitrogen gas can also be produced. Concentrations of the gases depend heavily on the composition of the organic material used for process and the operating conditions of the process.

4.2.3 Pyrolysis

Pyrolysis involves heating municipal solid waste in an oxygen-free environment to produce a combustible gaseous or liquid product and a carbon char residue. Technology types include - auger-type; rotary kiln; updraft and downdraft fixed bed; and bubbling and circulating fluidized bed. Municipal solid waste is pre-processed to segregate organics to prepare a uniform feedstock source like RDF.

Pyrolysis is a chemical process in which organic materials are decomposed by high temperatures in the absence of oxygen. The decomposed materials are converted to gas, liquid, and solid fuels. Pyrolysis is similar to the

process of gasification, but the process generally takes place at slightly lower temperatures. Syngas can be used as fuel for boilers, internal combustion units, or turbines, provided that the produced gas is clean enough and of sufficient quality. The feedstock for pyrolysis largely dictates whether the process will produce a product of sufficient quality to make the operation viable. The higher the content of organic materials, the better.

4.2.4 Waste to Liquid Fuel

These facilities generate liquid fuels from biomass (carbon-rich wastes) and organic wastes. Liquid fuels can be generated from biomass and organic wastes by undergoing three stages of processing. Non-recyclable waste can be processed into RDF. Using gasification, a thermal conversion process is used to generate syngas from the RDF. This syngas is cleaned to remove tar and other impurities and it is then combined with a chemical catalyst to undergo a series of chemical reactions to convert the syngas into a liquid fuel source. One of four types of chemical catalyst processes can be used to synthesize the syngas into a liquid fuel. These processes include Fischer-Tropsch synthesis, methanol synthesis, mixed alcohol synthesis, or syngas fermentation. Each process utilizes different reaction pressures and temperatures, requires different syngas compositions, and uses different catalysts.

4.2.5 Thermo-chemical Treatments

Thermo-chemical treatments (chemical recycling of waste plastic) are evolving for the management, treatment and handling of plastic solid waste as a fraction of municipal solid waste. Two alternative thermo-chemical treatment (TCT) technologies for the management of plastic solid waste are a low temperature pyrolysis reactor and a hydrogenation reactor. The pyrolysis process recovers valuable chemicals and petrochemicals (e.g., gases, liquid fractions, waxes and heat in the form of steam), whilst the hydrogenation process produces syncrude and e-gas which is comparable to natural gas. The feasibility of using the alternative TCT technologies depends on the market's ability to take-in the petrochemical by-products hence replacing their conventional production. Scenarios including pyrolysis appear to be more environmentally friendly in terms of GHG emissions when

compared with hydrocracking, while the reverse is true for eutrophication[9]. The issue with MSW is the purity of the plastic feedstock for these high tech options, which tend to be pilot test based. There has been more attention directed to these alternatives in the past few years.

4.2.6 Hydrolysis & Anaerobic Digestion

Hydrolysis is a chemical reaction in which the organic fraction of the waste material is used to synthesize glucose and/or other simple sugars that can then be fermented or digested to manufacture other products (e.g., ethanol). In processes used to chemically hydrolyze municipal solid waste or other organic feedstocks, an acid or enzyme is used as a catalyst to break down the complex structures of the material structures contained in the feedstock (e.g., paper, food waste, and yard waste) into simpler compounds like glucose and other sugars. Microorganisms and enzymes can then ferment the sugars, under appropriately controlled conditions, into ethanol, or process them using an anaerobic digestion system into methane-rich biogas.

Anaerobic digestion is a biological process that uses microorganisms to break down organic waste in the absence of oxygen. It is a proven method of managing sewage sludge from Wastewater Treatment Plants (WWTP). Co-digestion is an emerging technology for jointly managing household organics and sewage sludge. The resulting biogas is used in boilers, upgraded into renewable natural gas, or combusted to create electricity. The energy that is generated is typically used by the WWTP to reduce electricity costs and can be a revenue source depending on the energy demands of the WWTP. Using renewable energy also reduces GHG emissions. Use of biosolids as a soil nutrient is a well-established practice. Facility specific feasibility studies are required to determine how to integrate a co-digestion process into the WWTP and assess energy production potential and users.

[9] Life Cycle Assessment of Alternative Technologies. Accessed May 21, 2020. https://www.sciencedirect.com/science/article/abs/pii/S1385894714000916

4.2.7 Considerations

There are several factors to consider with the use of alternative disposal technologies. The capital and operating costs of these technologies is notably higher compared to landfilling, with some requiring additional equipment to process the feedstock. The business case for a facility typically relies on a constant supply and somewhat homogenous feedstock that can recover the desired output(s) (e.g., fuel, steam, electricity, metals) and the corresponding revenue from the outputs in order to make it viable. There are many changes coming in terms of waste policy and legislation (discussed further in **Section 5.0**) that could impact the quantity and composition of residual waste generated in the future. A benefit to these technologies is the significant reduction of the volume of waste sent to landfill. That said, residuals from the process that require landfilling will remain.

It is noted the most common alternative disposal technology used to process municipal solid waste is mass burn incineration. In Ontario, there is a municipal facility called the Durham-York Energy Centre that can process 140,000 tonnes per year and a private facility with the Emerald Energy-From-Waste Inc. that can process almost 184,000 tonnes per year and has also been historically used by Peel Region. Incineration is a proven technology that can effectively manage the non-homogenous waste stream that can come from municipal garbage collection programs around the world.

There have been attempts in Ontario to use other technologies such as gasification to process municipal residual waste. While these other technologies are in operation in Europe and Asia, examples within Canada are limited and have not been able to effectively process municipal residual waste beyond a pilot scale or demonstration facility. Some of the challenges associated with this are related to securing the necessary funding and power purchase agreement to make it an economically viable investment, being able to process a non-homogenous feedstock and the inability to compete with low landfilling rates, especially private rates and even lower rates across the US border. Because of this, little is known about the true costs and environmental impacts of these other alternative disposal technologies, which creates a high degree of risk in pursuing these technologies. Commercial viability of any technology would need to be confirmed as part of the process of examining various options. Potential business models to be

confirmed include a waste supply only approach to riskier options such as City investment of funds and/or property.

In general, the economic viability of these technologies depends on the tonnages managed and the corresponding tipping fees, as well as the access to transmission and/or distribution lines and the corresponding power purchasing agreements. Mass burn facilities are considered viable when handing more than 100,000 tonnes per year. Smaller facilities exist, particularly when alternative options are not available, and these facilities typically produce hot water or steam and need to be located within a cost-effective distance to end users.

Lastly, finding options for the processing or disposing of waste can be a highly controversial topic to the general public, including the siting of such facilities.

4.2.8 Planning and Implementation Timelines

The planning and implementation timelines for the alternative disposal options are difficult to estimate. Planning, approval and construction of any new disposal facility in Ontario is a complex process that requires significant lead time (approximately 10 years).

All of the technologies will require Environmental Compliance Approval (ECA) from the Ministry of Environment, Conservation and Parks (MECP). Alternative disposal technology facilities require Environmental Screening, or potentially an Individual EA, under the **Environmental Assessment Act**. The most recent municipal recovery facility approved in Ontario was the Durham-York Energy Centre which began operating in 2016, approximately 11 years after the EA was initiated in 2005. The need for alternative disposal options was identified by Durham and York Regions in municipal waste management planning processes before this time.

Utilization of private sector disposal options (landfill or recovery facilities) can also continue to be used; however, there are risks for the City during the SWMMP planning period due to limited disposal capacity in Ontario and associated risks of relying on disposal options in the US or other provinces. Ongoing monitoring of disposal capacity availability and quantities of waste

quantities will be necessary to ensure options are in place and to effectively manage costs.

Securing both short and long term disposal capacity should be initiated by the City as soon as possible given that City's current landfill contract will end in 2023 (with options to extend to 2028 or 2033), the long implementation timelines for alternative disposal technologies and limited disposal capacity in Ontario.

4.3 Summary of Disposal Strategy Findings

The City's current landfill contract with Waste Management Inc. will end in 2023 unless the options to extend to either 2028 or 2033 are exercised. Given the limited disposal capacity in Ontario, it is recommended that the contract extension to 2033 be formalized as soon as possible to secure disposal capacity. This will also provide time for the City to initiate the planning process for alternative disposal options and ensure a facility or contract is in place when the landfill contract extends.

Peel Region and York Region are large municipalities that rely on waste disposal facilities outside of their municipal borders and are thus competitors for the limited remaining disposal capacity. It is also recommended that Guelph initiate discussions with Peel Region to explore the feasibility of partnering in their mixed waste processing facility.

The planning process for investigating alternative disposal options should be initiated given the lengthy approval process, procurement and construction time for a new facility. The timeframe to implement a preferred option may be especially lengthy for some emerging technologies where the reliability for processing municipal solid waste is still being tested, and is not yet commercially available. Proven technologies, such as mass burn incineration, are more widely accepted and may offer regional examples to assist in the planning process. To reduce the risk associated with undertaking a large-scale project, pilot and test facilities should be considered as an option to ensure economic viability, gain public support and identify potential operating and environmental issues prior to carrying forward with full-scale production. Alternatively, the City could minimize risk by partnering with another jurisdiction or with the private sector and supply only tonnage and potentially a site for a disposal technology.

The City will need to consider the price differential of alternative technologies with landfills. Potential revenue streams from the sale of energy will need to examine current pricing and potential power agreements. A call for Expression of Interest (EOI), Request for Qualifications (RFQ), or Request for Proposal (RFP) for alternative disposal technologies will aid the City to develop a business case and determine the feasibility of preferred options. Vendor submissions could include capital and operation cost estimates, siting requirements, required feedstock composition and minimum tonnage and expected energy efficiencies.

The City will need to consider whether or not it wants to be fully self-sufficient for disposal capacity and what degree of reliance the City should have on the private sector for either operation or facility ownership. Partnerships with other municipalities or the private sector could also be considered. These partnerships will help secure feedstock sources for alternative disposal technologies that require a reliable supply of feedstock for sustained operation. Procurement of a long-term contract is ideal to ensure continued facility feedstock and sale of products but such waste contracts may be difficult to attain depending on partnership interest.

There are also opportunities for the City to utilize fuel and energy recovered from the processes for its own operations in support of greenhouse gas reduction initiatives and the City's Community Energy Initiative to become a Net Carbon Zero community by 2050[10]. Within this plan, there is a goal to have City operations powered by 100% renewable energy by 2050 and outputs from alternative disposal technologies waste could be considered as a renewable energy source. Local partnerships and energy use with industrial operations within Guelph can also be considered to provide economic growth and stability for the City.

The level of feedstock homogeneity varies between alternate disposal technologies and pre-processing of MSW may be required to prepare a more uniform feedstock and/or separate out organic matter. Changing consumption patterns and government policy may also impact residual waste composition over time. As such, the City will need to determine the

[10] Community Energy Initiative

robustness of the technology to accommodate changes to the waste stream and processing needs over time. Ongoing monitoring of waste generation rates and waste composition will be required to ensure long term disposal needs are flexible to adapt to changes resulting from zero waste and circular economy initiatives as well as the post COVID-19 "new normal" economy.

In summary, the City should extend its contract with Waste Management for disposal capacity. This will provide the City with sufficient time to further explore alternatives such as reducing the volume of waste sent to landfill through energy from waste technologies and mixed waste processing facilities and the preferred business model in pursuing alternative approaches to mitigate risks to the City.

5.0 Legislative and Regulatory Changes

The past five years has been a period of significant policy, program and legislative development across Canada in the solid waste area in general, and waste reduction and waste diversion in particular. All three levels of government have been very active in the field, which in itself is unusual (e.g. overall, waste has not been a focus for the federal government for some time). There has also been a growing interest and concerns about the greenhouse gas impacts of current waste management programs and practices and the challenges and opportunities for waste related greenhouse gas (GHG) mitigation at all levels of government, businesses, households and communities. The recent COVID-19 pandemic has delayed the development of these initiatives and will have both short and long term impacts for waste diversion, further discussed in **Section 6.9**.

As summarized in the SWMMP Task 3 Report for the City ("Single-Use Plastics Strategy"), the federal government has been unusually active, mainly because of its international commitments (e.g., the Ocean Plastics Charter), its engagement on the issue of plastic waste both through the Canadian Council of Ministers of the Environment (e.g., the recently developed Zero Waste Strategy with a focus on plastics also described in the Task 3 Report) and independently through Environment and Climate Change Canada (ECCC). In June 2019, Prime Minister Trudeau announced plans for European Union level action on waste plastics, singling out single-use plastics (SUPs). As a concrete step towards action (as described briefly in **Section 5.1**), ECCC announced on October 7th, 2020 the next steps in the Government of Canada's plan to achieve zero plastic waste by 2030. A key part of the proposed plan is a ban on harmful single-use plastic items where there is evidence that they are found in the environment, are often not recycled and have readily available alternatives.

At the provincial level, Ontario has been active on the waste legislation front with the passage of the **Waste Free Ontario Act (WFOA)** in 2016. Ontario was one of the first provinces to begin framing its future waste policies and programs through the lens of circular

economy thinking. The circular economy concept has been popularized by the UK-based Ellen MacArthur Foundation, using the definition that "A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems." First through its Strategy for a Waste Free Ontario and then through the province's Made-in-Ontario Environment Plan (summarized in **Section 5.2** of this Report), Ontario is moving forward with waste legislation and resulting policies and programs with primary attention on three main areas:

- Extended Producer Responsibility (EPR), with a specific focus on Individual Producer Responsibility (IPR), as compared to collective responsibility programs for an increased range of materials
- Increased food and organic waste diversion and reduction (in part driven by greenhouse gas concerns)
- Plastic waste diversion and reduction, with a growing interest in single-use plastics, litter and plastic microbead pollution

Interest and action on waste diversion has been at an all-time high at the municipal level in Ontario and across Canada. For the past 25 years, municipalities have been the drivers, primary overseers and often operators of waste management programs, waste diversion innovations and best practice exchanges to improve both diversion program cost effectiveness and environmental performance. With IPR programs transitioning into effect in Ontario (see **Section 5.2.2**), decisions need to be made by municipalities like the City of Guelph, regarding long-term roles and responsibilities in future waste management and waste diversion and reduction programs. The development of the SWMMP will assist the City of Guelph in assessing the impact of IPR programs on its integrated waste management system at the types and quantities of waste materials that will need to be managed and ensuring IPR programs are working effectively to keep designated materials out of the municipal waste management system.

A key difference of IPR responsibilities under the WFOA is the ability to have competing organizations to fund the industry provided waste diversion programs, which are referred to as Producer Responsibility Organizations (PROs). Under the original provincial diversion program framework, the Waste Diversion Act mandated the creation of four diversion programs, one for each designated material type: Blue Box, tires, electronics and MHSW

materials. Those diversion programs were each structured with its own organization to administer its diversion program, with producers paying fees to the industry funding organization (IFO) to fund the cost of the program. For example, the Tires program had Ontario Tire Stewardship (OTS) as its IFO representing all the tire industry producers in the province. There were no other organizations or contracts for any Ontario tire producer to choose to participate in the provincial diversion program. Another example of an IFO is Stewardship Ontario (SO), the IFO for Blue Box as well as MHSW under the Orange Drop program.

A PRO is any person retained by an industry producer to arrange the establishment of a waste diversion program to operate a management system to collect and recycle the designated material (i.e., tires, blue box, electronics and MHSW materials). Producers can choose the PRO they want to represent them, and the terms and conditions of each contract with a PRO may vary. There is no longer only one choice. In each case, the single IFO has undergone or is undergoing a wind up process to enable the establishment of multiple PROs. Further discussion on the impacts of IPR on the City of Guelph is discussed in **Section 5.2.2.2**.

5.1 Proposed Federal Actions

5.1.1 Federal Legislation and International Actions

The federal government's plans and actions with regard to waste in general and plastics waste in particular were described in some detail in the Task 3 Single-Use Items Strategy Report. Much of that work focused on joint activities among the federal and provincial governments through the Canadian Council of Ministers of the Environment (CCME) and especially through the Zero Waste Strategy and the Canada-wide Action Plan on Zero Plastic Waste.

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Since the Task 3 report was prepared for Guelph in November 2019, several actions have been taken by the federal and international levels that are notable.

In January 2020, the federal government released a draft state-of-the-science assessment on plastic pollution stating that macroplastics with particles greater than 5 millimeters cause harm to the environment. The impacts of microplastics were found to be less clear and sometimes contradictory. In releasing the assessment, Minister Wilkinson stated: "Science confirms that plastic pollution is everywhere and is negatively impacting our environment. This assessment will inform our decisions as our government follows through on our commitment to ban harmful single-use plastics as soon as 2021 because Canadians expect us to"[11]. On October 7, 2020, ECCC announced the next steps in the Government's plan to achieve zero plastic waste by 2030 including a proposed ban on six single-use plastic items by the end of 2021 (plastic checkout bags, straws, stir sticks, six-pack rings, cutlery and foodware made from hard-to-recycle plastics), establishing recycled content requirements for products and packaging, strengthening existing programs and increasing Canada's capacity to reuse and recover more plastics.

The proposed ban on harmful single-use plastic items include those with evidence that they are found in the environment, are often not recycled and have readily available alternatives. In May 2021, "plastic manufactured items" was added to Schedule 1 of the Canadian Environmental Protection Act (CEPA) which provides the government with the authority to regulate and limit certain products.

Consistent with the Canadian federal action, on April 15, 2020, Vivian Loonela, the European Union (EU) spokesperson for environmental matters, repeated as per the EU Single-Use Plastics (SUPs) Directive passed in June

[11] "Ottawa set to declare plastics as toxic substance", Kathryn Blaze Baum, March 11, 2020

2019, that "member states still have one year to transpose the SUPs Directive into national law" when asked to comment about industry calls to postpone the implementation of the SUPs Directive. Separately, the commission also issued guidelines to EU member states in order to ensure safe handling of the growing amount of medical waste (including plastics) generated during the pandemic. Loonela added that "the SUPs Directive foresees exceptions for medical devices".[12] The SUP was adopted and also introduced bans on a selected number of throw-away items such as cutlery, beverage cups, balloon sticks, straws and cotton bud sticks. The overall objective was to reduce marine litter, 80% of which is land-based to help address the problem of an estimated 4.6-12.7 million tonnes of plastic waste that find their way into the world's oceans each year.

On May 15, 2020, Plastics Recyclers Europe (PRE) reported that "European Plastics Recycling industry is closing production due to the current market developments caused by the COVID-19 pandemic. The major problems are the lack of the demand due to the closure of converting plants and the record low prices of virgin plastics as well as the decreased activity globally"[13]. There was no mention of the anticipated impacts of these closures and virgin material prices on the recycled content targets for PET (2025) and later (2030) all plastic bottles as contained in the EU's SUPs Directive.

Lastly, a notable development was the voluntary announcement, despite the UK's imminent departure from the EU, by the UK Plastics Pact (a consortium of 85 businesses representing 2/3 of UK plastic packaging) that "eight problematic or unnecessary single-use plastics are set to be eliminated by the end of 2020 and an additional 19 other single-use plastic items are being investigated to look at ways of reducing their environmental impact through avoidance of their use, reuse and/or smarter

[12] Euractiv Newsletter, April 15, 2020

[13] European Plastics Recyclers website and Press Release; May 15, 2020

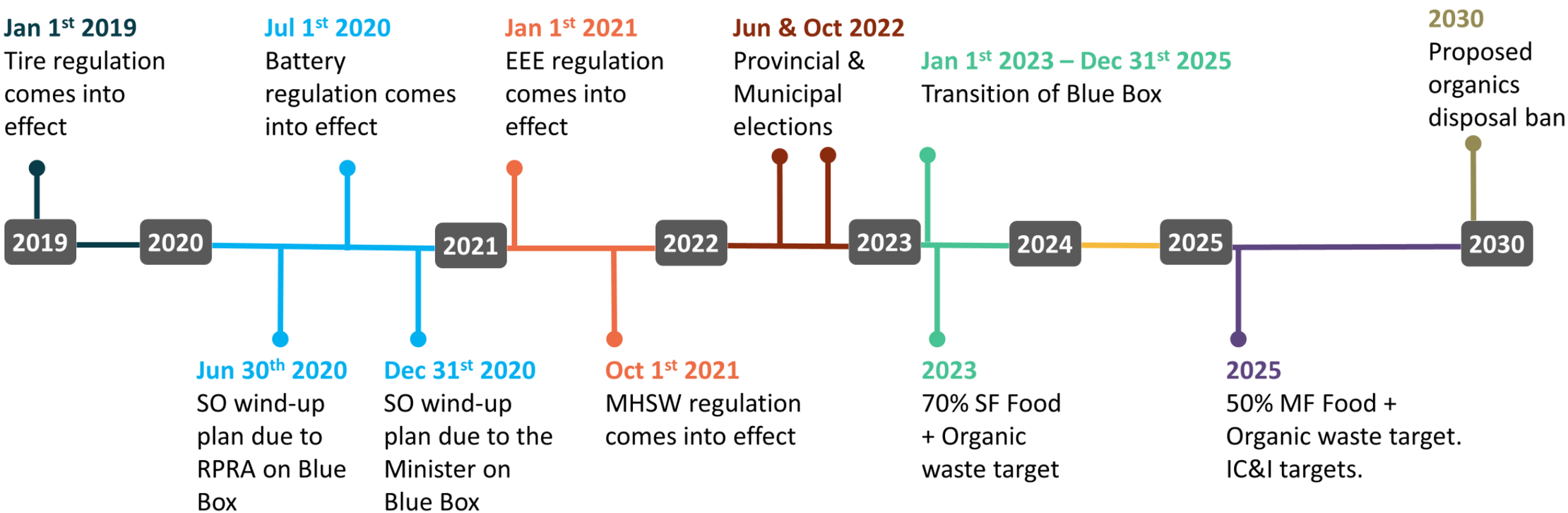
recycling". The eight items selected thus far are: plastic cutlery, all polystyrene packaging, cotton buds with plastic stems, plastic stirrers, plastic straws, oxo-degradables that break down to create microplastics, PVC packaging and disposal plastic plates and bowls. The UK Plastics Pact defines problematic or unnecessary plastics as "Single-use plastic items where consumption could be avoided through elimination, reuse or replacement and items that, post-consumption, commonly do not enter recycling and composting systems, or where they do, are not recycled due to their format, composition and size"[14].

5.2 Proposed Provincial Actions

In 2016, the Province of Ontario passed the Waste-Free Ontario Act, which comprises the Resource Recovery and Circular Economy Act (RRCEA) and the Waste Diversion Transition Act (WDTA). The WDTA prescribed how the existing waste diversion programs would continue to operate until their wind-up, and laid out the framework for wind-up. After wind-up, the diversion systems continue to operate under the RRCEA. Under the RRCEA, outcome based regulations hold individual producers fully responsible for collection and management of the products and packaging they put into the Ontario market. The RRCEA aims at further promoting resource recovery and reduction of waste to landfill. While application of the RRCEA is not limited to materials that were covered by the existing waste diversion programs, these are the first material categories to have regulations developed under this act. More may follow. **Figure 5** presents an overview of the anticipated timelines for the transitions of Ontario's waste diversion programs with descriptions following summarizing the key changes.

[14] UK Plastics Pact website

Figure 5: Timeline for Transition of Ontario Waste Diversion Programs and the Food and Organic Waste Framework



[1]Waste Free Ontario Act

5.2.1 Food and Organic Waste Policy Statement

The provincial **Strategy for a Waste-Free Ontario: Building the Circular Economy**, released on February 28, 2017, committed the MECP (formerly Ministry of the Environment and Climate Change at the time) to develop a **Food and Organic Waste Framework** to reduce the volume of food and organic waste sent to disposal. The Framework will help the province build a circular economy while contributing to the reduction of greenhouse gases and achieving the province's Climate Change Action Plan targets.

The Framework consists of two complementary components:

- Food and Organic Waste Action Plan
- Food and Organic Waste Policy Statement under the Resource Recovery and Circular Economy Act, 2016

In April 2018, the MECP released **Ontario's Food and Organic Waste Framework**[15] which identified 17 action items focused on reducing the quantity of compostable organic materials being directed to disposal facilities.

The April 2019 **Food and Organic Waste Policy Statement**, was issued under Section 11 of the **Resource Recovery and Circular Economy Act, 2016**, and provides direction to provincial ministries, municipalities, IC&I establishments, and the waste management sector to increase waste reduction and resource recovery of food and organic waste. The Statement aims to:

- educate people about the importance of preventing and reducing food and organic waste
- expand green bin or similar collection systems in large cities and to relevant businesses
- set food and organic waste reduction and recovery targets of between 50% and 70%
- help more businesses, condos and apartment buildings across the province collect food and organic waste
- help rescue surplus food from grocery stores, restaurants and hotels

[15] Food and Organic Waste Framework

- encourage municipalities to consider co-management of biosolids

In terms of the City of Guelph, the province has set targets of 70% waste reduction and resource recovery of food and organic waste generated by single-family dwellings in urban areas by 2023 and 50% waste reduction and resource recovery of food and organic waste generated at multi-residential buildings by 2025. The City is in a good position as it provides green cart collection to both single and multi-family residents and is pursuing aggressive approaches to reducing and diverting organic waste through Our Food Future (**Section 6.1.2**). In the case of multi-residential buildings, the building owner would be responsible for achieving the target. The City would be responsible for any of its community housing multi-residential facilities.

On September 30, 2020, the MECP announced it is moving forward with its plan to reduce the amount of food waste going to landfills by proposing changes to its Food and Organic Waste Policy Statement. The proposed changes are to:

- Encourage municipalities, businesses, institutions and processing facilities to continue taking action to meet their targets beyond 2023 and 2025
- Clarify the efforts required to divert the following types of food and organic waste:
    - efforts **shall** be made with respect to food waste, inedible parts of plants and animals resulting from food preparation and pet food waste
    - efforts **should** also be made with respect to several types of organic wastes, such as soiled paper and food packaging, coffee filters, tea bags, compostable coffee pods and compostable bags
    - efforts are **encouraged** to be made with respect to several types of harder to manage organic wastes, such as diapers and pet waste
- To support effective management of compostable products and packaging by encouraging:
    - municipalities, organic waste processers and the compost packaging industry to support the use of **pilot projects** and research on the processing of compostable products and packaging to maximize recovery and minimize contamination

- municipalities and organic waste processors to examine the feasibility of **updating existing technology** to process compostable products and packaging
- municipalities and organic waste processors to consider adopting technology to collect and process compostable products and packaging in their systems when they are **planning for new technology**

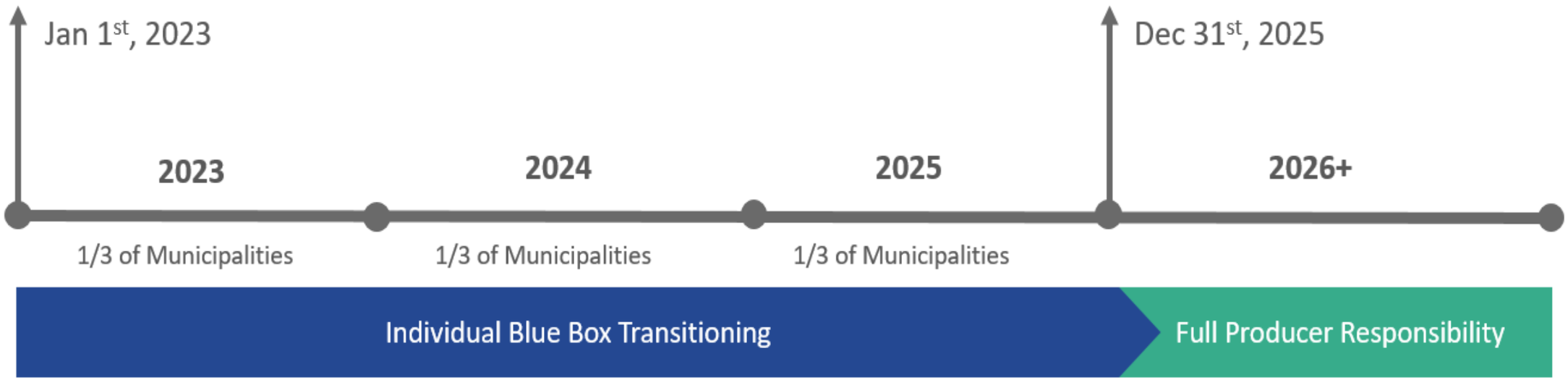
Reducing and diverting food and organic waste from households and businesses is also a key part of the plan as part of the Food and Organic Waste Framework and is discussed separately in **Section 6.1**. In November 2020, the Province provided an update on the Made-in-Ontario Environment Plan and as part of their next steps, noted they are looking to phase out food and organic waste from landfills by 2030.

5.2.2 Blue Box Program

On August 15, 2019, the Minister of the Environment made a three-part announcement to initiate the process of transitioning the Blue Box system from the WDTA to the RRCEA to "Improve Recycling and Tackle Plastic Waste."[16] The following schematic (**Figure 6**) presents the timeline for the Blue Box Program transition.

[16] Ontario's Next Steps to Improve Recycling and Tackle Plastic Waste

Figure 6: Timeline for the Blue Box Program Transition[17]



[17] Please note that the timeline has been updated and the first group of municipalities will transition July 1, 2023.

The MECP subsequently undertook a process to develop the new Blue Box Regulation under the RRCEA. Municipal input was coordinated through the Association of Municipalities of Ontario (AMO) and the Municipal 3Rs Collaboration (representing the AMO, Regional Public Works Commissioners of Ontario, Municipal Waste Association and the City of Toronto). Municipalities were also requested by AMO to pass Council resolutions indicating their preferred timing to transition the Blue Box Program to IPR. Guelph City Council approved a report on May 25, 2020 requesting a transition date of January 1, 2023. Municipal (and joint) working group meetings were scheduled by MECP staff through to July 2020 to address issues such as: the scope of producer responsibility under the new regulations; common collection system considerations; transition and target issues; and other core policy components.

On October 19, 2020, the MECP announced its proposed producer responsibility regulation for the new Blue Box system in Ontario. The proposed regulation makes producers responsible for providing collection services to local communities, managing blue box materials, meeting diversion targets, tackling plastic waste and protecting the environment. The Ministry finalized the regulation in June 2021.

The regulation defines producers are responsible for the diversion of blue box designated materials and enables the producers to contract with producer responsibility organizations (PROs) to meet their blue box regulatory requirements or act on their own behalf (via the collective Blue Box system or via an alternative collection system).

The regulation includes printed paper, packaging, and non-alcoholic beverage containers, and expands collection requirements to include the following additional materials commonly put in blue boxes by residents:

- Unprinted paper
- Single-use packaging-like products, such as foils, wraps, trays, boxes, bags
- Single-use items relating to food and beverage products such as straws, cutlery, plates, stir sticks

The regulation under the RRCEA:

- maintains or improves existing blue box services, including harmonizing the definition of blue box materials across Ontario
- expands producer responsibility for blue box services to additional sources, such as schools, retirement homes, long-term care homes and some public spaces
- makes producers responsible for meeting management requirements for blue box materials, such as diversion targets

The regulation does not:

- impact existing deposit return initiatives operated for alcohol beverage containers
- require producers to provide blue box services in the IC&I sectors (beyond additional sources mentioned above)

As noted earlier, this process will culminate with transitioning the existing Blue Box Program from January 1, 2023 to December 31, 2025 to a full producer responsibility regulatory framework. The regulation lists Guelph transitioning on January 1, 2025.

5.2.2.1 Potential Impact of Transition to IPR for Blue Box PPP

There are a number of issues to be considered and resolved regarding the details of the final regulation for Ontario's new Blue Box and its transition to IPR for Printed Paper and Packaging (PPP) materials. All stakeholders have an opportunity to participate in these discussions.

As noted above, AMO and M3RC are actively working together to represent and communicate municipal interests with regard to critical Blue Box Program issues. What follows below is a brief assessment of some of the most important issues that the AMO, MECP and producers are working to address through the new regulation.

5.2.2.1.1 MULTIPLE PROS AND NO PROGRAM PLANS

Under the new Blue Box Regulation, multiple PROs will be supporting producers to meet their individual collection and management obligations. At this time, it is not determined who or how many PROs will form. PROs may

form and register with the Resource Productivity and Recovery Authority (RPRA) at any time.

The RPRA functions as a non-Crown and not-for-profit corporation under the **Resource Recovery and Circular Economy Act, 2016**. RPRA's mandate is to support compliance with individual producer responsibility through education and enforcement to promote the circular economy in Ontario, as well as foster innovation, and protect the environment.

Producers are responsible under the Regulation to determine rules that will determine the annual development of an allocation table. The allocation table will define which producer is responsible to service which eligible source. PROs may act on behalf of producers to develop the rules, but would need to register with the RPRA before November 1, 2021 to be able to do so. The initial allocation table will be submitted to the RPRA on or before July 1, 2022, for the collection period commencing July 1, 2023. Subsequent allocation tables will be submitted on or before March 31 the year before the first year of the allocation table's collection period.

The regulation does not describe any operational or financial mechanisms that will be necessary for the coordination between the different PROs. No program plans are required from PROs, meaning such mechanisms are currently unknown and may change over time.

It is expected that PROs will issue tenders for collection and management services in the areas allocated to their producer clients. Municipalities may opt to respond to continue to deliver Blue Box services.

Any terms and conditions related to these services will need to be negotiated between the municipality and the PRO in case of a successful tender.

5.2.2.1.2 TARGETS AND TRANSITION

The diversion or management targets are defined in the regulation, set on a material level, and have been tightened compared to the existing program plan. Program transition will take place from 2023 to 2025. The targets come into force after the transition is completed in 2026. **Table 7** provides the minimum recovery targets by material category as defined in O.Reg. 391/21.

Table 7: Minimum Recovery Targets by Material Category

Material Category	Recovery Percentage (2026 – 2029)	Recovery Percentage (2030 onwards)
Paper	80%	85%
Rigid Plastic	50%	60%
Flexible Plastic	25%	40%
Glass	75%	85%
Metal	67%	75%
Beverage Containers	75%	80%

5.2.2.1.3 REPORTING

Under the new regulation, municipalities have no recurring reporting obligation to the RPRA. If a municipality will provide Blue Box services on behalf of a PRO or producer, there may be a reporting requirement determined under a contract between the two parties.

Municipalities only have reporting obligations to support the transition to full producer responsibility. Initial Reports have to be submitted to the RPRA by September 30, 2021. Guelph will have to submit a Transition Report by August 31, 2023. Municipalities also have to submit Change Reports to submit updates to the information provided in either the Initial Report or Transition Report.

5.2.2.2 Potential Impacts of IPR on the City

The final Blue Box Regulation was filed in June 2021 and the accompanying Transition Schedule lists Guelph transitioning by January 1, 2025. Although this was not the requested transition date, the final transition date will provide the City additional time to complete the SWMMP, plan for the changes and observe transitions in other municipalities.

The City has significant resources allocated to the collection and processing of recyclables including blue carts, front end bins, collection vehicles,

collection operators, the MRF, equipment and staffing, customer service staff and space allocated at the PDO.

City staff have been participating in the Blue Box Program consultation process and providing regular updates to Guelph City Council. A report was provided to Council on May 25, 2020, to seek approval to respond to the AMO request to municipalities on transition timing. The recommended preferred transition date of January 1, 2023, (i.e., the first transition year) for Guelph's Blue Box program as required under the WFOA to the AMO and the MECP was approved. A follow up report was provided to Council on December 7, 2020, with a recommendation to request this date be accommodated or full funding of program costs be provided to the City until transition occurs. Staff also requested authority to enter into negotiations with producers or PROs to develop transition strategies. The report and recommendations were approved on December 14, 2020.

The City retained a consultant (RSM Canada) to conduct an assessment of strategic options for the MRF to determine the best use of the facility post IPR transition which was completed in mid-2020. The assessment included a valuation of the City's MRF, development of strategic options related to the use of the MRF, narrowing down and estimating the valuation of a refined list of options, and provide a recommended option. The narrowed down options were to:

- convert the MRF to a mixed waste processing facility
- lease the MRF to a third party but retain responsibility for the building's operating and capital expenses
- convert the MRF to a transfer facility for blue cart recyclables

Evaluation criteria were developed to evaluate the three strategic options which led to options 2 and 3 being deemed preferred (with option 2 being marginally better than option 3). The assessment also included an inventory and condition assessment of the City's solid waste facilities. The MRF was assessed and costs were estimated based on recommended asset repair/replacement needs. Between 2020 and 2025, it was estimated to invest over $4 million to conduct the recommended lifecycle repair works.

It is noted that this assessment was conducted prior to the final Blue Box Regulation being released in June 2021. The report will be used as a

reference for the SWMMP financial analysis and the City's transition planning activities and cost benefit analysis.

As part of the SWMMP update, a number of tasks were undertaken that provided information that helped to inform the City's transition of the Blue Box program and resulted in an updated plan for the City's integrated solid waste management system including the development of a long-term growth forecasting model (discussed in **Section 3.0**). A financial analysis of the City's current and potential future costs of the Blue Box program was undertaken as part of Task 7 of the SWMMP. Although the final Regulation has been approved, there are still uncertainties with how the future Blue Box system will operate. Without such details, it is not possible to determine and finalize how best to transition the Blue Box program in the context of the City's waste management system and the SWMMP. The City will no longer have responsibility to manage designated blue box materials once the IPR system is fully in place and will need to consider what its role will be, if any. A technical memorandum was developed to provide the City with strategic advice on assessing options that may be available to the City and planning for the transition an IPR operated system. As part of the SWMMP, an assessment of a scenario to fully opt out of all blue box services was completed, based on financial information from Task 7 of the SWMMP and the use of an Excel-based transition tool that has been developed for the City. The Tool prompts the City to consider the people, business processes and facilities/equipment affected and the associated costs, benefits and risks. Completing an analysis of the impacts of completely opting out of blue box services will put the City in a position to more quickly assess the risks, benefits and financial implications of potential options it may have as a contractor within the new system and impacts on its waste management system, once information on available options is known.

5.2.3 Used Tires

The Used Tires Program was the first waste diversion program to be wound up under the WDTA and, therefore, tires were the first material designated under Ontario's IPR requirements. In February 2017, the MECP directed the wind up of the Used Tires Program on December 31, 2018 and Ontario Tire Stewardship (OTS) soon after. On January 1, 2019, tire producers became directly responsible and accountable for meeting mandatory and enforceable targets for collecting and recycling used tires. Tire producers, PRO's, and

service providers (collectors, haulers, re-treaders and processors) are now regulated by the RPRA.

The City's review of the IPR program found that the result was an expanded number of registered establishments accepting used tires, with over 50 registered used tire collectors in Guelph. Under the new program, the City would no longer be compensated for collecting tires and is unable to charge a fee for collecting tires. The City decided to opt out of providing a used tire program based on the availability of options and costs for the City to continue to accept tires at the WRIC and stopped accepting tires as of January 1, 2019.

As directed by the Minister, OTS submitted its wind up plan to the RPRA on November 30, 2017. The RPRA consulted on the wind up plan between December 2017 and March 2018, and approved the wind up plan with conditions in April 2018. The OTS Used Tires Program ended on December 31, 2018. During the fall of 2019, a liquidator was retained to formally wind up and dissolve OTS as a corporation. The liquidator initiated a process to sell off any remaining eligible OTS assets, lay off remaining OTS staff and wind down OTS as a corporation. On April 21, 2020, the Minister issued a direction letter to OTS requiring surplus funds of the Used Tire Program to be returned to stewards following the wind up of OTS.

Perhaps the most notable feature about the start-up of the Province's first IPR program for a designated material is that the new IPR regulatory framework has replaced OTS as the single tire IFO with multiple (currently 5) PRO's. One of the PRO's currently holds about 85% market share. This indicates the Ministry's move away from a monopolistic (100% market share) IFO regulatory framework to a more competitive market share system (PRO's).

5.2.4 Electrical and Electronic Equipment and Batteries

In February 2018, the MECP directed Ontario Electronic Stewardship (OES) to wind up the WEEE Program. After wind up, electrical and electronic

equipment (EEE)[18], as with the other designated materials, are managed under the new, mandatory IPR framework. This means that producers of EEE are responsible for ensuring their products and packaging are collected and reused or recycled at end-of-life. The Minister directed OES to submit a wind up plan to the RPRA by December 31, 2018. OES submitted its plan on time for the RPRA's approval. As part of its approval process, the Minister directed the RPRA to consult on the OES proposed plan.

The current WEEE Program wound up on December 31, 2020. As of January 1, 2021, following the wind up of the WEEE Program operated by the IFO OES, EEE producers are individually accountable and financially responsible for collecting and reusing, refurbishing or recycling their products when consumers discard them. There are no registration and reporting requirements for First Nations, municipalities or other EEE collectors under the new EEE Regulation that came into effect January 1, 2021.

Ontario is continuing its shift to a full producer responsibility framework for reduction, reuse and recycling of resources by proposing new regulations that will require producers to manage EEE and batteries at end-of-life in a safe and environmentally-sound manner. The new regulations require:

- producers to establish free collection networks for consumers
- producers to achieve resource recovery (i.e. reduction, reuse and recycling) targets
- producers to provide promotion and education materials to increase consumer awareness
- producers and service providers to register, report and keep records

[18] EEE includes products such as televisions, laptops, printers, mobile phones, etc. and is the new term for what was WEEE in Ontario.

61 | Legislative and Regulatory Changes

The requirements are set out in two regulations[19], which designate two classes of materials under the RRCEA: EEE and batteries. Further, each class of material includes defined categories that are used to specify the responsibilities that producers of such materials in the category will be required to undertake. It sets out two defined categories within the EEE class:

- ITT/AV -Information technology, telecommunications and audio-visual equipment
- Lighting, including lighting equipment, fixtures and bulbs

The addition of lamps/bulbs, is a new "managed" waste diversion material for the Province of Ontario. OES did not operate a program for lighting, and the responsibilities for lighting do not come into effect until January 1, 2023.

On February 20, 2020, Ontario announced a new regulation for batteries under the RRCEA establishing individual producer responsibility requirements to increase the number of batteries that are reused, refurbished and recycled. The new regulation makes batteries the second material, after tires, to be transitioned to Ontario's new individual producer responsibility regulatory framework.

RPRA is responsible for enforcing the requirements of the new Batteries Regulation. The RPRA is also responsible for providing information and supporting businesses in understanding and complying with the regulatory requirements.

The new IPR regulatory framework mandates select battery producers to be accountable for their products and packaging once consumers are finished with them; sets mandatory and enforceable targets for resource recovery; and gives producers choices for resource recovery services in a competitive market.

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[19] Electrical and Electronic Equipment Regulation

The Batteries Regulation applies to producers of single-use (primary) and rechargeable batteries that are 5 kg or less and sold separately in Ontario (i.e. not embedded in products). The Batteries Regulation require battery producers to:

- Establish and operate systems to collect and manage batteries discarded by consumers starting July 1, 2020
- Register with the RPRA on or before November 30, 2020
- Report annually on performance to the RPRA starting April 30, 2021

Battery haulers, processors and refurbishers were required to register with the RPRA by March 31, 2020, and identify the PROs they want to work with to meet their collection and management requirements as of July 1st, 2020. PRO's were required to register within 30 days of being retained by a producer. Battery collectors are not required to register with the RPRA. The previous producer recycling program for single-use batteries operated by Stewardship Ontario (SO) concluded on June 30, 2020.

The City continues to provide services for the recovery of EEE and batteries. EEE is accepted at the Waste Resources Innovation Centre (WRIC) at the public drop-off. Staff provided an update to Guelph City Council in June 2020 on the transition of the battery recycling program to IPR[20] and future plans for the transition of WEEE to IPR summarized below.

Batteries are currently accepted at the WRIC MHSW depot, at City Hall and at its fire stations. The City decided to end the annual curbside battery collection event program. Continuation of these services is being assessed by City staff based on evaluation of the new regulations and program plans.

The City entered into a one-year agreement with Call2Recycle beginning July 1, 2020, to collect batteries at the MHSW depot. Staff will analyze the program's performance during the timeline for the transition of the MHSW program which goes until December 31, 2022 in its first year, to determine direction with respect to future program offerings. This timeline corresponds

[20] Transition of Battery Recycling Program to Individual Producer Responsibility

with the wind up of the remaining materials collected under the MHSW program under the WFOA starting October 1, 2021, which may lead to alternative program options.

Call2Recycle will compensate the City at 55 cents per kg for designated batteries. The funding covers the cost of resources to manage the program. The funds do not cover the cost to collect batteries at the curb and as a result the City's curbside event has been discontinued. The 2019 event collected 2,455 kg of batteries at a cost of $11,000. The new producer responsibility framework does not have a requirement for curbside collection. The minimum requirement is for battery producers to provide at least one collection depot site for every 15,000 residents.

5.2.5 Municipal Hazardous or Special Wastes (MHSW)

In April 2018, the MECP directed the wind up of the MHSW program on December 31, 2020, as per the WDTA. Following wind up, hazardous or special materials is transitioning to the new, mandatory IPR framework under the RRCEA. In December 2018, the MECP amended the timeline for the wind up of the single-use batteries component of the MHSW Program to June 30, 2020.

In July 2019, the Minister issued new directions including extending the timeline to wind up the MHSW program to June 30, 2021. In October 2019, the MECP confirmed it will move forward with an electronic system to allow businesses and governments to better track and report on hazardous wastes. This system will be redeveloped and managed by the RPRA.

The new Hazardous Waste Program Digital Reporting Service will be available beginning January 1, 2022, with registration of regulated parties beginning on or before July 1, 2021. Batteries were previously part of the MHSW program and are now a separate material under the RRCEA as noted in the previous section.

Under the WDTA, the RPRA is responsible for overseeing the orderly wind up of current waste diversion programs and the original IFOs responsible for managing those programs. Until the wind up date, the MHSW programs continued to operate without disruption, with continued RPRA oversight. In the case of the Automotive Materials Stewardship, Product Care Association and SodaStream, these programs are required to wind up at the deadline,

although the current IFO organizations may continue to exist and offer services to producer stewards as a PRO under the new legislation. SO submitted its proposed MHSW wind up plan to the RPRA by the September 30, 2019 deadline set by the Minister.

As part of the wind up process, the Minister directed the RPRA to consult on the proposed plan before considering approval. RPRA consulted on SOs proposed MHSW program wind up plan by hosting several regional meetings until November 21, 2019. The consultations were open to all MHSW Program participants, municipalities, the public and other interested stakeholders. SO's Wind Up plan[21] is posted on RPRA's website. Following the consultation period and, as directed by the Minister, the RPRA approved the plan at the end of 2019. The draft Hazardous and Special Products (HSP) Regulation was released for comment on February 11, 2021. The comment period closed March 28, 2021. As noted above, the new HSP Regulation comes into force on October 1, 2021.

The City of Guelph continues to operate the MHSW depot at the WRIC and staff participated in consultations. Ensuring proper disposal of hazardous materials has been identified as a significant risk for protection of the City's drinking water system, with the City of Guelph being one of the largest groundwater-based water systems in Canada. MHSW relocated to the WRIC from the Eastview Landfill in 1995. Staff are assessing service options for MHSW as details of the MHSW transition to IPR become available.

[21] https://rpra.ca/consultations/past/mhsw-wind-up-plan/

6.0 Emerging Issues

This section provides a review of industry issues, some of which have relevance to Guelph as part of the SWMMP development.

6.1 Organic Waste

6.1.1 Food Waste Reduction

Uneaten food equates to Canadians throwing out millions of dollars each year, most of which ends up in landfills where it emits methane, a greenhouse gas. Cities are often motivated and well-positioned to address food waste because they are primarily responsible for providing solid waste services, seek to source and redistribute wholesome surplus or unsold food to residents in need of supplemental food, and have climate and sustainability goals, which addressing food waste can help them achieve.

A national **Food Loss and Waste Strategy for Canada** by the National Zero Waste Council (NZWC) developed in 2017 recommends a coordinated national effort to halve per capita food waste by 2030. A key theme of the strategy calls for a supply chain approach that would close the loop on food waste occurring during production, processing and distribution – before it even gets to consumers.

The strategy was built around three pillars: national, provincial and local policy change; innovation in technology and community infrastructure; and behaviour change throughout the supply chain. The actions under each pillar combined to tackle food waste challenges, from post-farm through to the consumer. Stakeholder feedback confirmed that there is interest and support for a National Zero Waste Council-led national strategy, but that a full supply chain approach is needed, with the primary emphasis on upstream change, preventing food loss and reducing waste from farm to fork, rather than on waste diversion. It was recommended that collaborators include provincial and territorial-level governments, along with both established and emerging innovation hubs. Stakeholders suggested alignment and engagement with the emerging **Food Policy for Canada**.

Recommendations for priority actions included addressing issues associated with best before dates, infrastructure investment that strengthens the capacity of the charitable sector, the development of a national consumer campaign, and educational and communication materials that support nutritious food donations.

The federal government's **Food Policy for Canada** includes four significant areas within food systems, which have been identified as key areas that require action in the short and medium term. While initial actions reflect the most pressing needs and priorities for 2019-2024, future actions taken by the Government of Canada will consider emerging needs over time. The Government will take into consideration advice provided by the Canadian Food Policy Council to identify future action areas. The four areas are:

- Help Canadian communities access healthy food
- Make Canadian food the top choice at home and abroad
- Support food security in Northern and Indigenous communities
- Reduce food waste

6.1.2 Our Food Future – Circular Economy

The City of Guelph and the County of Wellington (Guelph-Wellington) have embarked on an ambitious journey to create a local circular food economy through the successful application to **Canada's Smart Cities Challenge**. The funding, received through **Infrastructure Canada**, will be used to implement Guelph-Wellington's vision of creating Canada's first circular food economy called **Our Food Future**.

Guelph-Wellington is working to become Canada's first technology-enabled Circular Food Economy, reimagining an inclusive food-secure ecosystem that by 2025:

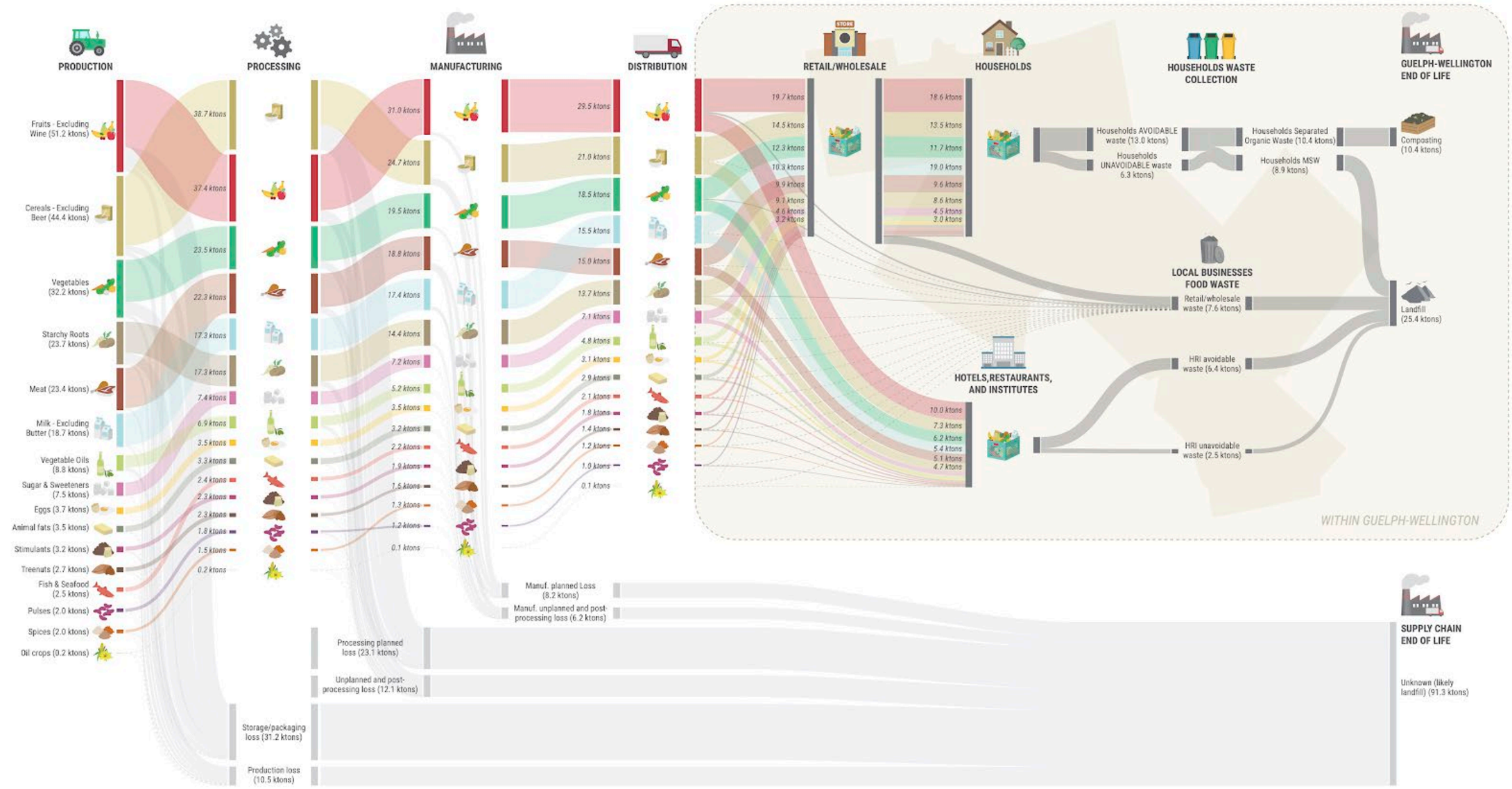
- **50%** increase in access to affordable, nutritious food, where "waste" becomes a resource
- **50** new circular business and collaboration opportunities
- **50%** increase in circular economic benefit produced by unlocking the value of waste

To assess the current status of organic 'waste' flows in the area and to identify strategies to close these loops, Guelph-Wellington retained Dillon

Consulting Limited, in partnership with Metabolic in the Netherlands and Dr. Michael von Massow from the University of Guelph, to conduct a food and food waste flow study of the local food system, from farm to fork, based on quantified data input and output modelling. **Figure 7** provides a Sankey diagram of the food and food waste flows in Guelph-Wellington. The Sankey diagram represents the entire value chain that supplies the food consumed in Guelph-Wellington with the thickness of the flows correlating to the quantities handled. The left side of the diagram represents production and the right side represents end of life. The diagram suggests that most of the food produced in Guelph-Wellington is exported to the rest of Ontario, Canada and the US to be processed further and some come back to Guelph-Wellington via these value chains. The top flows within Guelph-Wellington are fruits, cereals and vegetables. The bottom part of the Sankey diagram indicates losses during production, processing and manufacturing for both avoidable and unavoidable food. It is assumed that the majority of these losses are sent to landfill. The right side of the diagram shows household consumption. Approximately one third of all food waste originating from households is unavoidable, which could provide opportunities for recovery. The avoidable food waste could provide additional opportunities for food banks or food sharing. Guelph is diverting the majority of organics through the green cart program. Wellington initiated their green bin program in mid-2020.

Subsequently, a second phase of work, which began in April 2021, will develop a circular food strategy and roadmap with stakeholder engagement, as a starting point to transitioning to a circular food economy. Business cases will be developed to highlight the top performing interventions in order to provide Guelph-Wellington Smart Cities, and other stakeholders, with a high-level estimate of the cost-benefits of each intervention, and to inform on how to refine and operationalize the interventions described in business cases.

Figure 7: Food and Food Waste Flow in Guelph-Wellington



Source: Metabolic Inc.

6.2 Emerging Plastics Issues

It is widely known and reported that only about 9% of plastics in the waste stream in Canada are currently being recycled. An estimated 47% of plastics used are single-use plastics (SUPs), which is the reason why SUPs have attracted so much attention in recent years. About 12% of global fossil fuel consumption is used to make plastics. This application is growing and increasingly important to the fossil fuel industry as other markets (e.g., fuels for electricity generation and transportation) are facing renewable energy and electric vehicle displacement and growth over the long term.

Five emerging and evolving plastic waste issues, including the issue of how to address and better manage SUPs, have been identified and are briefly described below. The proposed federal actions on SUPs discussed in **Section 5.1** will help to alleviate some of these challenges, if (or when) implemented. Additional information on SUPs is provided in the Task 3 sub-report as part of the SWMMP.

6.2.1 The Importance of Packaging and Product Design for Recyclability

Plastic product and packaging design for recyclability is an essential element of the long term goal for plastics in a circular economy. Many large, global companies have recently made commitments that within 10 years all of their packaging will be recyclable, reusable or compostable.

Canada has been one of the world leaders, although a bit behind some EU countries, in the implementation of EPR for a wide range of materials. A core component of EPR is that the end-of-life responsibility for the management of every company's product or package is the physical, financial and management responsibility of the company from cradle-to-grave. Considerable progress has been made in Canada in EPR policy development and legislation implementation over the past 25 years.

The second core tenant of EPR, as defined by the Organisation for Economic Co-operation and Development[22] is that products and packaging should be designed for recyclability. To date, much less progress has been made in this area, especially for plastics. As noted earlier in this Task 4 report, jurisdictions across Europe especially are moving towards banning "problematic or unnecessary" plastics. Design for recyclability is an increasingly critical issue for plastics, and especially plastic packaging, in a more circular economy. Bans are the "other" option.

6.2.2 The Importance of Plastics Infrastructure and Technology Developments

For plastics recycling to become truly circular, considerable investments, both by the public and private sectors, are needed. Collection systems for plastic material (from household products and packaging to computers, carpeting, construction and demolition sites, agricultural locations, automotive manufacturers and scrap yards, as well as commercial and industrial establishments) need to be expanded, made more accessible and better promoted across Canada and across Ontario.

Plastics processing is undergoing a revolution with optical sorting and robotic technologies. In the near future (i.e., 3-5 years), increased mechanical sorting and processing will need to be complemented with chemical recycling processes to break polymers back to their constituent elements (i.e., so that the "molecules don't get lost"). Longer term (10-20 years), we can expect to see the emergence of plant-based plastics that will start to displace or complement fossil-fuel based plastics production. Plastic collection and processing investments could form a key aspect of green infrastructure spending in response to the Covid-19 crisis in both the short and long terms.

[22] Extended Producer Responsibility

6.2.3 The Importance of Post-consumer Recycled Plastics Demand

Post-consumer recycled (PCR) resin demand is the cornerstone of plastics management in a circular economy. Recent developments in this area are noteworthy.

As part of its retail bag ban, the State of California now requires reusable retail shopping bags to include 20% recycled content by 2020 and 40% by 2022. Already, this decision in California is starting to attract new investments in plastic film processing in and around the state. Film collected from curbside homes is difficult to clean and render into PCR resins to make new bags; but plastic garbage bags sold in California are now also required to include at least 10% PCR. In a similar vein and as noted earlier, the EU SUPs Directive requires 25% post-consumer recycled content for PET bottles by 2025 and 30% recycled content for all plastic bottles by 2030.

A new challenge for using increased PCR content is the global drop in energy prices in 2020 as a result of the COVID-19 pandemic. Recycled material needs to compete with virgin material as a supply option. This reality of "cheap oil", and thus "cheap" virgin plastics, may cause companies to reconsider their commitment to PCR content for their products and packaging (i.e., unless regulations require their use).

6.2.4 The Challenge of "Compostable Plastics"

Some of the complex challenges related to "compostable" plastics in general (and single-use plastics in particular) were discussed in some detail in Section 7 of the Task 3 Single-Use Items Sub-Report. There is a high degree of consumer confusion about "compostable plastics" labelling. Industrial scale composting plants that achieve sufficient temperature and ensure adequate treatment time are needed to properly manage plastics that are in fact truly compostable. One can only hope that the misleading statement on some plastics packaging that a package is "recyclable, where facilities exist" does not get applied to plastics composting which, to repeat, requires industrial scale compost plants specifically designed for the sole purpose of composting "compostable" plastics.

The three major concerns summarized in the Task 3 SUI Report regarding the economic and processing impacts in composting plants that could be created by an influx of compostable plastics and especially single-use items (SUIs):

- Composting facilities expressed concerns that allowing compostable SUIs as alternatives may inadvertently worsen contamination issues
- Tipping fees may increase to cover the anticipated higher operational costs associated with processing compostable plastic SUIs
- Market/public confusion and difficulties ensuring plastic producers are directed to facilities that can successfully process them seems unlikely

Section 7 of the Task 3 report concludes with an important statement: "Currently, plastic bags, cups, take-out containers and utensils (even those marked biodegradable or compostable) are considered contaminants and not accepted in the City of Guelph's green cart Program".

6.3 Public Education and Engagement

Promotion and education (P&E) is the cornerstone of a well-functioning waste management program. An effective P&E program is even more critical now with waste diversion programs facing increased contamination restrictions end market specifications.

Municipalities must develop communications that not only target the messaging nuances of demographic groups but must access them through a wide variety of traditional and social media approaches. **Figure 8** defines the date range of current social generations.

Figure 8: Generational Date Ranges

For example, the older generations (Baby Boomers and Generation X) continue to use more traditional modes of communication such as the newspaper, radio and internet to get information. The younger generations (Millennials and Generation Z) prefer social media to acquire information and want the information immediately, "if they can't immediately find what they need, they won't likely be back".[23]

The majority of Millennials (or Generation Y) access social networks on their smartphones, more than any other generational group. That said, a 2019 Canadian study indicates that 57% of Baby Boomers reported surfing the internet through their smartphones in 2019 compared with 24% in 2014.[24] Baby Boomers also use Facebook to interact with others and access information although to a lesser degree than the younger generations. In another Canadian study, while 88% of Millennials reported using Facebook on a weekly basis, 79% of Baby Boomers also reported using Facebook on a weekly basis along with 83% of Generation Xs.[25] See **Table 8** for the variety of ways the age groups look for information in terms of resources strongly used/relied upon for information, resources somewhat used/relied upon for information or rarely or not used at all.

Table 8: Generational Information Gathering Preferences

Information Gathering Preferences	Baby Boomers	Generation X	Millennials	Generation Z
Newspapers & magazines	Strongly used	Somewhat used	Rarely / not used	Rarely / not used

23 P&E: Are we getting through to residents? How can we find out? March 2, 2019. CIF blog at Are we getting through to residents? How can we find out?

24 2019 Canada's Internet Factbook. 2019. Canadian Internet Registration Authority (C I R A). Canada's Internet Factbook

25 2019 Report: Social Media Use in Canada. June 30, 2019. Online Business Canada Social Media Use in Canada

Information Gathering Preferences	Baby Boomers	Generation X	Millennials	Generation Z
Television & radio	Strongly used	Somewhat used	Rarely / not used	Rarely / not used
Computers and the internet	Somewhat used	Strongly used	Somewhat used	Somewhat used
Facebook	Somewhat used	Somewhat used	Strongly used	Strongly used
YouTube	Somewhat used	Somewhat used	Strongly used	Strongly used
Instagram	Rarely / not used	Rarely / not used	Strongly used	Strongly used
Messaging/Texting	Rarely / not used	Somewhat used	Strongly used	Strongly used

Currently, two of the groups, Millennials and Baby Boomers, represent over half (54%) of the total Canadian population.[26] This means for the next while, communication sources will need to continue to be diverse to capture the attention of the different generational groups.

[26] Consumer Corner – Millennials Who Are They and what do they like when it comes to food? November 2016. Alberta Government at Consumer Corner

Terms like 'contamination' and 'recyclable' may sound common sense to municipal staff but they can mean something entirely different to residents.

Terminology is an emerging issue, with municipalities realizing that the words or terms used to convey waste diversion information don't always resonate with the target audience as expected. Terms like 'contamination' and 'recyclable' may sound like common sense terms to municipal staff but they can mean something entirely different to residents. Recent studies conducted by the City of Toronto and Metro Vancouver explored how residents interpret waste terminology. The results showed that residents confused many common waste terms such as:

- The term "contamination" referred to something hazardous; it was recommended to use the term "non-recyclable items" instead
- The term "recyclable" could refer to blue box or organic materials; it was recommended to use the terms "Blue Box recycling" and "Green Bin organics" instead
- When using the term "organics" by itself, it could be interpreted as leaf and yard waste, organic chemicals or food waste; it was recommended to use the term "food waste" or "food scraps" instead

Another study conducted by the Foodservice Packaging Institute found that keeping the terminology simple and straightforward is key. Using words such as food waste instead of organics, and plastic container instead of plastic clamshell can help residents better understand what is being asked of them. The study identified that:

- The instructions "clean and empty" or even "empty before recycling" is better understood than "no food or soiled"

The study also investigated how well grouping of recyclable items are best understood by people. Participants were asked to view three different flyers that presented the recyclable materials in different groupings. The first flyer grouped items by waste stream (recycling, organics, trash, etc.); the second flyer grouped items by material type (plastics, glass, paper, etc.) and the third flyer did not group anything (**Figure 9**).

Figure 9: Testing Different Groupings of Recycling Information

Source: Food Service Packaging Institute

When asked which flyer was more useful for identifying where to place a plastic clamshell container, a majority of respondents found the easiest flyer to understand was Flyer 2, which used the materials categories – paper, plastics, glass, etc.[27]

Other key findings from the study, include:

- Residents rely on a municipality's website as a key source for recycling information
- Recycling educational flyers should show images grouped by recycling material categories, i.e. paper, plastic, glass and metals, with brief descriptions and provide instructions on how to prepare recyclables to achieve quality material

Finally, our exposure to increased advertising, messaging and screen time has resulted in reduced attention spans. A consumer study conducted in Canada revealed the average person's attention span is down to eight seconds from 12 seconds in 2000.[28] Therefore, messaging needs to be minimal, relevant and easy to understand to capture the attention of and educate a resident in eight seconds. Keeping terms and messages clear and simple can be the most effective approach to a successful P&E campaign.

As IPR programs are implemented, communicating program changes will be an emerging issue for municipalities. Given the challenges noted above, concentrated P&E efforts may require City input or collaboration with producers during the transition to IPR to ensure the desired behaviour changes are achieved. In addition, future P&E efforts will be required to inform customers of provincial and federal waste actions and their impact on the City's waste collection programs (e.g., organics, SUPs) and to inform of waste management initiatives and programs that are within the City's control (e.g., green cart, WRIC programs).

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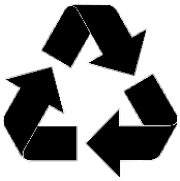
27 Resident Messaging Survey Findings. 2016. Foodservice Packaging Institute at Resident Messaging Survey Findings

28 Attention Spans. 2015. Microsoft Canada, Consumer Insights at Attention Span Consumer Insights Report

6.4 Unacceptable Items in Waste Collection Programs

When waste audits are conducted, the wastes can be separated into over 50 categories (e.g., cardboard, plastic bottles, steel cans, food waste, etc.). There are so many different materials that make up the waste stream that the City manages with this list constantly evolving as producers change the ways in which to package and/or design their products and new programs are introduced to reduce and recycle wastes. This can lead to confusion from the City's customers and uncertainty about the proper way to handle it (e.g., put it in the green cart, grey cart, or blue cart? bring it to a recycling depot?). The following presents some of the issues related to sorting of wastes:

6.4.1 Wish Recycling



Wish recycling, or aspirational recycling, is the practice of placing a non-recyclable item in the recycling bin with the **hope** the item is recyclable or that the recycling facility can sort out. Despite the resident acting in good conscience, wish recycled items may not be included in the specific collection program or be considered as garbage. Items made of materials typically understood as recyclable, such as any product with the recycling symbol or black plastic containers, are susceptive to this practice. Items accepted at a drop-off depot but not at curbside are also sometimes put out for collection, with the resident assuming that if the material can be dropped off, it is also accepted at the curb.

6.4.2 Curbside Sorting

Noting how many different materials there are in the residential waste stream, it is challenging for residents to understand the 'right' ways to participate in curbside collection programs. Residents may add soiled containers with food to their blue cart or they may contaminate the green cart with plastic food packaging. Others may add a material in the hopes of "wish recycling"; however, these materials are not acceptable and are garbage. Lastly, there are other materials that are commonly thought to be recyclable (e.g., hot beverage take-away cups, coffee pods) that are to be placed in the grey cart. Some companies offer a 'take-back program' (e.g.,

Nespresso coffee pods) where a customer can collect the item and mail it directly to the producer for recycling. However, some may deem this to mean it is recyclable in municipal recycling programs which can lead to effort being required at the sorting facilities to remove the unacceptable materials (referred to as 'contaminants').

Municipal blue cart and green cart programs may have high proportions of unacceptable material. By weight, unacceptable material may comprise up to 30% of municipal blue cart and green cart material collected. The additional effort to sort out the unacceptable materials at the processing facilities results in increased operational costs for the blue cart and green cart programs.

6.4.3 Promotion and Education Mitigation

Effective P&E plays a critical role in the proper sorting of materials for all municipal curbside collection programs. Sorting apps and websites are common P&E approaches to educate residents on proper sorting procedures for their specific municipality. In Ontario, each municipality has unique sorting guidelines for their jurisdiction while their neighbouring municipality may be different. The province's draft regulation for the Blue Box Program is to move towards a consistent and standardized "basket of goods" for the Blue Box Program for the whole province which can reduce confusion.

6.5 Disruptive and Problematic Materials

As previously mentioned, the ways in which producers change product and packaging design don't always consider the impact on waste or recyclability when it reaches the consumer. As examples, making packaging lighter in weight can make transportation of the products more efficient or using a different type of food packaging can extend the shelf life of fruits and vegetables. These changes in product packaging can present challenges to recycling facilities. In addition, certain materials can disrupt waste processing operations, damage equipment and/or end up in sorted waste stream. These disruptive and problematic materials emphasize the importance of legislative interventions on packaging and IPR. The following provides an overview of these 'problematic' materials.

6.5.1 Glass

Products made from glass (e.g., food containers, beverage bottles) can be placed in single stream curbside collection programs (i.e., blue cart recycling). When the carts get dumped into the waste collection vehicle, glass will break creating a health and safety issue at an MRF for the workers as well as create wear and tear on MRF conveyor belts. Broken glass can end up in the sorted paper stream thus lowering the paper bale quality and market value of the bale. Some options to mitigate broken glass is to collect it separately as they do in BC or to handle in a dual stream collection system. Recycle BC asks that residents sort glass into its own container, separate from other recyclables at curbside (if curbside collection of glass is available) or deliver glass to drop-off depots. Some municipalities have stopped collecting glass due to its very low revenue value. The June 2021 Continuous Improvement Fund (CIF) price sheet for mixed (i.e., clear and coloured) broken glass is listed as **-**$40 CAD per marketed tonne[29], i.e., municipalities are paying processors such as NexCycle Industries to purchase their recycled glass. In Ontario, there are few end sources for recycled glass, with NexCycle Industries being the predominant glass processor.

6.5.2 Plastic Film

Plastic film is also problematic due to the mechanical impacts at MRF's, in addition to its fluctuating market value (-$37 in February 2021 and $29 in June 2021). Film wraps around spinning sorting equipment and rolling discs causing the MRF sorting lines have to stop production and shut down operations so that hours of maintenance can be performed on the equipment to remove the wrapped plastic film. As part of their P&E campaigns, many municipal programs ask residents to bag all plastic film together so that it can be sorted off the line at the beginning of the sorting process.

[29] Continuous Improvement Fund Price Sheet - October 2020.

6.5.3 Standup Pouches

Disruptive materials also include multi-material packaging pouches, also referred to as multi-laminated pouches or standup pouches, and compostable plastics such as the plant-based soda drink bottles. Multi-laminated pouches are a common new packaging choice for food retail; however, they are not recyclable in the blue cart program. The pouches have several layers of different material to preserve and protect the contents and on the outside to provide labeling. This flexible packaging material is being collected at depots and other locations in BC for a research and development project by Recycle BC. This packaging is not collected in Ontario but is commonly found in Blue Boxes as "wish recycling" and is a contaminant as noted in the previous section.

6.5.4 Compostable Plastic

There is a trend by some plastic packaging manufacturers to solve their sustainability challenges by producing compostable plastics or bioplastics; for example, the PlantBottle, a plastic bottle made of 30% plant material and 70% from fossil fuels. The product, known as PlantBottle, was launched by Coca Cola in 2009[30]. Some bioplastics can be composted and others leave toxic residues or plastic fragments behind, making them unsuitable for composting if compost is being used to grow food. There are two types:

- **Bioplastics** made from natural materials such as corn starch
- **Biodegradable plastics** made from traditional petrochemicals, which are engineered to break down more quickly

The most familiar bioplastics are made from natural materials such as corn starch and sold under such names as EverCorn™ and NatureWorks. Some bioplastics look virtually indistinguishable from traditional petrochemical plastics. This causes the problem for recycling and sorting. Polylactide acid (PLA) looks and behaves like polyethylene and polypropylene and is now widely used for food containers. It also looks like easily recycled polyethylene terephthalate (PET) plastic and, if missorted, could contaminate bales of recyclable plastics. Also it tends to crack and break apart at

[30] Everybody Clean Up Website Accessed May 21, 2020.

recycling facilities. Options may include additional optical sorting technology that can separate it out. Producers are also looking for ways to recycle it. P&E would have to clearly educate residents on whether this is a green bin or a blue box material or garbage.

Some bioplastics can decompose in a matter of weeks. Unfortunately, not all bioplastics compost easily or completely and some leave toxic residues or plastic fragments behind. Some will break down only at high temperatures in industrial-scale, municipal composters or digesters, or in biologically active landfills (also called bioreactor landfills), not in ordinary home compost heaps or in conventional landfills. There are various eco-labeling standards around the world that spell out the difference between home and industrial composting and the amount of time in which a plastic must degrade in order to qualify.[31] Unfortunately, typical municipal compost programs do not allow for long retention times required for these specific materials to fully decompose.

6.6 Changing Technology and Approaches

The use of technology to improve the efficiency and effectiveness of waste management systems continues to evolve. These emerging technologies are improving collection and operational efficiencies and increasing recycling and recovery of waste materials.

6.6.1 RFID Tags

As part of the City's conversion to fully automated cart based collection, all carts are equipped with radio-frequency identification (RFID) tags. Each RFID tag has a unique serial number that identifies the type and size of cart connected to each household address. With additional software, the RFID tags could be used to gather more data and improve efficiencies in waste collection programs.

[31] Bioplastics and biodegradable Plastics. Accessed May 21, 2020.

6.6.2 Optical Sorting

Infrared optical eye sorting technology has been used in larger municipal MRF's for the past two decades. Initially, when the technology was introduced, only one or two optical sorters were in place in an MRF. To retrofit a MRF for optical sorting was approximately one million dollars depending on the infrastructure. Now, it's not uncommon to have multiple optical sorting lines in a MRF due to the many materials that can be sorted using optical eye technology. The capital cost of adding this technology to an MRF is a long term investment. With the Blue Box transition beginning in 2023, municipalities have been reconsidering investing in updating or adding technology to their MRF's until the new IPR Blue Box Regulation is finalized and its impacts are clearly understood.

6.6.3 Artificial Intelligence

Artificial Intelligence (AI) has found applications in waste management services. AI is used to support proper sorting of material as well as communicating waste or recycling bin fullness and indication for collection. Vancouver airport currently has AI technology to support correct sorting of waste streams into the proper bins. Users hold the item in front of the bin camera and the interactive screen then informs the user which bin the item belongs in.

The City of Newcastle, UK won an award in 2019 for the use of AI technology to improve public space waste collection. Newcastle employed Enevo's patented waste sensor and analytics software to service its public litter bins. Enevo sensors measure fill levels while its analytics software monitors and predicts waste behaviour, creating a customized collection schedule for each location. The smart waste system prevents overflow, eliminates unnecessary collections, and creates the most efficient route between sites in need. The Enevo AI technology created a 50% reduction in resource and a 51% reduction in community complaints in Newcastle, along with an overall decrease in carbon emissions, noise, traffic, and litter.

The City of Guelph issued a Request for Proposals for a food waste data challenge that aimed to automatically gather data on avoidable food waste and incorrect sorting in the residential green cart program and have mechanisms in place to communicate that information back to applicable

households. The project recently was completed and the final report is being prepared along with next steps. A key outcome would be for the approach to use an AI solution using the City's state-of-the-art waste collection vehicles and enhance the use of RFID tags and GPS.

6.6.4 Mixed Waste Processing

Mixed waste processing (MWP) approaches have often been used as a replacement for source separation approaches. These systems are also being used in some waste management systems to minimize waste requiring disposal by recovering resources from the waste management system that are not otherwise captured in waste diversion programs.

Mixed waste processing involves recovering recyclables and/or organics and/or reusable materials, leaving the residual waste for landfilling or another appropriate waste processing application. Depending on the streams processed, they are also known as "dirty" MRFs.

Mechanical and biological treatment processes incoming waste to produce refuse derived fuels (RDF), biogas, plastics, metals, minerals and inert materials (e.g., stones, glass, etc.), process water and effluent.

The Region of Peel is currently investigating the feasibility of building an MWP facility to process residual waste coming out of apartment and condominium buildings. The Region is looking for interested municipal partners in this facility.

6.7 Circular Economy

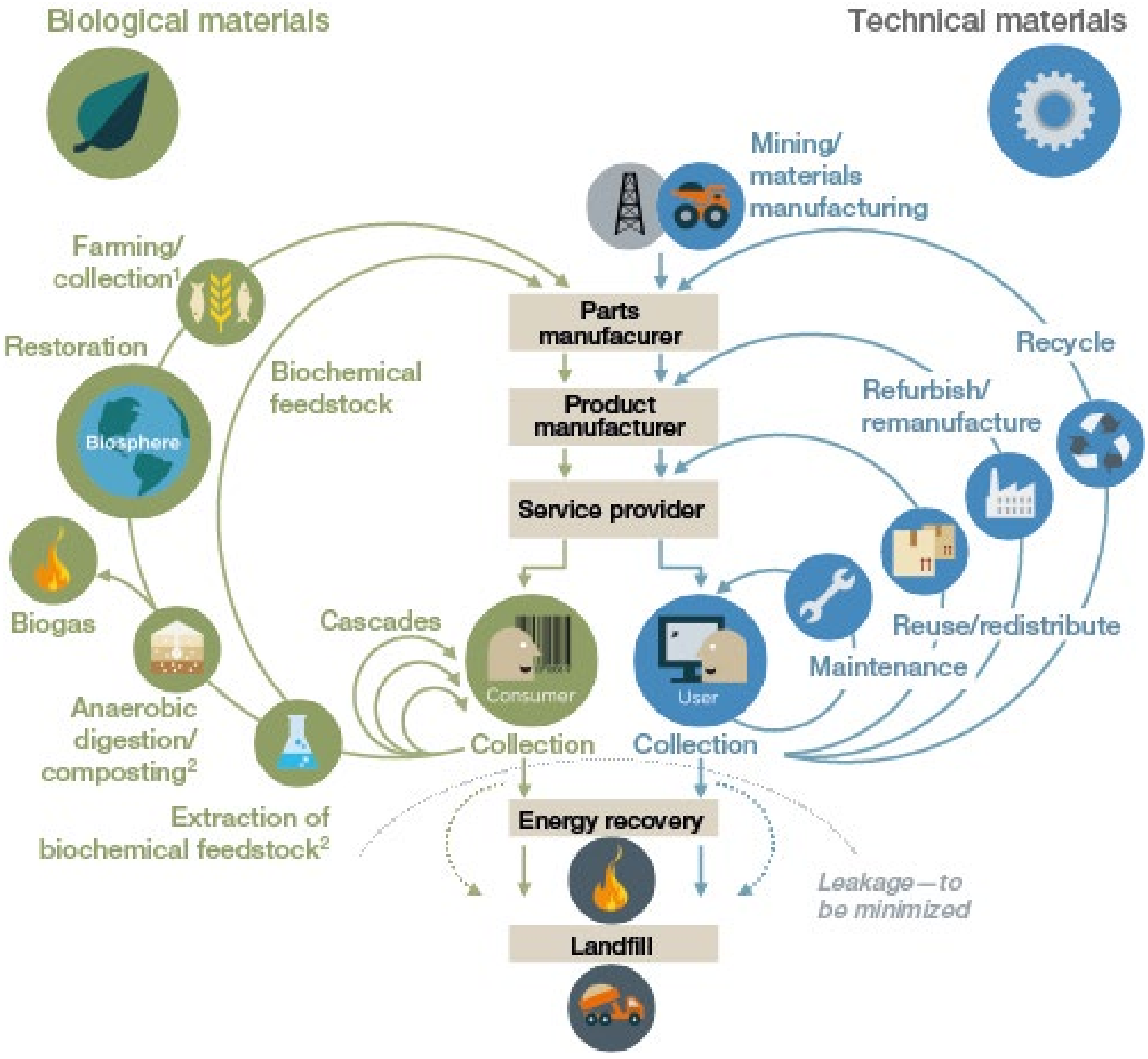
The guiding principles of a circular economy are to keep resources in the economy as long as possible by recirculating them back into the economy through recycling, refurbishing or repurposing. It is a shift in systems thinking, from linear systems (make – use –waste) to closed loop systems (make – reduce -use – reuse –remake). In order to explore the City's role in pursuing circular economy policy and investments in circular business, a new dedicated staff position has been added. This staff person is also acting as a liaison between the City and the Our Food Future circular food economy initiative discussed in **Section 6.1.2**.

"A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models".[32]

See **Figure 10** for a representative Circular Economy schematic of the flow of biological and technical materials and resources in a circular economy based restorative closed loop industrial system.

[32] From Linear to Circular - Accelerating a Proven Concept. Accessed May 22, 2020.

Figure 10: The Circular Economy - An Industrial System that is Restorative by Design.[33]



Source: World Economic Forum, From Linear to Circular – Accelerating a Proven Concept.

[33] From Linear to Circular - Accelerating a Proven Concept. Accessed May 22, 2020.

Some common elements for a circular economy system include policies towards:

- Reduction of waste, and waste avoidance, the highest pillar of the recycling hierarchy
- Policy and promotion for EPR, which in turn encourages policy for post-consumer recycling content (PCR) in products and sustains end markets for recyclable materials, especially locally
- Product life extension and reparability in the design stage, built-in design for long life and repairability
- Remanufacturing, reuse, repurposing of products
- Product as a service, i.e. purchasing a service rather than the product, e.g. lighting service rather than lights
- Sustainable procurement policies especially by governments taking the lead, such as recyclable content, product as service and social equity, and
- Maintaining sustainability goals such as the 17 sustainable development goals by the United Nations[34], including sustainable cities and communities and responsible consumption and production and climate action. "The seventeen Sustainable Development Goals (SDG) are our shared vision of humanity and a social contract between the world's leaders and the people," UN Secretary-General Ban Ki-moon said of the 2030 Agenda for Sustainable Development adopted unanimously by 193 Heads of State and other top leaders at a summit at UN Headquarters in New York in September 2015. "They are a to-do list for people and planet, and a blueprint for success," he added of the 17 goals and 169 targets to wipe out poverty, fight inequality and tackle climate change over the next 15 years. See **Figure 11**.

[34] Welcome to the World's Largest Lesson. Accessed April 2, 2020.

Figure 11: The United Nation's 17 Sustainable Development Goals

Source: United Nations, Sustainability Goals.

Getting to a Circular Economy: A Primer for Canadian Policymakers is a 2019 policy publication by the Smart Prosperity Institute. It reviews best practices internationally and identifies six policy tools to support the transition to a circular economy in Canada. It is an introduction to the circular economy concepts and landscape, written for both government and business audiences. One of its key messages is that circular economy approaches can improve business competitiveness by mitigating risks of price volatility and supply uncertainty, increasing efficiency and productivity, generating new revenue, creating deeper relationships with customers, and enhancing market differentiation.

6.8 Performance Metrics

Setting measurable targets and measuring performance of municipal waste management programs and services is an important activity to ensure the system is operating as designed and to make ongoing improvements. For Ontario municipalities, an annual data call has been in place for a number of years that has been used to determine levels of stewardship funding for the Blue Box Program. Performance metrics also serve to provide accountability and demonstrate program value to tax payers. Changes to the waste stream and waste management systems have resulted in the need to develop new metrics that better represent performance compared to other municipal services.

6.8.1 Light-Weighting of Recyclables

The "evolving" tonne has been coined to describe the trend towards light-weighting of packaging and recyclable materials and paper products including newspapers. Use of heavier packaging such as glass containers and steel cans has been declining, and there is a shift toward use of increasingly lighter packaging materials, as well as less printed paper. Consequently, a tonne of materials set out for recycling today is a very different mix of materials than what was in the tonne that recycling systems were originally designed to handle. Likewise, the trend to digital technology has led to a decline in printed form especially for newspapers and magazines.

As one example, according to materials processor, ReCommunity, it takes over 10,000 more 16-ounce plastic bottles to make 1 ton of recycled PET today than it did in 1980. Aluminum containers are following the same

trend. While a positive indication of resource efficiency, this is not good news for MRFs. The same volume of material now hits the recycling facility scale at a much lower weight. Essentially, MRFs are doing double the processing work for the same revenue. This, plus a dip in commodity prices is making it very difficult to operate MRFs profitably. Making things even more challenging is public confusion over what is now recyclable, resulting in an increase in contaminants in the incoming materials stream. When in doubt, consumers practice what the industry has termed "wishful recycling".[35]

6.8.2 Disposal versus Diversion Metric

Waste management performance metrics are typically measured by a weight basis. Some jurisdictions, like Ontario, report waste performance in terms of a diversion rate. Alberta and Nova Scotia both have provincial waste targets in terms of a disposal rate. **Nova Scotia Environmental Goals and Sustainable Prosperity Act** contains waste management goals for a solid-waste disposal rate less than 300 kg/person per year by 2015. They have not achieved that goal to date. In 2008, **Alberta Environment & Sustainable Resource Development's Business Plan** targets were adjusted as the 500 kg per capita disposal target was not considered attainable; the disposal targets are now set annually in the business plan. For EPR programs, mandated EPR targets are typically set as a recovery rate i.e., the ratio of the tonnes recovered versus the tonnes put onto the market. With the light-weighting trend of materials mentioned above, the debate of using tonnes, units or volume continues. The negative impact of light-weighting is most evident when using a weight based metric as the weight per unit or density of material is getting lighter over time. Light-weighting therefore portrays annual performance rates lower than they actually are.

6.8.3 Program Performance

Performance measurement is a means of monitoring how well a service model is working and ensuring that service delivery approaches continue to be effective in terms of costs and defined service expectations. Many

[35] The Evolving Ton and the Circular Economy. Accessed May 22, 2020.

municipalities are reporting program specific measures as part of the annual budget process.

A number of municipalities are using performance measures established by the Municipal Benchmarking Network Canada (MBNC). The MBNC is a 16-member municipal partnership established in 2016 that benchmarks municipal services across 37 service areas including solid waste. It grew from the Ontario Municipal CAO's Benchmarking Initiative and now includes municipalities from six provinces. MBNC municipalities report annually on seven measures for the Waste Management Service area:

6.8.4 Service Level Measures

1. Tonnes of All Residential Material Collected per Household
2. Tonnes of Residential Solid Waste Disposed per Household
3. Tonnes of Residential Solid Waste Diverted per Household

6.8.5 Community Impact Measure

1. Percent of Residential Solid Waste Diverted

6.8.6 Efficiency Measures

1. Total Cost for Garbage Collection per Tonne - All Property Classes
2. Total Cost for Solid Waste (All Streams) Disposal per Tonne - All Property Classes
3. Total Cost for Solid Waste Diversion per Tonne - All Property Classes

The annual report also includes the previous two years of data, which shows trends. The MBNC notes six influencing factors in comparing data from year to year and between municipalities.

1. Diversion Efforts – type and number of programs offered
2. Education – public education and outreach efforts
3. Geography – location, size, density, housing types, urban form
4. Government Structure – single tier vs. upper tier
5. Infrastructure –disposal capacity availability and transportation distances
6. Organizational Form – varying service levels, providers and standards

6.8.7 Service Reviews

Detailed reviews of service delivery levels and performance help to assess delivery approaches to ensure they are optimized and are continuing to deliver value at a reasonable cost. They are done periodically and involve a detailed examination of what services are provided, delivery methods, resource requirements, costs and available performance measures to identify opportunities for improvement.

The City of Guelph's Solid Waste Resources undertook a business services review[36] of their operations in 2017 as part of the City's larger process to conduct business service reviews. The following lists the solid waste elements considered in the review with the current service delivery approach noted in brackets: collections (in-house), green cart material processing (own facility, contract operations), MRF (own and operate), leaf and yard waste processing (contract), MHSW management (own and operate), public drop-off depot (own and operate), transfer station (own and operate) and disposal (contract).

The purpose of the review was to review the City's current services and determine if the service delivery approach exceeded or was in line with comparator municipalities or if changes needed to be made. The findings indicated that the City meets or exceeds service levels of the other applicable municipalities in all but one waste service element (MRF) included in the scope of the review. The City has been implementing the 11 approved recommendations coming out of the service review. To date, eight recommendations have been completed and the remaining three recommendations are in progress and are included in the scope of work being undertaken as part of the SWMMP.

[36] https://guelph.ca/wp-content/uploads/council_agenda_052818-1.pdf#page=82

6.9 Pandemic Impacts (COVID-19)

6.9.1 Waste Generation Patterns

The recent global pandemic of the COVID-19 infectious disease has impacted waste generation patterns and solid waste management systems due to rapid and unexpected medical, behavioural and economic changes. The initial economic shutdown of business and non-essential services at the outset of the pandemic led to a shift in solid waste generation managed by municipal waste services and private waste collection and disposal companies.

The province of Ontario declared a state of emergency on March 17, 2020, and resulted in the closure of all non-essential activities to reduce the spread of COVID-19. As a result of the closures and stay home directive, the generation of waste has increased in the residential stream and decreased in the IC&I sector due to shutdown of non-essential businesses. The Ontario Waste Management Association (OWMA) reported in April 2020 that residential collection rates have increased for garbage by approximately 5%, green bin by 8%, blue box by 2%, and overall by 5%. For the IC&I sector, anecdotal information indicate that IC&I waste collection tonnages has generally decreased between 12 – 22%. Overall, IC&I tonnages have decreased and some increases are sector-specific: general commercial waste appears down (including a substantial reduction in office paper generation), food processing/grocery stores appear up in excess of 20%, restaurants appear down in excess of 70%, and manufacturing appears down by roughly 15%. Reduced IC&I tonnage may also be impacting residential tonnage numbers, where IC&I materials from individual businesses and business improvement areas (BIA) are collected as part of residential collection routes. Anecdotal information also suggests that bio-medical and healthcare waste tonnage has increased considerably as a result of the COVID-19 pandemic.

Although the economy has partially reopened, it continues to adapt to the ongoing pandemic and as a result, waste generation continues to be affected. Even after the pandemic, working from home may become a more

common approach for a portion of the workforce and in turn, maintain to some degree an increase in residential generation rates and a decline in IC&I generation rates. An economic recession as a result of the pandemic will also decrease waste generation rates as consumers spend less and some portion of business declines or goes bankrupt. Ongoing monitoring of impacts will be required and adjustments made to the Tonnage Forecasting model as trends emerge.

6.9.2 Public Consultation

The City's consultation and engagement activities have had to switch from in-person to virtual means to maintain health and safety requirements and reduce the community spread of COVID-19. As a result, engagement and consultation of the SWMMP was completed online.

6.9.3 Waste Reduction and Reuse

The COVID-19 pandemic resulted in the suspension of reuse programs and initiatives such as the use of travel mugs at coffee shops and reusable bags at grocery stores. Thrift stores were temporarily closed but have since reopened. Demand for second-hand items is expected to increase with the anticipated ongoing economic pressures resulting from changes and closures of businesses and high unemployment rates. Longer-term impacts will need to be considered as the City's SWMMP is developed and implemented.

6.9.4 MECP Approvals

Other short term impacts include the MECP's response to Environmental Compliance Approvals (ECA) emergency relief requests to quickly handle case-by-case situations. The form can only be used to request temporary relief from current ECA conditions. The loss of solid waste staff and contractors arriving to work due to sickness, PPE concerns or childcare needs is reported. Some municipalities have changed their green bin sorting specifications for residents by removing tissues and paper towels as acceptable materials and requesting these to be placed in the garbage stream in a sealed bag in order to protect the collection workers from the virus.

6.9.5 Long Term Implications

The following presents some of the considerations into the potential longer term impacts that COVID-19 is having on the waste management industry:

- Attitudes on single use plastics, reusable items - will pre-pandemic attitudes continue?
- Less retail with online shopping here to stay - what will be the impacts on residential wastes?
- More meals prepared at home - will this continue? Translates to more food waste in the green bin program
- Awareness of food supply, safety & security - will help with initiatives developed as part of the OFF Smart City
- Working from home benefits - continuing will mean more residential waste and less IC&I
- Action on climate change
- Importance of sustainability
- Will conservation continue?

7.0 Recommendations

Based on the information presented above, the following recommendations to address Guelph's long term disposal needs, transition of the Blue Box program to individual producer responsibility and emerging issues are put forward as part of the SWMMP Update.

Residual Waste Management

- Explore approaches to identify alternatives to landfilling (e.g., feasibility study, request expressions of interest to provide alternative disposal capacity).

Blue Box Transition

- Implement the Blue Box Transition Strategy. The City continues to monitor developments to the Blue Box Regulation as details are made available and use the Blue Box Transition Strategy tool and financial model to evaluate the viability of providing services as a contractor to a Producer Responsibility Organization (PRO) in the new system and / or to determine the feasibility, costs and diversion impacts of providing services to non-eligible customers (IC&I, downtown).

Emerging Issues

- Update the SWMMP. With the anticipated major changes and issues facing waste management within the City, province and country, it is recommended that the City monitor progress and update the SWMMP every five years.

Appendix A

Waste Management Forecasting Results

Table A-1: Organics Compost Facility – Incoming Tonnage Forecast Basis

Criteria	Mixed Organics	City of Guelph	Region of Waterloo	Brush, Amendment, and Mulch
Forecast Basis	Not applicable	Based on the average per capita amount between 2017 to 2019	Continue with 20,000 tonnes as per the agreement amount	Forecast as average % (2017-2019) of Mixed Organics
Annual Forecast	Not applicable	0.0748	20,000.00	1.50%

Table A-2: Organics Compost Facility – Incoming Tonnage Forecast

Year	Forecast Population	Mixed Organics	City of Guelph	Region of Waterloo	Brush, Amendment, and Mulch	Total
2020	141,000	n/a	10,548	20,000	458	31,006
2021	143,300	n/a	10,720	20,000	461	31,181
2022	145,600	n/a	10,892	20,000	463	31,355
2023	147,900	n/a	11,064	20,000	466	31,530
2024	150,100	n/a	11,229	20,000	468	31,697
2025	152,300	n/a	11,393	20,000	471	31,864
2026	154,500	n/a	11,558	20,000	473	32,031
2027	156,700	n/a	11,722	20,000	476	32,198
2028	158,900	n/a	11,887	20,000	478	32,365
2029	160,000	n/a	11,969	20,000	480	32,449
2030	161,000	n/a	12,044	20,000	481	32,525
2031	162,100	n/a	12,126	20,000	482	32,608
2032	163,100	n/a	12,201	20,000	483	32,684
2033	164,100	n/a	12,276	20,000	484	32,760
2034	166,700	n/a	12,471	20,000	487	32,958
2035	169,200	n/a	12,658	20,000	490	33,147
2036	171,800	n/a	12,852	20,000	493	33,345
2037	174,300	n/a	13,039	20,000	496	33,535
2038	176,900	n/a	13,234	20,000	499	33,732
2039	179,400	n/a	13,421	20,000	501	33,922
2040	182,000	n/a	13,615	20,000	504	34,119
2041	184,500	n/a	13,802	20,000	507	34,309

Table A-3: Organics Compost Facility – Outgoing Tonnage Forecast Basis

Criteria	Finished Compost	Overs	Screening Waste	Residual Compost Waste	Organic Rejected Load
Forecast Basis	Forecast as average % (2017-2019) of Mixed Organics	Forecast as average % (2017-2019) of Mixed Organics	Forecast as average % (2017-2019) of Mixed Organics	Forecast as average % (2017-2019) of Mixed Organics	Forecast as average % (2017-2019) of Mixed Organics
Annual Forecast	21.90%	3.00%	1.50%	1.50%	0.10%

Table A-4: Organics Compost Facility – Outgoing Tonnage Forecast

Year	Forecast Population	Finished Compost	Overs	Screening Waste	Residual Compost Waste	Organic Rejected Load	Total
2020	141,000	6,690	916	458	458	31	8,553
2021	143,300	6,728	922	461	461	31	8,602
2022	145,600	6,765	927	463	463	31	8,650
2023	147,900	6,803	932	466	466	31	8,698
2024	150,100	6,839	937	468	468	31	8,744
2025	152,300	6,875	942	471	471	31	8,790
2026	154,500	6,911	947	473	473	32	8,836
2027	156,700	6,947	952	476	476	32	8,882
2028	158,900	6,983	957	478	478	32	8,928
2029	160,000	7,001	959	480	480	32	8,951
2030	161,000	7,018	961	481	481	32	8,972
2031	162,100	7,036	964	482	482	32	8,995
2032	163,100	7,052	966	483	483	32	9,016
2033	164,100	7,068	968	484	484	32	9,037
2034	166,700	7,111	974	487	487	32	9,092
2035	169,200	7,152	980	490	490	33	9,144
2036	171,800	7,195	986	493	493	33	9,199
2037	174,300	7,236	991	496	496	33	9,251
2038	176,900	7,278	997	499	499	33	9,305
2039	179,400	7,319	1,003	501	501	33	9,358
2040	182,000	7,362	1,008	504	504	34	9,412
2041	184,500	7,403	1,014	507	507	34	9,465

Table A-5: Transfer Station – Incoming Tonnage Forecast Basis

Incoming	Mixed Solid Waste	Curbside Waste	PDO Waste	Non-residential	MRF Glass Residue	MRF Residue
Forecast Basis	Not applicable	Based on the average per capita amount between 2017 to 2019	Based on the average per capita amount between 2017 to 2019	Based on the average % share of total mixed solid waste from 2017 to 2019	Based on the 2019 per capita amount.	Based on the 2019 per capita amount.
Annual Forecast	Not applicable	0.09	0.07	55%	0.003	0.008

Table A-6: Transfer Station – Incoming Tonnage Forecast

Year	Forecast Population	Mixed Solid Waste	Curbside Waste	PDO Waste	Non-residential	MRF Glass Residue	MRF Residue	Total
2020	141,000		13,111	9,486	27,798	464	1,197	53,003
2021	143,300		13,325	9,641	28,251	472	1,217	53,858
2022	145,600		13,539	9,796	28,704	479	1,236	54,712
2023	147,900		13,752	9,950	29,158	487	1,256	55,567
2024	150,100		13,957	10,098	29,592	494	1,275	56,384
2025	152,300		14,162	10,246	30,025	501	1,293	57,201
2026	154,500		14,366	10,394	30,459	509	1,312	58,018
2027	156,700		14,571	10,542	30,893	516	1,331	58,836
2028	158,900		14,775	10,690	31,327	523	1,349	59,653
2029	160,000		14,878	10,764	31,543	527	1,359	60,062
2030	161,000		14,971	10,832	31,741	530	1,367	60,433
2031	162,100		15,073	10,906	31,957	534	1,377	60,842
2032	163,100		15,166	10,973	32,155	537	1,385	61,213
2033	164,100		15,259	11,040	32,352	540	1,393	61,585
2034	166,700		15,501	11,215	32,864	549	1,416	62,551
2035	169,200		15,733	11,383	33,357	557	1,437	63,480
2036	171,800		15,975	11,558	33,870	566	1,459	64,446
2037	174,300		16,207	11,727	34,363	574	1,480	65,374
2038	176,900		16,449	11,901	34,875	582	1,502	66,340
2039	179,400		16,681	12,070	35,368	591	1,523	67,269
2040	182,000		16,923	12,245	35,881	599	1,545	68,235
2041	184,500		17,156	12,413	36,373	607	1,567	69,164

Table A-7: Transfer Station – Outgoing Tonnage Forecast Basis

Criteria	Mixed Solid Waste
Forecast Basis	Average % over 2017 to 2019 of incoming materials
Annual Forecast	106.36%

Table A-8: Transfer Station – Outgoing Tonnage Forecast

Year	Forecast Population	Mixed Solid Waste	Total
2020	141,000	53,598	53,598
2021	143,300	54,472	54,472
2022	145,600	55,347	55,347
2023	147,900	56,221	56,221
2024	150,100	57,057	57,057
2025	152,300	57,894	57,894
2026	154,500	58,730	58,730
2027	156,700	59,566	59,566
2028	158,900	60,402	60,402
2029	160,000	60,821	60,821
2030	161,000	61,201	61,201
2031	162,100	61,619	61,619
2032	163,100	61,999	61,999
2033	164,100	62,379	62,379
2034	166,700	63,367	63,367
2035	169,200	64,318	64,318
2036	171,800	65,306	65,306
2037	174,300	66,256	66,256
2038	176,900	67,245	67,245
2039	179,400	68,195	68,195
2040	182,000	69,183	69,183
2041	184,500	70,134	70,134

Table A-9: Material Recovery Facility – Incoming Tonnage Forecast Basis

Criteria	OCC - Baled and Loose	OWP/Fine - loose	Single Stream Loose
Forecast Basis	Based on the average per capita amount between 2017 to 2019	Based on the average per capita amount between 2017 to 2019	Based on the average per capita amount between 2017 to 2019

Criteria	OCC - Baled and Loose	OWP/Fine - loose	Single Stream Loose
Annual Forecast	0.0123	0.0025	0.0718

Table A-10: Material Recovery Facility – Incoming Tonnage Forecast

Year	Forecast Population	OCC - Baled and Loose	OWP/Fine - loose	Single Stream Loose	Total
2020	141,000	1,729	348	10,118	12,195
2021	143,300	1,757	354	10,283	12,394
2022	145,600	1,786	360	10,448	12,593
2023	147,900	1,814	365	10,613	12,792
2024	150,100	1,841	371	10,771	12,982
2025	152,300	1,868	376	10,928	13,173
2026	154,500	1,895	382	11,086	13,363
2027	156,700	1,922	387	11,244	13,553
2028	158,900	1,949	393	11,402	13,743
2029	160,000	1,962	395	11,481	13,839
2030	161,000	1,974	398	11,553	13,925
2031	162,100	1,988	401	11,632	14,020
2032	163,100	2,000	403	11,703	14,107
2033	164,100	2,012	406	11,775	14,193
2034	166,700	2,044	412	11,962	14,418
2035	169,200	2,075	418	12,141	14,634
2036	171,800	2,107	425	12,328	14,859
2037	174,300	2,138	431	12,507	15,075
2038	176,900	2,169	437	12,694	15,300
2039	179,400	2,200	443	12,873	15,516
2040	182,000	2,232	450	13,060	15,741
2041	184,500	2,263	456	13,239	15,958

Table A-11: Material Recovery Facility – Outgoing Tonnage Forecast Basis

Criteria	Total Aluminum	Glass Residue (from process)	HDPE#2 - Baled	Mixed Glass	Baled Residue	OCC Baled	ONP #8 Baled	OWP/Fine Paper	PET #1	Residue (from processing)	Tubs and Lids
Forecast Basis	Average % of incoming materials for 2017-2019	% of incoming materials for 2019	% of incoming materials for 2019	% of incoming materials for 2019	Average % of incoming materials for 2017-2019	Average % of incoming materials for 2017-2019	% of incoming materials for 2019 (include mixed paper)	Subtracted out incoming amounts to isolate the residential share. Then forecast on a per capita basis using 2019 data.	% of incoming materials for 2019	Match to incoming materials	Forecast based on 2019 per capita
Annual Forecast	2.85%	4.76%	1.35%	7.24%	31.36%	####	####	0.0002	4.45%		0.0001

Table A-12: Material Recovery Facility – Outgoing Tonnage Forecast

Year	Forecast Population	Total Aluminum	Glass Residue (from process)	HDPE#2 - Baled	Mixed Glass	Baled Residue	OCC Baled	ONP #8 Baled	OWP/Fine Paper	PET #1	Residue (from processing)	Tubs and Lids	Total
2020	141,000	289	481	136	733	3,173	3,007	2,123	34	450	1,197	14	11,637
2021	143,300	293	489	138	745	3,225	3,056	2,158	35	457	1,217	14	11,827
2022	145,600	298	497	141	757	3,276	3,105	2,193	35	465	1,236	15	12,017
2023	147,900	303	505	143	768	3,328	3,154	2,227	36	472	1,256	15	12,207
2024	150,100	307	512	145	780	3,378	3,201	2,260	36	479	1,275	15	12,388
2025	152,300	312	520	147	791	3,427	3,248	2,294	37	486	1,293	15	12,570
2026	154,500	316	527	149	803	3,477	3,295	2,327	37	493	1,312	16	12,751
2027	156,700	321	535	151	814	3,526	3,342	2,360	38	500	1,331	16	12,933
2028	158,900	325	542	153	826	3,576	3,389	2,393	38	507	1,349	16	13,115
2029	160,000	327	546	155	831	3,600	3,412	2,410	39	511	1,359	16	13,205
2030	161,000	330	550	156	837	3,623	3,433	2,425	39	514	1,367	16	13,288
2031	162,100	332	553	157	842	3,648	3,457	2,441	39	517	1,377	16	13,379
2032	163,100	334	557	158	847	3,670	3,478	2,456	39	521	1,385	16	13,461
2033	164,100	336	560	159	853	3,693	3,499	2,471	40	524	1,393	17	13,544

Year	Forecast Population	Total Aluminum	Glass Residue (from process)	HDPE#2 - Baled	Mixed Glass	Baled Residue	OCC Baled	ONP #8 Baled	OWP/Fine Paper	PET #1	Residue (from processing)	Tubs and Lids	Total
2034	166,700	341	569	161	866	3,751	3,555	2,510	40	532	1,416	17	13,758
2035	169,200	346	578	163	879	3,807	3,608	2,548	41	540	1,437	17	13,965
2036	171,800	352	586	166	893	3,866	3,664	2,587	41	548	1,459	17	14,179
2037	174,300	357	595	168	906	3,922	3,717	2,625	42	556	1,480	18	14,386
2038	176,900	362	604	171	919	3,981	3,772	2,664	43	565	1,502	18	14,600
2039	179,400	367	612	173	932	4,037	3,826	2,702	43	573	1,523	18	14,807
2040	182,000	372	621	176	946	4,095	3,881	2,741	44	581	1,545	18	15,021
2041	184,500	378	630	178	959	4,152	3,934	2,778	44	589	1,567	19	15,227

Table A-13: Public Drop-Off Depot – Incoming Tonnage Forecast Basis

Criteria	Shingles	Drywall	Yard waste (Residential Collection)	Yard waste (from Transfer Station)	Brush	Rubble/ Brick/ Toilets	Clean Wood	Clothing	Scrap Metal	Electronics	OCC - Baled and Loose	Single Stream Loose	Leaves
Forecast Basis	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)	Amount per capita (2017-2019)
Annual Forecast	0.0138	0.0031	0.023	0.0003	0.0138	0.0032	0.0016	4E-05	0.004	0.0013	0.0006	0.0038	0.0166

Table A-14: Public Drop-Off Depot – Incoming Tonnage Forecast

Year	Forecast Population	Shingles	Drywall	Yard waste (Residential Collection)	Yard waste (from Transfer Station)	Brush	Rubble/ Brick/ Toilets	Clean Wood	Clothing	Scrap Metal	Electronics	OCC - Baled and Loose	Single Stream Loose	Leaves	Total
2020	141,000	1,948	441	3,240	39	1,947	447	224	6	560	183	91	533	2,346	12,005
2021	143,300	1,980	449	3,293	39	1,979	454	228	6	569	186	92	541	2,384	12,201
2022	145,600	2,012	456	3,345	40	2,011	462	231	6	578	189	94	550	2,422	12,397
2023	147,900	2,044	463	3,398	41	2,043	469	235	7	587	192	95	559	2,461	12,592
2024	150,100	2,074	470	3,449	41	2,073	476	239	7	596	195	97	567	2,497	12,780
2025	152,300	2,105	477	3,499	42	2,103	483	242	7	604	198	98	575	2,534	12,967
2026	154,500	2,135	484	3,550	42	2,134	490	246	7	613	200	100	583	2,570	13,154
2027	156,700	2,165	491	3,600	43	2,164	497	249	7	622	203	101	592	2,607	13,342
2028	158,900	2,196	498	3,651	44	2,195	504	253	7	631	206	103	600	2,644	13,529
2029	160,000	2,211	501	3,676	44	2,210	507	254	7	635	208	103	604	2,662	13,623
2030	161,000	2,225	504	3,699	44	2,224	510	256	7	639	209	104	608	2,678	13,708
2031	162,100	2,240	508	3,725	45	2,239	514	258	7	643	210	105	612	2,697	13,801
2032	163,100	2,254	511	3,748	45	2,253	517	259	7	647	212	105	616	2,713	13,887
2033	164,100	2,268	514	3,770	45	2,266	520	261	7	651	213	106	620	2,730	13,972
2034	166,700	2,304	522	3,830	46	2,302	528	265	7	662	216	108	630	2,773	14,193
2035	169,200	2,338	530	3,888	46	2,337	536	269	7	672	220	109	639	2,815	14,406
2036	171,800	2,374	538	3,947	47	2,373	545	273	8	682	223	111	649	2,858	14,627
2037	174,300	2,409	546	4,005	48	2,407	552	277	8	692	226	113	658	2,900	14,840
2038	176,900	2,445	554	4,065	49	2,443	561	281	8	702	230	114	668	2,943	15,062
2039	179,400	2,479	562	4,122	49	2,478	569	285	8	712	233	116	678	2,985	15,274
2040	182,000	2,515	570	4,182	50	2,514	577	289	8	722	236	117	687	3,028	15,496
2041	184,500	2,550	578	4,239	51	2,548	585	293	8	732	239	119	697	3,069	15,709

Table A-15: Public Drop-Off Depot – Outgoing Tonnage Forecast Basis

Criteria	Shingles	Clean Wood	Drywall	Concrete, Rubble	Brush	Clothing	Electronics	Scrap Metal	Yard Waste	Leaves
Forecast Basis	Average % over 2017 to 2019 of incoming materials	Average % over 2017 to 2019 of incoming materials	Average % over 2017 to 2019 of incoming materials	Average % over 2017 to 2019 of incoming materials	Match to incoming materials	Match to incoming materials	Match to incoming materials	Match to incoming materials	Match to incoming materials	Match to incoming materials
Annual Forecast	99.59%	103.61%	116.60%	140.16%	0.00%	-	-	-	-	-

Table A-16: Public Drop-Off Depot – Outgoing Tonnage Forecast

Year	Forecast Population	Shingles	Clean Wood	Drywall	Concrete, Rubble	Brush	Clothing	Electronics	Scrap Metal	Yard Waste	Leaves	Total
2020	141,000	1,940	232	515	626	1,947	6	183	560	3,240	2,346	11,596
2021	143,300	1,972	236	523	637	1,979	6	186	569	3,293	2,384	11,785
2022	145,600	2,004	240	532	647	2,011	6	189	578	3,345	2,422	11,974
2023	147,900	2,035	244	540	657	2,043	7	192	587	3,398	2,461	12,163
2024	150,100	2,066	247	548	667	2,073	7	195	596	3,449	2,497	12,344
2025	152,300	2,096	251	556	677	2,103	7	198	604	3,499	2,534	12,525
2026	154,500	2,126	255	564	686	2,134	7	200	613	3,550	2,570	12,706
2027	156,700	2,156	258	572	696	2,164	7	203	622	3,600	2,607	12,887
2028	158,900	2,187	262	580	706	2,195	7	206	631	3,651	2,644	13,068
2029	160,000	2,202	264	584	711	2,210	7	208	635	3,676	2,662	13,158
2030	161,000	2,216	265	588	715	2,224	7	209	639	3,699	2,678	13,240
2031	162,100	2,231	267	592	720	2,239	7	210	643	3,725	2,697	13,331
2032	163,100	2,245	269	595	725	2,253	7	212	647	3,748	2,713	13,413
2033	164,100	2,258	270	599	729	2,266	7	213	651	3,770	2,730	13,495
2034	166,700	2,294	275	609	741	2,302	7	216	662	3,830	2,773	13,709
2035	169,200	2,328	279	618	752	2,337	7	220	672	3,888	2,815	13,915
2036	171,800	2,364	283	627	763	2,373	8	223	682	3,947	2,858	14,128
2037	174,300	2,399	287	636	774	2,407	8	226	692	4,005	2,900	14,334
2038	176,900	2,434	291	646	786	2,443	8	230	702	4,065	2,943	14,548
2039	179,400	2,469	296	655	797	2,478	8	233	712	4,122	2,985	14,753
2040	182,000	2,505	300	664	809	2,514	8	236	722	4,182	3,028	14,967
2041	184,500	2,539	304	674	820	2,548	8	239	732	4,239	3,069	15,173

Table A-17: Municipal Hazardous and Special Waste – Incoming Tonnage Forecast Basis

Material	Forecast Basis	Annual Forecast
Paints and Coatings Non-aerosol; #145 (L)	Based on the average per capita amount between 2017 to 2019	0.0267
Paints and Coatings Aerosol; # 331 (kg)	Based on the average per capita amount between 2017 to 2019	0.0039
Solvents # 213 (L)	Based on the average per capita amount between 2017 to 2019	0.0014
Antifreeze (L)	Based on the average per capita amount between 2017 to 2019	0.0004
Propane Cylinders (kg)	Based on the average per capita amount between 2017 to 2019	0.0002
Cleaners/Detergents #148 (L)	Based on the average per capita amount between 2017 to 2019	0.0016
Car Products #213 (L)	Based on the average per capita amount between 2017 to 2019	0.0018
Non-Paint Aerosols #331 (kg)	Based on the average per capita amount between 2017 to 2019	0.0004
Motor Oil (L)	Based on the average per capita amount between 2017 to 2019	0.0007
Plaster/Cement/Grout (kg)	Based on the average per capita amount between 2017 to 2019	0.0002
CFL Lightbulbs (kg)	Based on the average per capita amount between 2017 to 2019	0.0126
Fluorescent Tubes (kg)	Based on the average per capita amount between 2017 to 2019	0.0154
Alkaline Batteries (kg)	Based on the average per capita amount between 2017 to 2019	0.0624
Car Batteries (kg)	Based on the average per capita amount between 2017 to 2019	0.0815
Client Count	Based on the average per capita amount between 2017 to 2019	0.0054

Table A-18: Municipal Hazardous and Special Waste – Incoming Tonnage Forecast, Part 1

Year	Forecast Population	Paints and Coatings Non-aerosol; #145 (L)	Paints and Coatings Aerosol; # 331 (kg)	Solvents # 213 (L)	Antifreeze (L)	Propane Cylinders (kg)	Cleaners/Detergents #148 (L)	Car Products #213 (L)
2020	141,000	3,767	545	199	56	21	228	252
2021	143,300	3,828	553	202	57	22	231	256
2022	145,600	3,889	562	205	58	22	235	260
2023	147,900	3,951	571	208	59	22	239	264
2024	150,100	4,010	580	212	60	23	242	268
2025	152,300	4,068	588	215	61	23	246	272
2026	154,500	4,127	597	218	61	23	249	276
2027	156,700	4,186	605	221	62	24	253	280
2028	158,900	4,245	614	224	63	24	256	284
2029	160,000	4,274	618	225	64	24	258	286
2030	161,000	4,301	622	227	64	24	260	288
2031	162,100	4,330	626	228	64	24	262	290
2032	163,100	4,357	630	230	65	25	263	291
2033	164,100	4,384	634	231	65	25	265	293
2034	166,700	4,453	644	235	66	25	269	298

Year	Forecast Population	Paints and Coatings Non-aerosol; #145 (L)	Paints and Coatings Aerosol; # 331 (kg)	Solvents # 213 (L)	Antifreeze (L)	Propane Cylinders (kg)	Cleaners/Detergents #148 (L)	Car Products #213 (L)
2035	169,200	4,520	653	238	67	25	273	302
2036	171,800	4,589	663	242	68	26	277	307
2037	174,300	4,656	673	246	69	26	281	311
2038	176,900	4,726	683	249	70	27	286	316
2039	179,400	4,792	693	253	71	27	290	320
2040	182,000	4,862	703	256	72	27	294	325
2041	184,500	4,929	713	260	73	28	298	330

Table A-19: Municipal Hazardous and Special Waste – Incoming Tonnage Forecast, Part 2

Year	Forecast Population	Non-Paint Aerosols #331 (kg)	Motor Oil (L)	Plaster/Cement/Grout (kg)	CFL Lightbulbs (kg)	Fluorescent Tubes (kg)	Alkaline Batteries (kg)	Car Batteries (kg)	Client Count
2020	141,000	63	98	32	1,776	2,169	8,794	11,492	764
2021	143,300	64	100	33	1,805	2,204	8,937	11,679	776
2022	145,600	65	102	33	1,834	2,239	9,080	11,866	789
2023	147,900	66	103	34	1,862	2,275	9,224	12,054	801
2024	150,100	67	105	34	1,890	2,308	9,361	12,233	813
2025	152,300	68	106	35	1,918	2,342	9,498	12,413	825
2026	154,500	69	108	35	1,946	2,376	9,635	12,592	837
2027	156,700	70	109	36	1,973	2,410	9,773	12,771	849
2028	158,900	71	111	37	2,001	2,444	9,910	12,950	861
2029	160,000	72	112	37	2,015	2,461	9,979	13,040	867
2030	161,000	72	112	37	2,027	2,476	10,041	13,122	872
2031	162,100	73	113	37	2,041	2,493	10,109	13,211	878
2032	163,100	73	114	37	2,054	2,508	10,172	13,293	884
2033	164,100	74	115	38	2,066	2,524	10,234	13,374	889
2034	166,700	75	116	38	2,099	2,564	10,396	13,586	903
2035	169,200	76	118	39	2,131	2,602	10,552	13,790	917
2036	171,800	77	120	39	2,163	2,642	10,714	14,002	931
2037	174,300	78	122	40	2,195	2,681	10,870	14,206	944
2038	176,900	79	124	41	2,228	2,721	11,032	14,417	958
2039	179,400	81	125	41	2,259	2,759	11,188	14,621	972
2040	182,000	82	127	42	2,292	2,799	11,351	14,833	986
2041	184,500	83	129	42	2,323	2,838	11,506	15,037	1,000