

Appendix B

Long Term Source Separated Organic Waste Processing Plan

March 2020

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Executive Summary

This *Long Term Source Separated Organic Waste Processing Plan* (the Processing Plan) has been prepared to ensure that source separated organic waste (SSO) processing services continue to be provided to York Region's residents in a cost effective and environmentally sustainable way for the next 25 years. This Processing Plan builds on the December 2017 *Source Separated Organics Processing Feasibility Study* by CH2M Hill Canada Limited (the Feasibility Study). The Feasibility Study evaluated numerous processing methods for SSO and determined that anaerobic digestion (AD) was the preferred technology option for the Region's feedstock. This Processing Plan considers various methods of implementing CH2M Hill's recommendations and identifies a preferred methodology to deliver AD processing services.

The Processing Plan uses eight scenarios to assess alternate strategies for transitioning from the Region's current aerobic composting contracts to a long term solution using AD technology. Total lifecycle costs, greenhouse gas (GHG) emissions, and other performance metrics were calculated for each scenario over a 20 year operating period from 2026 through 2045 to quantify the effects of key decisions such as contracted service delivery versus Regional ownership, facility location, facility size, and timing of phased construction.

Based on recent Ontario examples of privately owned and municipally owned AD facilities, this study concludes that procurement of long-term contracts with privately owned AD facilities provides the highest overall value to the Region. It is anticipated that private contracts will provide the same level of environmental benefit as similar municipally owned facilities at reduced overall lifecycle cost. It is recommended that the Region issue a request for proposals (RFP) in late 2020 to secure contracted AD processing capacity for all of the Region's SSO with implementation currently anticipated in 2024. Detailed recommendations for this procurement process are provided in Section 6.0: Implementation Plan.

1.0 Introduction

1.1 Purpose

The Regional Municipality of York (the Region) is currently undertaking a long term planning exercise to ensure that processing services for source separated organic waste (SSO) can continue to be provided to residents in a cost effective and environmentally sustainable way for the next 25 years. The first step in this process was completion of the *Source Separated Organics Processing Feasibility Study* by CH2M Hill Canada Limited in 2017 (The Feasibility Study). The Feasibility Study identified 47 processing methods and technologies that could potentially be used to manage the Region's SSO. These technology options were evaluated based on total lifecycle cost, resource consumption, compatibility with the Region's feedstock, GHG emissions, control of odours and other nuisances, traffic impacts, process reliability, process safety, marketability of end products, compatibility with the existing regulatory framework, and implementation timeframe. While it was not the lowest cost option, the Feasibility Study identified AD technology as the best overall value to the Region when all of these criteria were taken into consideration.

Building on the recommendations of the Feasibility Study, Region staff prepared this Long Term Source Separated Organic Waste Processing Plan (the Processing Plan) to evaluate alternate methods of transitioning from existing aerobic composting contracts to a long-term solution using AD technology. This Processing Plan considers the impacts of Regional versus private ownership, timing of construction, facility sizing and facility location on overall lifecycle costs, GHG emissions and social impacts.

1.2 Overview of Existing SSO Program

The Region and its local municipalities provide curbside collection, transfer, and processing of SSO for residents. Service delivery follows a two-tiered structure, with curbside collection provided by the local municipalities, and transfer and processing services provided by the Region. The Region currently provides processing services through contracts with privately owned facilities.

Residential curbside collection trucks from the local municipalities deliver SSO to two Regional transfer stations. Collection trucks from the three southern municipalities, Markham, Richmond Hill, and Vaughan (the S3) deliver SSO to the Earl Turcott Waste Management Facility (Earl Turcott) located at 300 Rodick Road in Markham. Collection trucks from the six northern municipalities, Aurora, East Gwillimbury, Georgina, King, Newmarket, and Whitchurch-Stouffville (the N6) deliver SSO to the York Region Waste Management Centre (YRWMC) located at 100 Garfield Wright Boulevard in East

Gwillimbury. Collection contractors currently use split collection trucks with separate compartments for SSO and blue box recyclables, which reduces collection costs for the local municipalities by allowing these materials to be collected in the same truck. This type of co-collection arrangement might change when the blue box program transitions to full producer responsibility, or it could continue if local municipalities elect to provide blue box collection service as contractors to the stewards or switch to co-collection of garbage and SSO.

As summarized in Table 1, the Region received 100,874 tonnes of SSO at its two transfer stations in 2019, with 76% of the tonnage originating in the S3 municipalities. From the transfer stations, the SSO is shipped in long-haul tractor trailers to privately-owned processing facilities.

The SSO receiving floors at the transfer stations are equipped with floor drains and storage tanks to capture liquid leachate that seeps out of the SSO. The leachate storage tanks are periodically pumped out and the liquid is shipped to a privately owned AD facility for processing. On an average annual basis, liquid leachate currently accounts for approximately 1,300 tonnes per year or 1.3% of total inbound SSO.

Table 1
Summary of 2019 Inbound SSO Tonnage by Transfer Station

Transfer Station	Location	Tonnes Collected	Percentage
Earl Turcott Waste Management Facility	300 Rodick Rd. Markham	76,730	76%
York Region Waste Management Centre ¹	100 Garfield Wright Blvd, East Gwillimbury	24,144	24%
Total		100,874	100%

1.3 Summary of Existing SSO and Leachate Processing Contracts

The Region currently maintains three contracts for SSO processing and one contract for leachate processing as summarized in Table 2. Most of the Region's contracted SSO processing capacity employs aerobic composting technology with the exception of Cornerstone Renewables, which uses anaerobic digestion. As noted previously, the leachate processing contract also employs AD technology, but the facility is not equipped to manage solid SSO. The facility can only manage liquid leachate, which

represents only 1.3% of the Region’s total inbound tonnage. The processing contracts are structured with optional term extensions, which, if executed, could provide processing for all of the Region’s SSO through June 2027. The earliest date that the Region could terminate all of the existing processing contracts is June 2022.

As shown in Table 2, the current contracted processing facilities are located a considerable distance from the Region, with one-way travel distances ranging from 132 to 465 kilometers. In addition, the Renewi facility (formerly Orgaworld) has periodically experienced problems with nuisance odours resulting in complaints from the local community and enforcement action by the Ministry of Environment, Conservation and Parks (MECP) including fines and temporary restrictions on processing capacity. The Feasibility Study noted that anaerobic digestion technology inherently reduces nuisance odour risks by confining the biodegradation process to fully enclosed vessels, making it feasible to locate AD facilities closer to populated areas including locating a facility within York Region itself. This reduction in travel distances benefits the Region by reducing transportation costs and greenhouse gas and other vehicle emissions.

Table 2
Summary of York Region’s Current SSO and Leachate Processing Contracts

Contract	Material Type	Facility Location & Travel Distance ¹	Facility Type	Annual Tonnage ²		Current Term Expiry Date ³	Extension Term Expiry Dates
				Min.	Max.		
Renewi	SSO	London (211 km)	Aerobic Composting	52,000	80,000	June 2022	June 2024, June 2026, June 2027
GFL	SSO	Moose Creek (465 km)	Aerobic Composting	32,500	50,000	June 2020	June 2022, June 2024, June 2026, June 2027
Cornerstone	SSO	Elmira	Anaerobic	8,000	10,000	June	N/A

Renewables		(132 km) and Leamington (369 km)	Digestion		0	2022	
Region of Huronia Environmental Services	Leachate	Georgian Bluffs (168 km)	Anaerobic Digestion	N/A	N/A	August 2022	N/A

1. Average one-way travel distance from transfer stations to processing facility.
2. Cornerstone Renewables' minimum and maximum tonnages are a combined total for both facilities.
3. In June 2020, the Renewi contract includes an option to continue at the current tonnage and retain the optional extensions shown above to June 2027, or to reduce a minimum commitment of 35,000 tonnes per year and a maximum of 60,000 tonnes per year and end the contract in June 2022.

1.4 Overview of Anaerobic Digestion

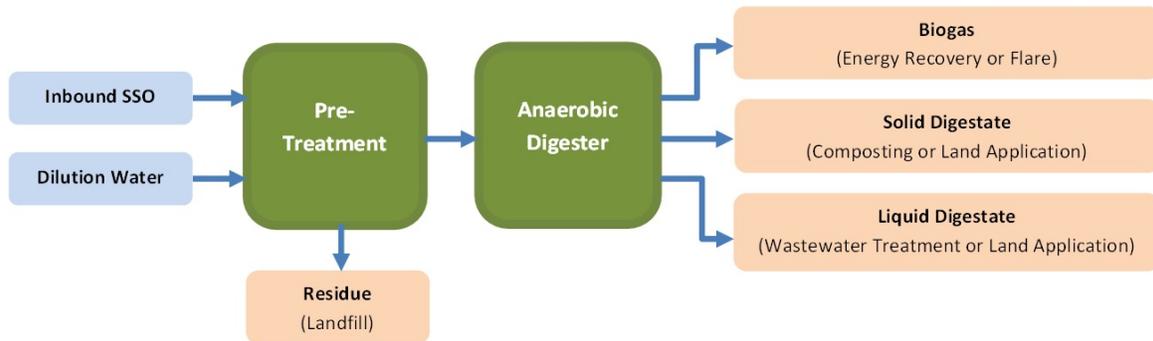
While there are different variations of AD technology, many facilities currently processing municipal waste use a wet AD system as described in the following paragraphs. A simplified process schematic is provided in Figure 1

Inbound SSO is delivered to an indoor receiving area, which is typically required to be maintained under negative pressure to prevent odours from escaping the building. Air from inside the processing building is treated by a biofilter or other odour control technology before being discharged to the environment.

From the receiving area, SSO is loaded into a pre-processing system where it is shredded or pulped and combined with dilution water to form slurry with an overall water content of approximately 90 percent. The dilution water may be a combination of potable water, harvested rainwater, or if possible, some recirculated process water provided that it is relatively clean.

Light fraction contaminants such as plastic film float to the slurry surface and are removed by a skimmer, while heavy fraction contaminants such as broken glass and grit are removed at the bottom of the preprocessing vessel. The light and heavy fraction contaminants are managed as residue, typically by landfill disposal.

Figure 1
Simplified Wet Anaerobic Digestion Process Schematic



After removal of contaminants, the pre-processed slurry is pumped into a sealed digester vessel (or in some cases a series of digester vessels) where anaerobic bacteria break down organic waste in the absence of oxygen. The digester vessel is typically designed with a total hydraulic retention time on the order of 15 to 20 days.

The microbial digestion process releases biogas, which collects above the slurry surface at the top of the digester vessel. Biogas is a mixture of gases that typically consists of 60 to 65% methane. The remainder of the biogas is mostly carbon dioxide, with a small amount of water vapor, hydrogen sulfide, and other trace gases. Virtually all of the usable energy content is contained in the methane.

Biogas can be used directly to generate heat, electricity, or both. It can also be upgraded (cleaned) to remove carbon dioxide and trace gases to meet end use product specifications for various markets such as vehicle fueling or injection into the utility grid as renewable natural gas (RNG). Anaerobic digesters are equipped with flares to allow biogas to be burned off on a temporary basis when the intended end use is not available. A flare can also be used on a permanent basis if no viable end uses for the biogas exist.

Undigested organic material and water that remain in the digester at the end of the process are referred to as “digestate”. Digestate is rich in nutrients and has value as soil conditioner and fertilizer. There are multiple options for managing digestate, and the best option typically depends on facility location, proximity to end uses, and other process-specific factors.

One common option is to dewater the digestate using a centrifuge or screw press and manage the solid and liquid fractions separately. The liquid fraction is typically discharged to the sanitary sewer system. Solids may be sent to a composting facility for secondary processing into an unrestricted use product or directly applied to farmland or

a reclamation site that has the necessary approvals to receive the material without further processing. The dewatering option may be preferable in developed urban areas that have the necessary sewer infrastructure and where suitably licensed farmland or reclamation sites are not readily available.

Direct land application of digestate to farmland without further processing can also be a viable option. This typically requires nearby farmland to receive the product since high water content reduces per-tonne nutrient value and makes transportation over long distances expensive. The product may be registered with the Canadian Food Inspection Agency (CFIA) as a fertilizer for unrestricted farm use, or it may be managed as “Non-Agricultural Source Material” (NASM) under the *Nutrient Management Act*, in which case the receiving farm must have a NASM plan approved by the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA). For farm use, regulatory criteria or end user specifications may prevent or limit use of sewage sludge as feedstock, and may also require that the process include a pasteurization step where the product is heated to kill pathogens.

For consistency, all of the scenarios considered in this Processing Plan assume a wet AD process as described above with biogas upgraded to RNG and injected into the utility grid and digestate separated into solid and liquid fractions with the liquid fraction being discharged to the sanitary sewer and the solid fraction being transported to composting facilities for processing into unrestricted use product. Additional discussion of other options for biogas utilization is provided in Section 3.10. Proponents in an RFP process may propose wet, dry or slurry AD processes, or other gas utilization methods and digestate management options based on their unique circumstances. Each of these options will have implications for cost, GHG emissions, and other performance metrics. Specifications and scoring for any RFP process should be performance based, with flexibility to allow proponents to propose different solutions to achieve the best overall performance at the lowest possible price.

1.5 Anaerobic Digestion and Greenhouse Gas Emissions Reductions

GHG emissions accounting systems differentiate between biogenic and non-biogenic carbon emissions. Biogenic emissions come from decomposition or combustion of organic material from natural sources such as animals and plants. Non-biogenic emissions come from non-natural sources—primarily from combustion of fossil fuels. GHG accounting systems do not consider biogenic emissions to contribute toward climate change because these emissions would eventually occur naturally with or without human intervention.

Carbon emissions from decomposition of SSO in an aerobic composting system are considered to contribute nothing toward climate change because the source materials are 100% biogenic. In the case of anaerobic digestion, emissions from combustion of biogas are considered to be negative (i.e. an emissions reduction) provided that the biogas produced is used to satisfy pre-existing demand for energy from fossil fuel sources. This ability to reduce GHG emissions by displacing fossil fuels is one of the primary benefits of anaerobic digestion technology, together with its ability to reduce odourous emissions. However, if the biogas is flared, or used to satisfy internal process energy needs, or to displace energy from non-fossil sources, then emissions from combustion are zero (not negative), just like an aerobic composting system.

2.0 Scenarios

This study uses eight scenarios to assess alternate strategies for transitioning from the current aerobic processing contracts to a long term solution using AD technology. The analysis of these scenarios considers total lifecycle costs, emissions, and other performance metrics over a 20 year operating period from 2026 through 2045. These scenarios were selected to quantify effects of key decisions such as contracted service delivery versus Regional ownership, facility location, facility size, and timing of phased construction. The order of the scenarios corresponds to increasing levels of Region ownership, with fully contracted alternatives at the beginning of the list, progressing through a series of blended alternatives with an increasing percentage of Regional capacity ownership.

The following sections provide a brief description of each scenario and the rationale for including it in the analysis. A table summarizing all of the Scenarios is provided in Appendix A. A process schematic and detailed cost and emissions calculations for each scenario are provided in Appendices B – I.

2.1 Scenario 1: Continuation of Existing Contracts in Current Proportions

Under this scenario, existing contracts would be extended through the whole analysis period with proportional increases to tonnage quantities as required to accommodate future growth. This scenario is included to establish the baseline level of system performance that other scenarios are measured against.

2.2 Scenario 2: All Tonnage Processed at Privately Owned AD Facilities

Under this scenario, the Region would process all of its SSO at privately owned AD facilities. Potential advantages of a fully contracted solution include lower overall cost, reduced implementation timeframes, no requirement for initial capital investment by the Region, reduced Regional staffing and administrative costs, and increased transfer of operational risks to the contractor.

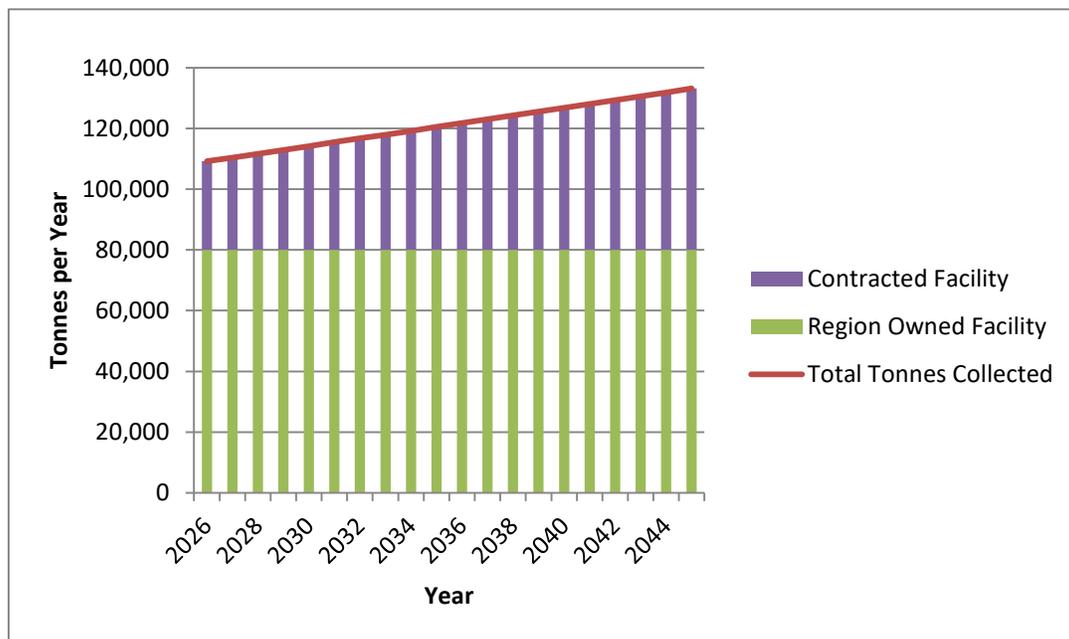
2.3 Scenario 3: Region Owned 80,000 Tonne Facility at Earl Turcott

Under this scenario, the Region would build an AD facility with 80,000 tonne annual capacity located adjacent to Earl Turcott in Markham. The balance of the Region's tonnage would be managed through a private contract. The authors note that there is currently vacant land available directly adjacent to Earl Turcott.

Locating an SSO processing facility adjacent to the transfer station allows curbside trucks to deliver directly to the processing facility with no impact on current collection routes or costs, while allowing the Region to avoid paying transfer and transportation fees to move SSO from the transfer station to the processing facility. On an annual basis, fees avoided through direct delivery of 80,000 tonnes would be approximately \$1.8 million per year.

Sizing the Region owned facility at 80,000 tonnes per year allows the facility to operate at full capacity throughout its lifespan while the required growth capacity is provided through the contract. This is an efficient use of capital compared to building a facility with growth capacity that remains unused for many years. The distribution of tonnage between the Region owned and contracted facilities is shown in Figure 2.

Figure 2
Region Owned and Contracted Facility Tonnages, Scenarios 3 – 6



2.4 Scenario 4: Region Owned 80,000 Tonne Facility at YRWMC

This scenario is the same as Scenario 3 except that the Region owned processing facility would be located at the York Region Waste Management Centre (YRWMC) in East Gwillimbury instead of Earl Turcott. The YRWMC property and the property adjacent to it are already owned by the Region, which reduces the Region’s initial capital cost compared to locating at Earl Turcott. In addition, the YRWMC is located in a

less densely populated area, which might make it a more desirable location from a public acceptance and operational risk perspective.

As noted previously, the YRWMC currently receives only 24% of the Region's total inbound SSO. Locating the SSO processing facility at this smaller transfer station reduces opportunities for direct SSO delivery from the curb and results in longer average travel distances since a portion of the tonnage to feed the facility must be transferred from Earl Turcott. In Year 1, the annual savings realized by locating the processing facility at YRWMC instead of another location within the Region would be approximately \$0.7 million as compared to \$1.8 million by locating the facility at Earl Turcott.

2.5 Scenario 5: Region Owned 80,000 Tonne Facility at Duffin Creek Plant

Under this Scenario, the Region would build an SSO processing facility with 80,000 tonne annual capacity located at our Duffin Creek Plant and manage the balance of its tonnage through a private contract. As part of their work on York Region's *Sludge Management Study*, CIMA+ completed a feasibility study on options for processing SSO at Duffin Creek which confirmed that sufficient unused anaerobic digester capacity and surplus land exist at the site to accommodate an 80,000 tonne SSO processing facility without adversely affecting future plant operations. Biogas production rates calculated under this scenario are additional to biogas production from existing plant operations.

For the purposes of this Processing Plan it is assumed that the Region would build a new facility on-site to receive and pre-process SSO into slurry and remove unacceptable materials prior to feeding the slurry into the plant's existing digesters. To maximize end-market options for the finished digestate, it is further assumed that two of the plant's existing digesters would be dedicated to SSO processing rather than co-processing with sewage sludge. By making use of existing infrastructure in this way, the authors estimate that the Region could realize a capital savings on the order of \$10 million relative to the 80,000 tonne facilities considered in Scenarios 3 and 4. Since the Region already owns a share of the land, there is also a potential savings on land cost since York Region would only need to purchase Durham Region's share. Durham Region approval would need to be obtained to implement this option. However, only preliminary feasibility-level discussions have occurred at this point.

Another advantage of this option is that the plant could potentially use additional biogas produced by SSO processing to generate electricity and process heat. However, as further discussed in Section 3.10, using biogas for electricity generation produces a smaller GHG emission reduction than upgrading the gas for pipeline injection or use as a vehicle fuel. For these reasons, all scenarios assume that Region-owned facilities will

upgrade their gas for sale to external markets. However, on-site gas utilization is a potential option for this site if the Region is unable to secure a suitable contract to sell the energy.

2.6 Scenario 6: Region Owned 80,000 Tonne Facility at Generic Location in the Region

Under this scenario the Region would build an SSO processing facility with 80,000 tonne annual capacity at an unspecified location in York Region, with the balance of tonnage managed through a contract. This facility could theoretically be located anywhere in the Region provided that the site has the necessary permitting, municipal zoning approvals and access to required servicing. It has been assumed that this generic location is near the outer edges of the Region for the purposes of estimating transportation costs and emissions conservatively.

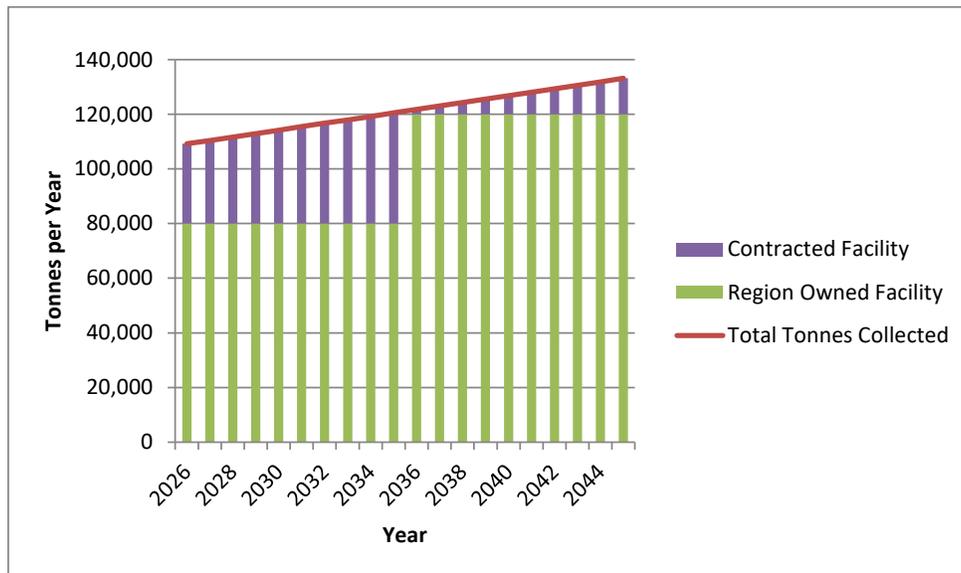
It is assumed that all SSO will be routed through a transfer station under this scenario since a more remote location further from the transfer stations limits direct delivery and co-collection opportunities. However, direct delivery may be a possibility in some local areas depending on facility location and the curbside collection landscape after blue box transition. Routing all SSO through transfer stations adds significant cost relative to Scenarios 3-4 since bypassing the transfer stations saves the Region \$1.8 million annually under Scenario 3 or \$0.7 million annually under Scenario 4. However, Scenario 6 should still be considered because moving the facility to a more remote location might be advantageous from a public acceptance and operational risk perspective.

2.7 Scenario 7: Two-Phased Construction of 120,000 Tonne Facility at Earl Turcott

Under this scenario, the Region would initially build a processing facility with 80,000 tonne annual capacity at Earl Turcott transfer station in Markham and manage the balance of its tonnage through a contract. In year 10 the facility would expand to 120,000 tonne annual capacity. The distribution of tonnage between the Region owned and contracted facilities is shown in Figure 3. This approach could also be implemented at YRWMC, Duffin Creek Plant, or a generic York Region location, but additional transfer and transportation costs and emissions would be incurred.

This phased approach increases Region capacity ownership over the analysis period while keeping approximately the same level of initial capital investment as Scenarios 3-6 and deferring a portion of the ultimate capital expenditure until the capacity is needed. The phased approach also results in a larger ultimate facility size, which results in improved economies of scale in the later years of the contract.

Figure 3
Region Owned and Contracted Facility Tonnages, Scenario 7



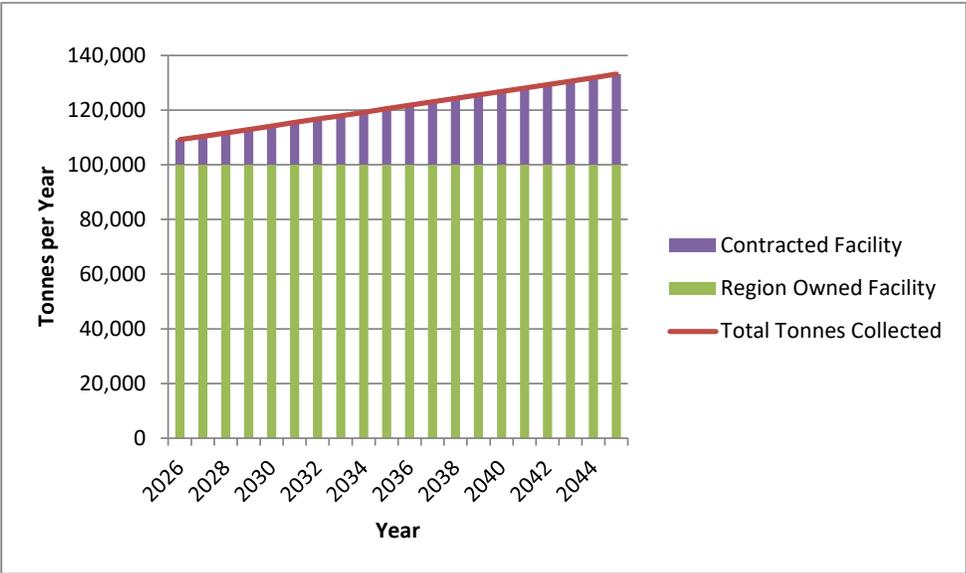
2.8 Scenario 8: Joint Municipal Ownership of 150,000 Tonne Facility at Earl Turcott

Under this Scenario the Region and a municipal partner build a facility with 150,000 tonne annual capacity located at Earl Turcott. The Region is assumed to own 100,000 tonnes of capacity and share capital and operating costs with the municipal partner in proportion to capacity ownership. The balance of the Region’s tonnage is managed through a private contract. The distribution of tonnage between the Region owned and contracted facilities is shown in Figure 4. This approach could also be implemented at YRWMC, Duffin Creek Plant, or a generic York Region location, but additional transfer and transportation costs and emissions would be incurred.

The primary purpose of this scenario is to estimate the lowest possible unit cost that the Region could expect to achieve with a Region owned facility by maximizing economies of scale. This alternative requires the Region to allocate almost all of its current tonnage to a single facility, which reduces flexibility and increases operational risk in the event of a processing disruption.

There are currently no clear candidates for an inter-municipal partnership. Durham Region and Peel Region are currently proceeding with their own initiatives. However, the City of Toronto may have some interest in partnership, having taken reports to their council in recent years regarding the possibility of building a third AD facility. At this point, Toronto has not been contacted to validate any interest in a jointly owned facility.

Figure 4
Region Owned and Contracted Facility Tonnages, Scenario 8



3.0 Methodology and Assumptions

Each of the scenarios described in Section 2.0 was analyzed using key performance metrics such as lifecycle operating cost per tonne, capital cost, greenhouse gas emissions, truck traffic impacts, control of odours and other nuisances, and location risk as further described in Section 3.3. The methodology and assumptions used in this analysis are described in the following sections.

3.1 Analysis Period

Each scenario was analyzed over a 20 year analysis period from 2026 through 2045. The length of the analysis period was set at 20 years to coincide with conservative estimates of a processing facility's useful lifespan. Beyond a 20-year timeframe, it is likely that major additional capital investment would be required to keep the facility in good operating condition.

The beginning of the analysis period was set in 2026 to correspond to the earliest anticipated date that a Region owned facility could feasibly be ready considering both typical municipal development timeframes and the availability of capital. This commencement date coincides with one of the optional contract extension dates listed in Table 2. For a Region owned facility to be ready by 2026, expenditures for land acquisition, approvals, design, and construction are assumed to occur between 2022 and 2025. For each scenario, estimated expenditures during the pre-operations period are shown on the "Scenario Summary" tables in Appendices B – I.

Region owned and contracted options have been assessed over the same 20 year time period to make the analyses directly comparable. However, the contracted components of any of the scenarios could potentially be ready earlier than 2026, especially if bids are received from existing facilities or facilities that are already under construction. It is therefore recommended that the Region consider procuring the contracted components in 2020 with a scheduled 2024 start date to allow for new construction if needed. The RFP could be structured to allow the contract to start in 2022 if the facility could be ready earlier.

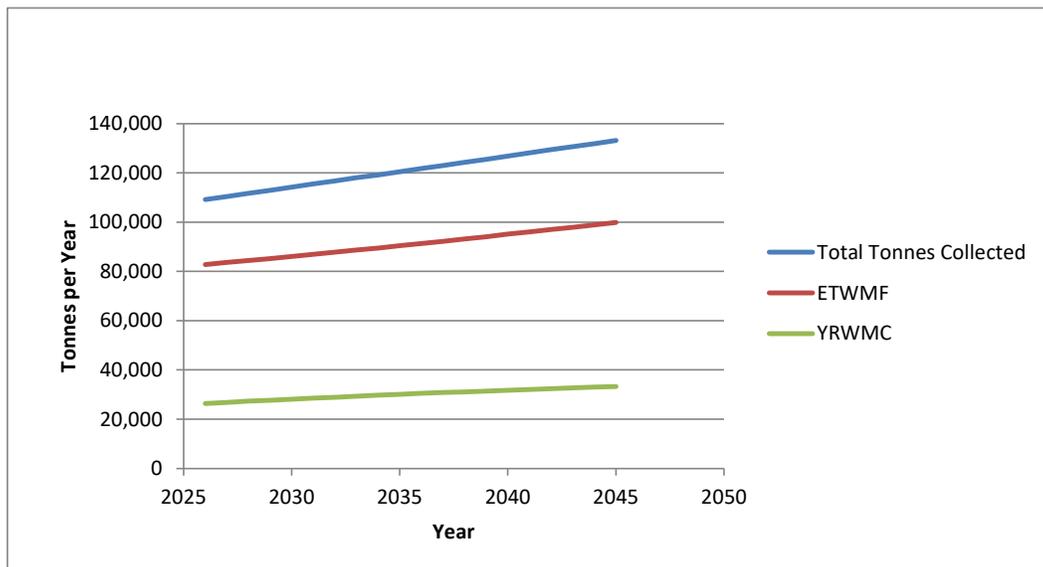
3.2 Tonnage Projections

Operating cost estimates are based on tonnage projections prepared by York Region's Fiscal Planning Unit for inclusion in the SM4RT Living Plan 5-Year update. The Fiscal Planning Unit's original analysis included annual tonnage estimates under a lower bound scenario, a median scenario, and an upper bound scenario through 2031. At the request of the Region's solid waste management team, the Fiscal Planning Unit issued

an addendum report with forecasts extended through 2051 for use in this Processing Plan; however, they noted that confidence in these latter year projections is reduced due to the very long timeframes. For the purposes of this analysis, long term costs have been calculated using the median growth scenario.

Since this Processing Plan considers the impacts of facility location on long-term costs and emissions, it is necessary to have separate estimates of tonnage originating from Earl Turcott and YRWMC. Since the Fiscal Planning Unit's forecasts were not broken down by local municipality, the authors estimated the tonnage split between the two transfer stations based on forecasted long-term municipal growth rates from Regional planning documents and current municipal per capital waste generation rates. Details of these calculations are provided in Appendix J. The Fiscal Planning Unit's total tonnage projections and the authors' estimated split between Earl Turcott and YRWMC are shown on Figure 5.

Figure 5
Projected Long Term York Region SSO Tonnage Projections



Due to higher growth rates forecasted for the northern six municipalities in the coming years, the authors estimate that the percentage of tonnage originating from Earl Turcott will decrease slightly from 76% to 75% by the end of the planning period. While transition to full producer responsibility for the blue box may impact the source separated organics tonnages, particularly if there is an increase in compostable packaging, this factor has not been included in this analysis. Impacts if any will continue to be assessed as we move forward to implementation.

3.3 Performance Criteria

Each of the eight scenarios in Section 2 was evaluated and ranked in terms of the performance criteria listed in Table 3. These performance criteria are designed to capture key aspects of the system's economic, environmental, and social impacts.

Table 3
Summary of Performance Criteria and Weighting

Performance Criterion	Description	Weighting Percentage
Lifecycle Cost Per Tonne	The total estimated lifecycle cost per tonne over all phases of facility development, construction, and operation, annualized over the 20-year analysis period and expressed as a total equivalent cost per tonne	20%
Capital Cost	Total facility capital cost to be borrowed by the Region, including land acquisition, approvals, design, construction, and contract administration and inspection.	10%
GHG Emissions	Total GHG emissions from all phases of the project from receipt of SSO at the transfer station through the point when all products or byproducts can be released to the environment without further treatment or management.	30%
Truck Traffic Impact	The amount of truck traffic generated by each scenario is calculated with separate consideration being given to each transfer station. A ranking matrix is used to assign a weighted score that is representative of traffic impacts relative to the other scenarios.	10%
Control of Odour and other Nuisances	A score is assigned based on the inherent ability of the SSO processing technology to control odours and other nuisance impacts on the surrounding community.	20%
Location Risk	The proposed processing facility locations for each scenario are assigned scores based on their proximity to sensitive receptors, which increases operational risk to the Region in the event of a process malfunction.	10%

3.4 Lifecycle Cost Methodology

The lifecycle cost per tonne was calculated for each of the scenarios in Section 2. The lifecycle cost per tonne includes costs associated with all phases of program delivery including:

- land acquisition
- facility approvals and construction
- facility operation and maintenance
- management of residues and end products
- transfer station and trucking costs
- Regional staffing and administrative costs
- external legal and engineering consulting
- property taxes

These costs were annualized over the 20-year operating period and expressed as an equivalent cost per tonne, which represents the gate fee that the Region would need to charge on each tonne received at the transfer station to make the program fully user funded. For the purposes of this analysis, general site development costs, servicing, and structures were assumed to comprise 25% of facility construction cost and were amortized over a period of 40 years. Processing equipment was assumed to comprise the remaining 75% of facility construction costs, and was amortized over a period of 20 years. Both categories of constructed assets were assumed to have zero salvage value at the end of their respective amortization periods. The cost of land acquisition was amortized over a period of 40 years with an assumed salvage value equal to 100% of the original purchase price. Amortization payments falling outside the 20-year analysis period are allocated to future tonnage and are not included in the lifecycle cost per tonne for the current study period.

All costs except for private facility capital costs were annualized at an interest rate of 4% which is intended to represent the long-term inflation adjusted time value of money to the Region. Private facility capital costs were annualized at 7%. Impacts of higher and lower interest rate environments are discussed in Section 5.1.

Curbside collection costs are not included in the lifecycle costs presented in this study because curbside collection is provided at the local municipal level. However, none of the scenarios under consideration would affect curbside collection costs since local municipalities would continue to deliver SSO to the same locations in all scenarios.

Detailed lifecycle cost calculations for each scenario are provided in Appendices B –I. Each Appendix includes a table called “Scenario Summary” (Appendices B-1 through I-1) where the total lifecycle cost is calculated, and a table called “Annual Operating Cost

Detail” (Appendices B-2 through I-2) which provides the detailed annual cost calculations for each year of the analysis period. These costs are preliminary estimates for planning purposes. Unless otherwise noted, all costs contained in this study are expressed in 2019 dollars.

3.5 Capital Cost Methodology

While capital costs are included in the annualized lifecycle cost estimates discussed in Section 3.4, they should also be considered separately since the Region’s ability to access capital within the required timeframes is an important consideration. Estimated capital costs for Scenarios 2—8 are summarized in Table 4. The Region would fund capital construction of Region owned alternatives directly, while for privately owned alternatives, the contractor would finance capital construction and recover costs through per-tonne gate fees charged to the Region and other customers.

Estimated facility construction costs for Region-owned facilities are based on reported costs for Toronto’s Disco Road and Dufferin Organics Processing Facilities and are consistent with current estimates for proposed municipally owned facilities in Peel and Durham Regions. These estimates include an additional allowance for biogas upgrading equipment, which was not originally included in the Toronto projects. Facility construction costs for the privately-owned facility in Scenario 2 are based on reported construction costs for the Cornerstone facility in Elmira and other privately owned European and Canadian reference facilities. Additional details about the estimates for Region-owned and privately owned facilities are provided in Appendix K. For clarity the capital cost estimates for privately owned facilities are solely based on reported capital values for these facilities.

The capital cost estimates in Table 4 include land acquisition, approvals, design, construction, and contract administration and inspection. These costs are expressed in 2019 dollars and are assumed to be incurred over the four year period prior to commencement of facility operations as shown in the “Scenario Summary” tables in Appendices C – I.

Table 4
Estimated Capital Costs for Scenarios 2 – 8

Scenario	Construction Period	Capital Cost
Scenario 2: Privately Owned 80,000 Tonne Facility	2022-2025	\$45,000,000 to \$65,000,000
Scenario 3: Region Owned 80,000 Tonne Facility at Earl Turcott	2022—2025	\$113,780,000
Scenario 4: Region Owned 80,000 Tonne Facility at YRWMC	2022—2025	\$109,280,000
Scenario 5: Region Owned 80,000 Tonne Facility at Duffin Creek Plant	2022—2025	\$100,330,000
Scenario 6: Region Owned 80,000 Tonne Facility at Generic Location in the Region	2022—2025	\$110,780,000
Scenario 7: Two-Phased Construction of 120,000 Tonne Facility at Earl Turcott	(Phase 1) 2022—2025	\$119,780,000
	(Phase 2) 2032—2035	\$29,780,000
Scenario 8: Joint Municipal Ownership of 150,000 Tonne Facility at Earl Turcott ¹	2022—2025	\$109,352,000

1. Scenario 8 capital costs includes York Region's 100,000 tonne (66.7%) share. Total estimated facility cost is \$163,780,000.

The private facility capital costs shown in Table 4, Scenario 2 are used together with other inputs to estimate the per-tonne processing fee charged by private facilities in Scenarios 2—8 as shown in Appendix C. This methodology produces a processing fee estimate of \$121 to \$147 per tonne for a private facility costing \$45,000,000 to \$65,000,000 to construct. Processing fee estimates exclude transfer, transportation, and York Region staffing costs, which increase the overall estimated cost of managing SSO to \$158 to \$183 per tonne. The impact of higher initial capital costs for privately owned facilities is discussed further in Section 5.2.

All private and public sector capital costs in this report have been based on reported costs from reference facilities. While these costs have not been independently verified at this time, they generally align with our understanding of higher costs associated with municipally owned organics waste processing facilities.

3.6 Facility Operating Costs

Lifecycle cost per tonne estimates include annual facility operating costs as summarized in Table 5. These estimates are gross costs prior to deduction of energy revenue and include administration, labour, supplies, equipment, utilities, maintenance and management of residue and digestate. Estimated per-tonne costs for Region-owned facilities decrease with increasing facility size due to improved economies of scale.

Facility operating costs for the Region owned scenarios were estimated based on reported operating costs for Toronto’s Disco Road and Dufferin Organics Processing Facilities. An additional amount was added to account for operating costs for gas upgrading, which was not originally included in these reference projects. Facility operating costs for privately-owned facilities are based on the Region’s current contract with Cornerstone Renewables. Additional details on the annual operating cost estimates are provided in Appendix L.

Table 5
Estimated Annual AD Facility Operating Costs for Scenarios 2 – 8

Scenario	Annual Capacity (tonne/year)	Operating Cost ^{1,2} (\$/tonne)
Scenario 2 Privately owned facility	80,000	\$105
Scenarios 3 – 6 Regionally owned facilities	80,000	\$138
Scenario 7 Regionally owned Two phased construction at Earl Turcott	(Phase 1) 80,000	\$138
	(Phase 2) 120,00	\$126
Scenario 8 Joint municipal ownership at Earl Turcott	150,000	\$122

1. For Scenario 7, the per-tonne operating cost for Phase 2 will apply to all tonnage processed at the facility after the expansion is complete.
2. Estimated costs for Scenarios 3 – 8 include \$22 per tonne for gas upgrading system, which was not included in previously published operating costs for Toronto reference facilities.

3.7 Regional Staffing Costs

Regional ownership of waste management facilities requires much greater investment of Regional staff time than an equivalent quantity of contracted services. The higher level of risk and responsibility assumed through Regional ownership creates an increased need for involvement by staff at all levels, in all phases of the project, in all disciplines including procurement, realty services, legal, finance, capital project management, waste operations, regulatory compliance, and asset management.

Estimates of staffing cost during the pre-operations and operating phases were included in the lifecycle cost estimates for Region-owned and contracted scenarios. These estimates are summarized in Table 6, with additional details provided in Appendix M

Table 6
Estimated Staffing Costs for Region-Owned and Contracted Facilities

Facility Ownership	Average Annual York Region Staffing Cost (Per Facility)	
	Pre-Operations Period	Operations Period
Region Owned Facility	\$370,000	\$120,000
Contracted Facility	\$32,500	\$50,000

While estimated staffing costs were much higher for Region-owned versus contracted facilities, it should be noted that staffing costs in both cases represented less than one per cent of total estimated lifecycle cost. Therefore, this exercise demonstrates that staffing costs do not figure prominently in decision making on facility ownership.

3.8 Processing Assumptions

For the purposes of this analysis, it is assumed that all new Regional owned and privately owned SSO processing facilities will dewater digestate and discharge the liquid fraction to the sanitary sewer for treatment. The solid fraction is assumed to be transported by truck to a composting facility for secondary processing and residue is assumed to be transported by truck to a landfill. Vendors may propose other options through the RFP process. The assumed mass balance and other process-related parameters and model inputs are summarized in Appendix N.

3.9 GHG Emissions Methodology

Reportable carbon dioxide emissions for Scenarios 1-8 come from the following sources:

- fossil fuels used to transfer and transport SSO, process residues, and byproducts
- fossil fuels used to generate heat and electricity used in processing or secondary processing
- emissions from disposal of process residue
- emissions reductions (negative emissions) from production of renewable natural gas

While there are also downstream carbon emissions from transportation and application of finished compost or digestate to farmland, these activities are outside the scope of the Region and its contractors and subcontractors. Use of end products satisfies a pre-existing demand that would otherwise be satisfied in a similar manner using other soil amendments. For these reasons, carbon emissions from downstream use of the finished product have not been included in this analysis.

Detailed calculations of the Region’s GHG emissions for Scenarios 1 – 8 are included in Appendices B –I, respectively. GHG emissions from transportation are calculated based on the assumed travel distances shown in Table 7. A complete list of emissions factors used to model transfer, transportation, processing, and by-product management activities is provided in Appendix N.

**Table 7
Assumed Travel Distances for GHG Emissions Calculations**

Calculation Parameter	Value
Distances from transfer stations to Region owned facilities at Earl Turcott, YRWMC, or Duffin Creek Plant (Scenarios 3, 4, 5, 7, 8) or to existing processing facilities (Scenario 1)	Actual distances
One-way distance from transfer stations to processing facility located at generic location in York Region (Scenario 6)	40 km
One-way distance from transfer stations to new privately owned processing facilities and from all processing facilities (Regional or private) to secondary processing facilities and residue disposal sites (Scenarios 2 – 8).	200 km

3.10 Biogas Utilization

The GHG reduction benefit of anaerobic digestion technology is not realized unless the biogas is used to displace fossil fuel energy sources external to the process. Table 9 summarizes estimated annual costs and GHG emissions for the following three methods of biogas utilization.

- **Biogas upgrading and pipeline injection:** Under this scenario biogas is upgraded to pipeline quality and injected into the utility grid and the Region is paid \$15 per gigajoule (GJ) through a contract with the utility. This is the baseline assumption for Scenarios 1-8.
- **Co-generation of electricity and heat for use at Duffin Creek Plant:** Under this scenario, the Region installs a combined heat and power (CHP) system at Duffin Creek Plant instead of gas upgrading equipment. The CHP system generates process heat and electricity which is assumed to save the Region \$0.15 per KWh on avoided electricity purchases and \$2.60 per GJ on avoided natural gas purchases.
- **Electricity generation for sale to the Ontario grid:** Under this scenario the Region installs a CHP system instead of gas upgrading equipment at any of the proposed locations for a Region-owned facility in Scenarios 3-8. Electricity is sold to the Ontario grid at \$0.02 per KWh.

Additional details about the Table 8 estimates are provided in Appendix O.

Table 8
Cost and GHG Emissions Impacts for Different Biogas Utilization Methods

Biogas Utilization Method	Net Annual Cost	Annual GHG Emissions (tonnes eCO ₂ /year)
Biogas upgrading and pipeline injection	(\$800,000)	(10,700)
Co-generation of electricity and heat at Duffin Creek Plant	(\$2,600,000)	(6,700)
Electricity generation for sale to the Ontario grid	\$800,000	(700)

1. All Table 9 estimates are based on an SSO processing facility with 80,000 tonne-per-year annual capacity.

2. Estimates in Table 9 include capital and operating costs and emissions related to biogas utilization only. Overall costs and emissions for Scenarios 1-8 also include additional contributions from transportation and other activities.

Biogas upgrading with pipeline injection provides the highest GHG reduction at 10,700 tonnes of eCO₂ per year. It also reduces annualized capital and operating costs by \$800,000 per year relative to flaring the gas.

Based on the assumed pricing scheme, co-generation at Duffin Creek performs better than pipeline injection financially, increasing the annual cost savings from \$800,000 to \$2,600,000 per year. However, utilizing the gas to generate heat and power also increases the Region's annual GHG emissions by 4,000 tonnes relative to pipeline injection. This increase in emissions is attributable primarily to the following factors:

- Approximately 90% of Ontario electricity generation already comes from non-fossil carbon sources. As a result, electricity production from biogas does not displace as much fossil carbon emissions as pipeline injection, which displaces one cubic meter of fossil gas for every cubic meter of RNG injected into the system.
- Energy losses in the combined heat and power system, which are assumed to be equal to 20% of total heat input, do not displace any carbon emissions whereas 100% of RNG injected into the pipeline displaces an equivalent amount of fossil-sourced natural gas.

It should be noted that locating a processing plant at Duffin Creek Plant adds an estimated \$1.8 million per year in transfer station and transportation fees relative to locating the facility at Earl Turcott, which cancels out the cost savings of the power generation option. It also increases estimated GHG emissions from transfer and transportation operations by an additional 290 tonnes per year.

The third alternative, generating electricity for sale to the grid, is no longer a viable option because the province is no longer offering contracts with preferred pricing for biogas electricity generation. Under this scenario, it is assumed that electricity would be sold to the grid at spot price, which is typically \$0.02 per kWh or less. As shown in Table 8, this price is not sufficient to recover the capital and operating cost of the CHP unit, making it more expensive to generate electricity than to flare the gas. Generating electricity without recovering the heat also eliminates most of the GHG reduction.

The economic and GHG emissions performance of gas upgrading could potentially improve further if the upgraded gas was used to fuel fleet vehicles instead of being injected into the pipeline. On an equivalent energy basis, diesel is a higher carbon fuel than natural gas with GHG emissions of 69.5 kg eCO₂/GJ versus 49 kg eCO₂/GJ for natural gas. Diesel is also a more expensive fuel on an equivalent energy basis. Diesel

prices ranging from \$1.00 to \$1.20 per litre are equivalent to \$26 to \$31 per GJ, which is approximately twice the assumed contract price of \$15 per GJ for pipeline injection. This means that every GJ of diesel replaced with RNG results in a larger cost savings and a larger GHG emissions reduction than replacing a GJ of pipeline natural gas.

However, using RNG to fuel fleet vehicles results in additional costs and GHG emissions downstream of the processing facility such as construction and operation of fueling stations, liquefaction and transportation of fuel product to distribution points, and conversion of fleet vehicles to natural gas. These additional costs vary considerably for each application, and can reduce the benefits of fleet fueling relative to pipeline injection. However, this alternative is worthy of further consideration if the Region elects to proceed with construction of a Region owned facility. Section 5.2 includes a sensitivity analysis that considers the impact of higher and lower RNG prices on the outcomes of this analysis. The upper end of the price range could represent a fleet fueling solution with minimal downstream costs or a highly favorable utility contract for pipeline injection.

3.11 Truck Traffic Methodology

Each of the scenarios under consideration in this Processing Plan has different implications for truck traffic in the vicinity of the Region's transfer stations. Truck traffic can potentially affect residents and businesses in a negative way, and should be considered as part of the decision making process.

The annual number of tractor trailer trips was calculated for each scenario and transfer station individually. The individual transfer station results were used to compute a combined weighted score for truck traffic impacts for each scenario using the scoring matrix in Appendix P. The scoring matrix assigns points to each scenario based on its deviation from the overall mean.

Inbound curbside collection trucks were not included in the truck counts since existing curbside collection services are not affected by any of the analysis scenarios.

3.12 Control of Odour and Other Nuisances

One of the key performance criteria used to assess processing technologies in the 2017 Feasibility Study was a technology's ability to control odour and other nuisance impacts such as dust, vermin and noise. Odour control has been an issue of ongoing concern under the Region's existing aerobic composting contract with Renewi (formerly Orgaworld) in London, Ontario. Because anaerobic digestion takes place in a completely enclosed vessel and there is proactive biogas management, the inherent risk of odour issues is greatly reduced. To ensure that this important advantage of

anaerobic digestion is captured in the scoring of alternatives for this Processing Plan, the overall scoring matrix in Appendix A includes an item for odour and nuisance control worth 20% of each scenario’s overall score. For the purposes of this assessment, all scenarios using anaerobic digestion were assigned a score of 7 out of 10 whereas a score of 5 out of 10 was assigned to the existing aerobic composting option in Scenario 1.

3.13 Location Risk

Although use of anaerobic digestion technology significantly reduces the risk that a processing facility will have an adverse impact on neighbors, a location in close proximity to sensitive receptors increases potential impacts in the event of a processing failure. To capture these location related risks, the scoring matrix in Appendix A includes an item for location risk worth 10% of each scenario’s overall score. Points are assigned on a scale of 1 to 10 with 1 being a high-risk location and 10 being a low-risk location.

Since the locations of privately owned facilities in Scenario 2 and the Region-owned facility in Scenario 6 are not currently known, these scenarios were assigned a location risk score of 6, which represents a typical location with no abnormally high risks associated with nearby sensitive receptors. The RFP scoring process will give appropriate consideration to actual location risks once these locations are known.

3.14 Scoring Methodology

Each of the scenarios was scored based on the six performance criteria listed in Section 3.3. Scores for objective numerical criteria such as lifecycle cost per tonne, capital cost, annual GHG emissions, and traffic counts were calculated based on the number of standard deviations above or below the mean value as further described in Appendix A. Odour control and location risk were scored subjectively by the authors on a scale of 1 to 10 as described in Sections 3.12 and 3.13.

Scores for the individual criteria were converted to an overall weighted score on a scale of 1 to 100 based on the criteria weights listed in Table 9.

**Table 9
Performance Criteria Weights**

Performance Criterion	Points Available	Percentage of Total
Lifecycle Cost per Tonne	20	20%

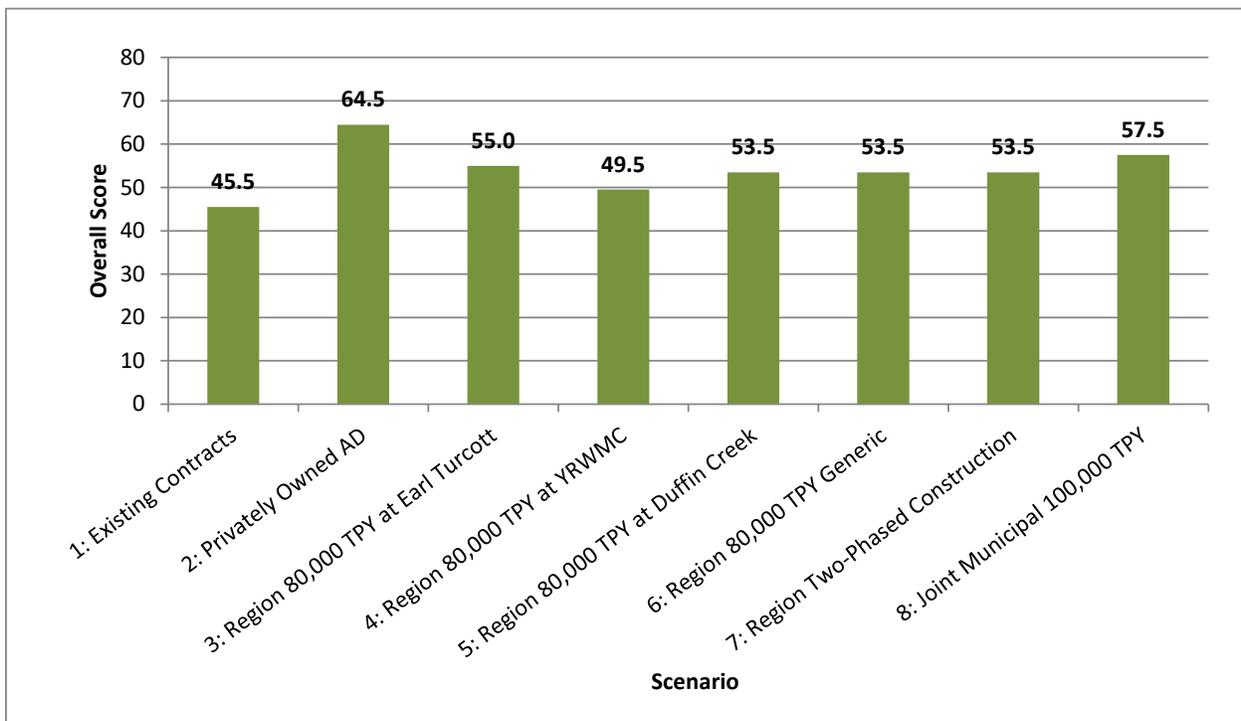
Performance Criterion	Points Available	Percentage of Total
Capital Cost	10	10%
GHG Emissions	30	30%
Truck Traffic Impacts	10	10%
Control of Odours and Other Nuisances	20	20%
Location Risk	10	10%
Total	100	100%

4.0 Results

4.1 Preferred Alternative

Based on the methodology and assumptions outlined in Section 3.0, the preferred alternative is to process all of the Region’s SSO at privately owned anaerobic digestion facilities through new long term contracts issued through a competitive RFP process (Scenario 2). As illustrated in Figure 6, Scenario 2 provides the best overall value to the Region, receiving an overall score of 64.5 out of 100 points as compared to 57.5 out of 100 points for the next closest alternative. Scoring details for each scenario are provided in Appendix A.

Figure 6
Summary of Overall Scores for Scenarios 1-8



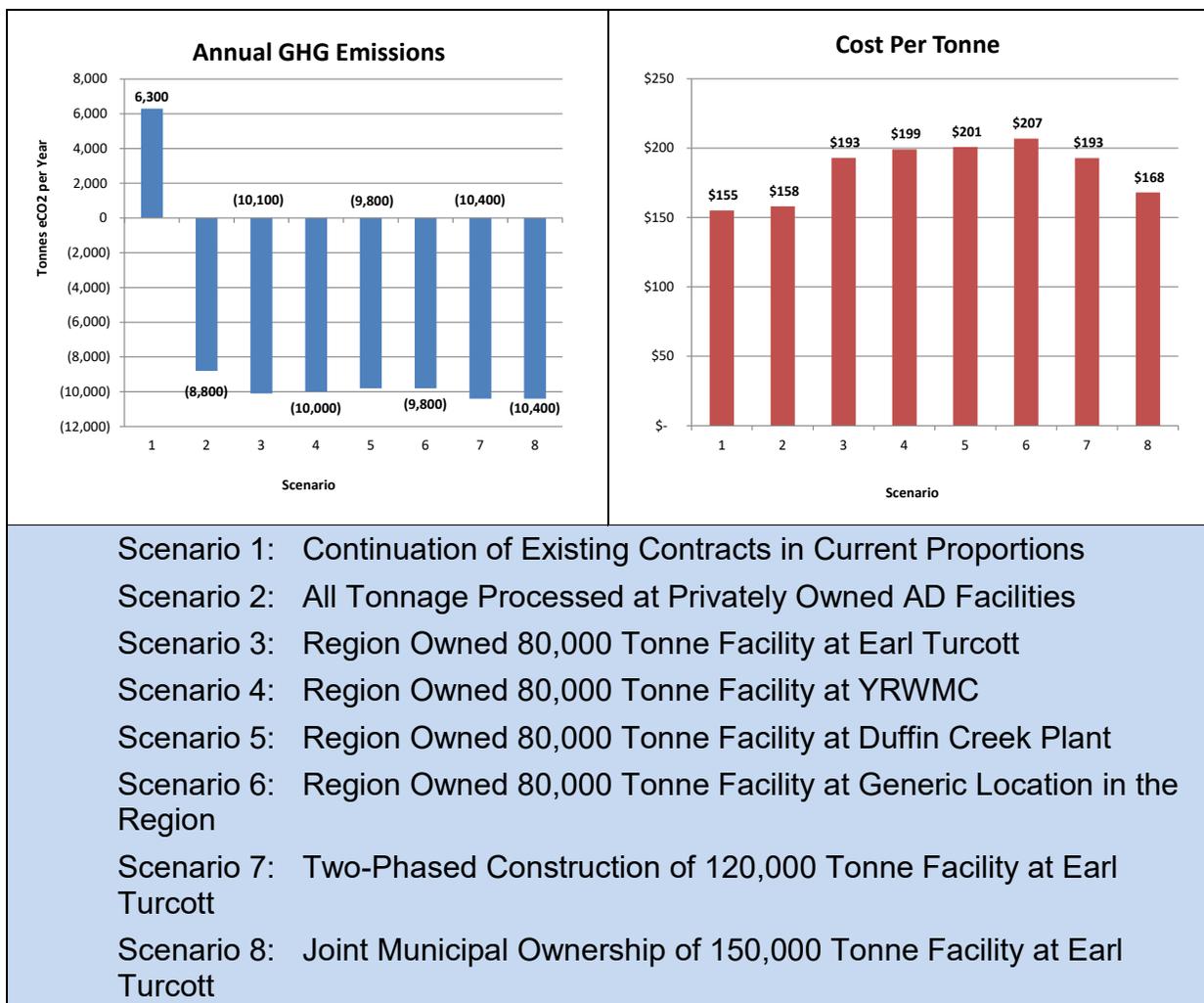
Scenario 2 scored highest because it provided similar reductions in GHG emissions to Region-owned alternatives at reduced cost. Although Region-owned alternatives provided some additional GHG reductions due to shorter assumed transportation distances, these differences were small relative to the cost differential. The lowest performing alternative was continuation of existing aerobic processing contracts under Scenario 1. While Scenario 1 was the least expensive option, it scored lower overall due

to low performance on GHG emissions and odour control. Additional discussion on key performance criteria is provided in the following sections.

4.2 GHG Emissions Results

GHG emissions results for Scenarios 1-8 are summarized on the left side of Figure 7. Details of the emissions calculations are provided in Appendices B – I.

Figure 7
GHG Emissions and Lifecycle Cost per Tonne Results for Scenarios 1-8



Most of the GHG emissions reductions are accomplished by switching from the current aerobic composting contracts (Scenario 1) to one of the anaerobic digestion options (Scenarios 2-8). The differences between the various anaerobic digestion options are

relatively small by comparison. While Figure 7 does show slightly increased GHG reductions for Region-owned scenarios (Scenarios 3-8) relative to the contracted scenario (Scenario 2), this difference can be attributed to the conservative assumption that the contracted facility will be located 200 km away. Staff are aware of proposed facility developments that are well within that radius, and it is likely that an RFP will secure capacity closer to or within the Region since RFP scoring will give significant weight to GHG reductions. It is also possible that facilities located in more remote locations will land apply liquid and solid digestate directly to farmland instead of shipping the product for secondary composting, which would further reduce emissions for the contracted option.

4.3 Lifecycle Cost per Tonne Results

Lifecycle cost per tonne results for Scenarios 1-8 are summarized on the right side of Figure 7. Details of the cost calculations are provided in Appendices B – I.

While the difference in GHG emissions between contracted and Region owned AD facilities is relatively small, there is a significant differential in lifecycle cost. The difference in lifecycle cost between Scenario 2 and Scenarios 3-8 ranges from \$10 to \$49 per tonne, which translates to approximately \$1.2M to \$5.9M per year over the lifespan of the project. Given the price premium associated with Regional ownership and the relatively small incremental environmental benefit, the authors recommend that the Region choose contracted ownership and take reasonable measures to incentivize contractors to locate processing facilities close to the Region to minimize transportation emissions.

4.4 Capital Cost Results

Although annualized capital costs are included in the lifecycle costs in the previous section, they should be considered separately since the Region's ability to secure the required capital is an important consideration. Region-owned alternatives require the Region to borrow funds to finance construction, which is assumed to occur over a four year period prior to service commencement. Estimated capital costs for the Region-owned components of Scenarios 3-8 range from approximately \$100,000,000 to \$120,000,000.

The Region's long-term capital plan currently includes \$100,000,000 for construction of a Region-owned facility between 2025 and 2028. To be ready for commencement of operation in 2026 as contemplated in this Processing Plan, procurement and construction would need to commence no later than 2022. Therefore, it is likely that the capital budget would need to be increased by as much as \$20,000,000 and moved

forward by three years to meet a 2026 start date, which poses a significant challenge with respect to the Region's current debt ceiling.

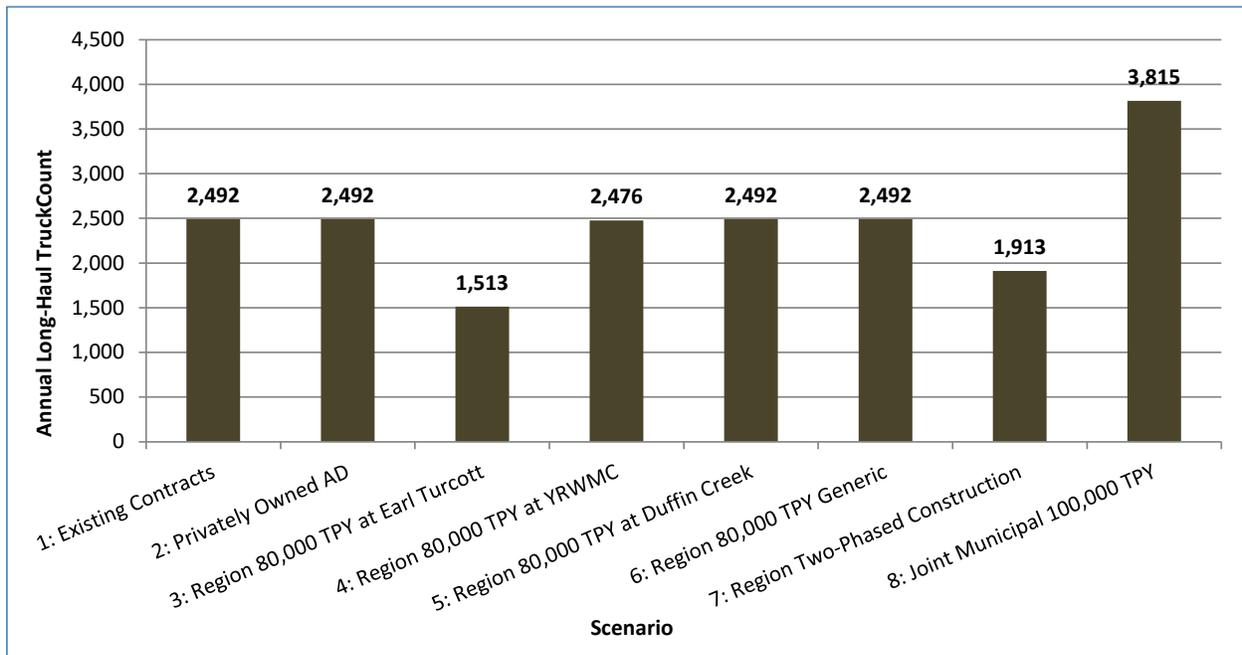
By contrast, the contractor's costs for initial capital construction under the private ownership scenario represent approximately 47% of the per-tonne gate fees charged to the Region. One of the principal advantages of a contracted solution is that the Region does not need to borrow money to finance capital construction prior to service commencement since the contractor is compensated for their capital investment through gate fees over the term of the service contract. No additional capital contribution by the Region is required. The authors believe that a contracted solution could be ready by 2024 if new construction is required, or as early as 2022 if the successful bidder has a facility that is already in operation or under development. Therefore, a contracted solution will allow the Region to transition to AD processing earlier, realize GHG emissions reductions sooner, and free capital dollars for use on other Region priorities.

It is recommended that the \$100,000,000 of uncommitted funding currently being carried in years 2025 to 2028 of the long-term capital plan continue to be held as a risk mitigation measure in the event of unforeseen challenges in transitioning to anaerobic digestion. Once the new anaerobic digestion contracts and facilities are in place and operating successfully, the continued need for these funds will be re-evaluated through the annual budget process.

4.5 Truck Traffic Results

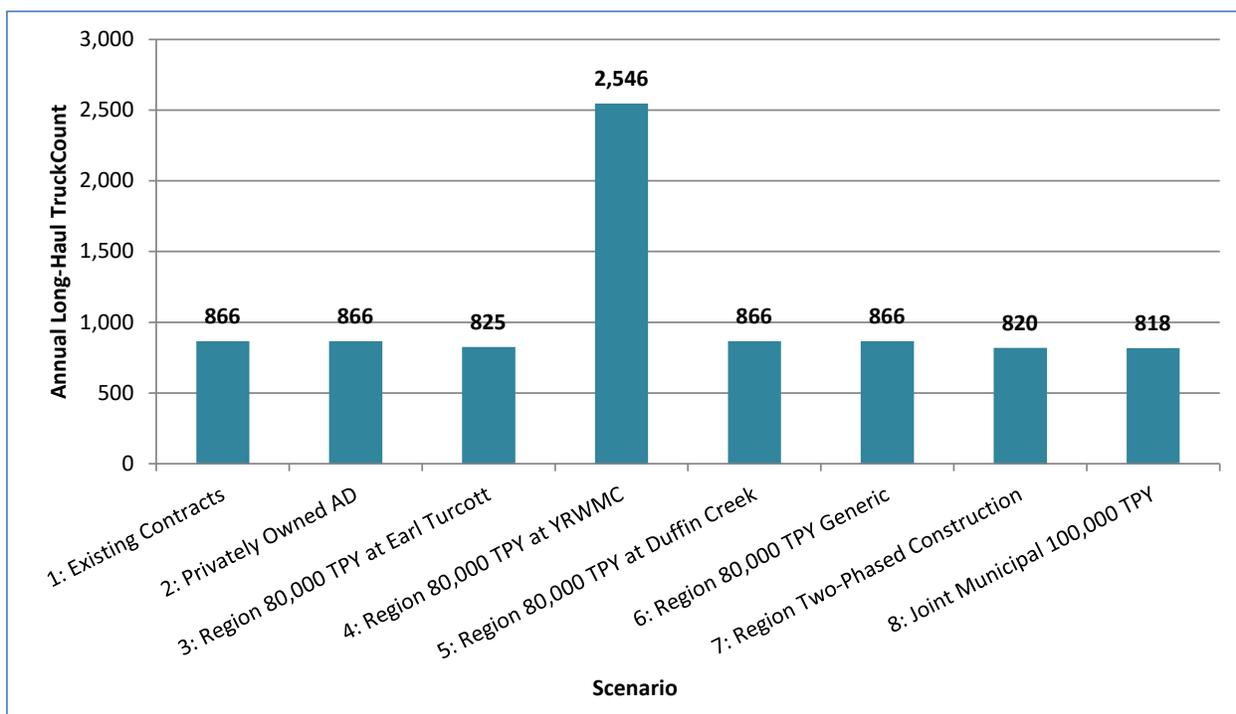
Average annual long-haul truck counts were calculated for each transfer station under Scenarios 1-8. Curbside collection trucks are not affected by any of the scenarios and are not included in the truck counts. Results for the Earl Turcott transfer station are summarized in Figure 8 and results for York Region Waste Management Centre are summarized in Figure 9.

**Figure 8
Long-Haul Truck Counts – Earl Turcott**



At Earl Turcott, Scenarios 3 and 7 reduce truck counts because SSO is processed at a Region-owned facility located on-site, which eliminates truck-trips associated with transfer of SSO to other processing facilities. However, Scenario 8 increases truck counts because 50,000 additional tonnes of SSO are received from the local municipal partner. Under the remaining scenarios, SSO continues to be processed at off-site locations, resulting in no significant change to existing truck counts.

**Figure 9
Long Haul Truck Counts – York Region Waste Management Centre**



At York Region Waste Management Centre, Scenario 4 increases truck traffic because additional inbound transfer trucks from Earl Turcott are required to keep the on-site Region owned SSO processing facility running at full capacity. These additional inbound trucks more than compensate for the outbound trucks that are eliminated by locating the processing facility on-site. Under the remaining scenarios, SSO continues to be processed at off-site locations resulting in no significant change to existing truck counts.

Implementation of Scenario 2 as recommended in this processing plan has no impact on baseline truck counts at either transfer station.

5.0 Sensitivity Analysis

The results presented in Section 4.0 can potentially be influenced by key assumptions such as private facility capital costs, interest rates, Renewable Natural Gas prices, and different levels of funding from outside agencies such as Infrastructure Ontario toward Region owned infrastructure. This section considers the impact of changing these baseline assumptions.

5.1 Sensitivity Analysis Scenarios

To test the impact of the baseline assumptions on the overall rankings of Scenarios 1 – 8, these rankings were recalculated under different sets of assumptions as summarized in Table 10. Additional details and discussion about these calculations are provided in Appendix Q.

Table 10
Summary of Sensitivity Analysis Scenarios

Sensitivity Analysis Scenario	Baseline Assumption	Revised Assumption
Estimated Private Facility Capital Cost	\$45,000,000	\$65,000,000
Low Interest Rate	Region Capital: 4% Private Capital: 7%	Region Capital: 2% Private Capital: 5%
High Interest Rate	Region Capital: 4% Private Capital: 7%	Region Capital: 6% Private Capital: 9%
Low RNG Price	\$15 per GJ	\$10 per GJ
High RNG Price	\$15 per GJ	\$30 per GJ
Agency Funding Contribution	0% Contribution	30% Contribution

5.2 Sensitivity Analysis Results

As discussed in Section 4, processing all of the Region's SSO at privately owned facilities (Scenario 2) was the highest-ranked alternative under the baseline set of assumptions because it provided similar environmental benefit as the Region owned alternatives at reduced cost. In Table 11, the overall scores of Scenarios 1 – 8 are recalculated under the revised sets of assumptions outlined in Table 10.

Table 11
Summary of Sensitivity Analysis Results

Sensitivity Analysis Scenario	Revised Processing Facility Scenario Score (out of 100)								Revised Scenario 2 Rank
	1	2	3	4	5	6	7	8	
Estimated Private Facility Capital Cost	47.5	60.5	55.0	49.5	53.5	53.5	53.5	57.5	1
Low Interest Rate	43.5	64.5	55.0	49.5	53.5	51.5	55.5	57.5	1
High Interest Rate	47.5	62.5	55.0	51.5	55.5	53.5	53.5	55.5	1
Low RNG Price	47.5	62.5	55.0	49.5	53.5	53.5	53.5	55.5	1
High RNG Price	37.5	66.5	57.0	51.5	55.5	53.5	55.5	59.5	1
Agency Funding Contribution	43.5	62.5	55.0	49.5	53.5	51.5	55.5	59.5	1

As shown in Table 11, Scenario 2 retained its first place ranking under all of the revised sets of assumptions in this sensitivity analysis. While the gap between Scenario 2 and the other scenarios narrowed under some sets of assumptions, it remained the best overall value to the Region.

The baseline scenario parameters are representative of current market conditions, and are considered to be the most likely scenario. However, this sensitivity analysis confirms that contracts with private facilities as contemplated in Scenario 2 are likely to produce the best overall outcome over a wider range of market conditions.

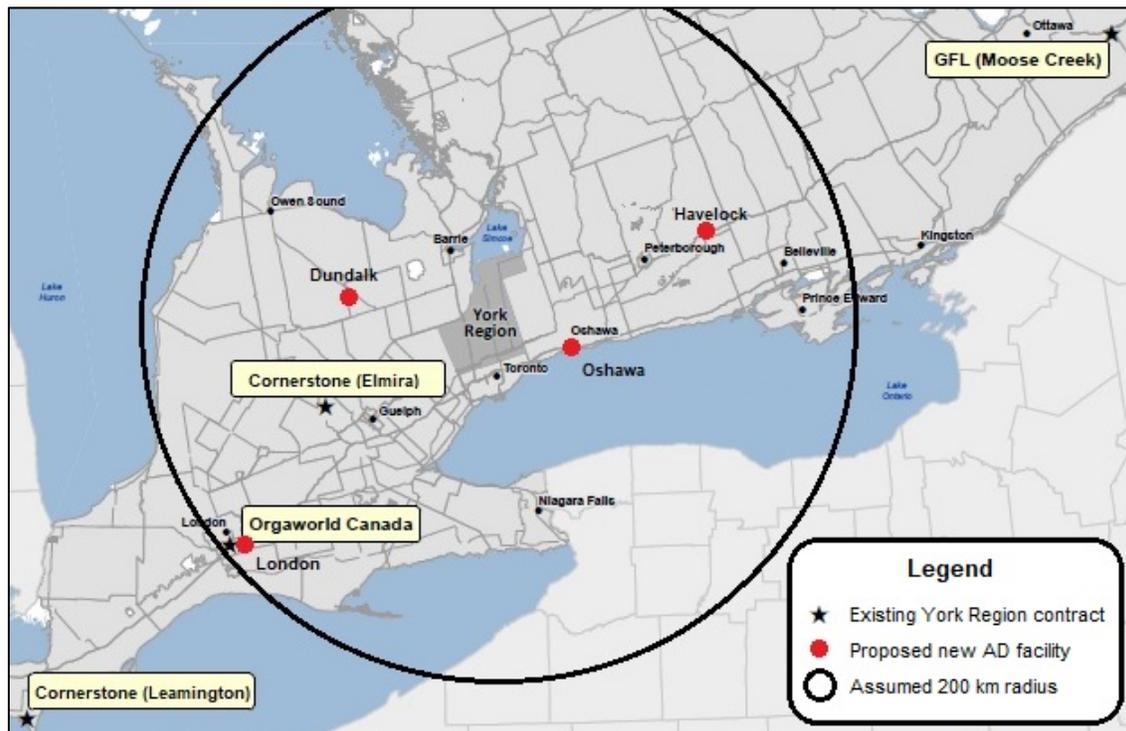
6.0 Implementation Plan

6.1 Implementation Plan for Procurement of Private Contracts

Securing long-term contracts with privately owned anaerobic digestion facilities to process the Region’s SSO provides the highest overall value to the Region of all available options. Based on this analysis and recent examples of privately owned and municipally owned anaerobic digestion facilities in Ontario, it is expected that contracts with privately owned facilities will provide the same level of environmental benefit as a municipally owned facility at significantly reduced overall lifecycle cost.

The Provincial policy discussion about banning landfill disposal of organic waste has created significant activity in the private sector regarding development of new AD processing capacity. In recent months, multiple private sector vendors have requested meetings with Region staff to discuss their plans to build AD processing facilities within 200 km of York Region, including proposed developments in Oshawa, Havelock, Dundalk, and London. The locations of these proposed developments and the Region’s existing contracted facilities are shown in Figure 10.

Figure 10
Locations of Existing York Region Contracts and Proposed New AD Facilities



On this basis, the authors suggest that timing is currently favorable to issue an RFP for contracted capacity, which could also generate new responses from other vendors who do not currently have sites in development or have not informed the Region of their plans.

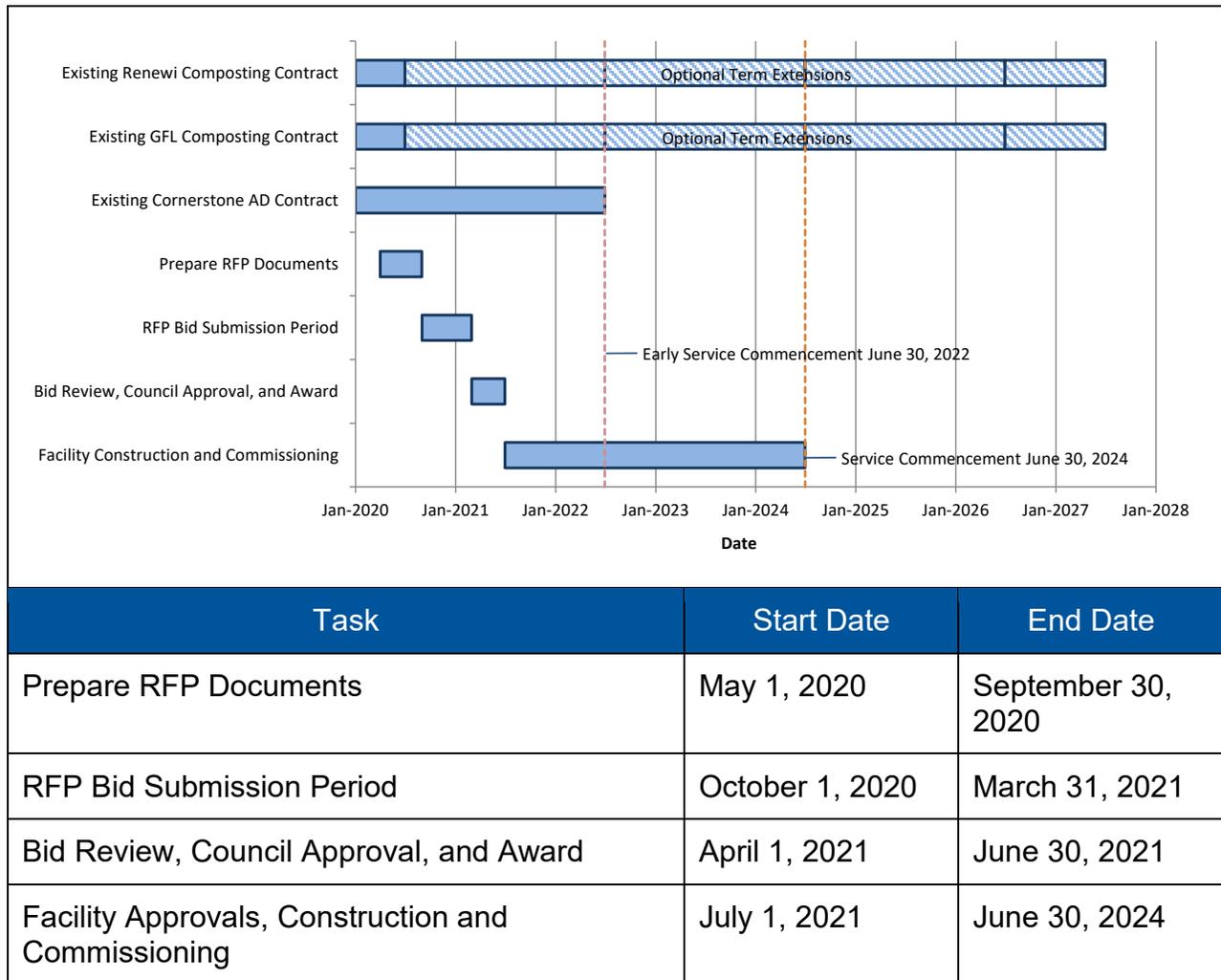
To implement this strategy, it is recommended that the following steps be taken.

- The Region should retain the services of an engineering consultant with expertise in anaerobic digestion technology and in SSO facility implementation contracting approaches to assist with preparation of an RFP.
- The RFP should be issued to prospective bidders in Q4 2020 to allow the transition to anaerobic digestion to occur by as early as 2022.
- The RFP should be open to existing facilities in addition to facilities that are not yet constructed.
- The contract should be set to commence in June 2024 to coincide with one of the optional extension dates for the Region's existing contracts, and to provide sufficient time for proponents to construct a new facility if required.
- The RFP could be structured with a flexible start date to allow the contract to commence as early as June 2022 if the successful bidder can have the new facility ready by that date.
- The Region should consider setting the contract term at 20 years to secure capacity for a period of time that is comparable to the expected useful lifespan of a Region owned facility and to make the RFP attractive by providing bidders with sufficient time to recover their investments in facility capital. Beyond this term, optional five-year extensions could be considered as appropriate.
- To provide process redundancy and operational flexibility, the Region should structure the RFP in two equally sized blocks. Each proponent would be eligible to win one of the two blocks, but not both.
- The RFP should include rigorous, performance-based specifications on processing and odour management to ensure that the Region's environmental objectives are met while also providing bidders with flexibility to choose digestate management and biogas utilization options that are well suited to their process and location.
- The RFP should require proponents to submit detailed calculations of the facility's emissions performance through all phases of the process including transportation to the facility, processing, biogas utilization, and digestate and residue management. The RFP scoring mechanism should attach significant weight to the results of these calculations.
- The RFP should require bidders to supply transportation services to further incentivize a facility location in close proximity to the Region.

- Staff should be authorized to execute optional contract extension terms with Renewi and GFL to secure the Region’s existing processing capacity for an additional two-year term from June 2020 to June 2022 to provide time for the plan to be implemented.
- The \$100,000,000 of uncommitted capital funding currently being carried in years 2025 through 2028 of the 10-year capital plan should continue to be held as a risk mitigation measure. Once the new anaerobic digestion contracts and facilities are in place and operating successfully, the continued need for these funds will be re-evaluated through the annual budget process.

The proposed implementation schedule is summarized in Table 12

**Table 12
Preliminary Project Implementation Schedule**



6.2 Implementation Plan for Procurement of a Region Owned Facility

As noted in the previous section, this analysis indicates that contracting with privately owned facilities is the best value option for the Region. However, if the Region decides to construct a Region Owned facility to meet some of its capacity needs, the following additional steps are recommended:

- Land should be purchased in the preferred location if not already owned by the Region.
- If the Region wishes to pursue the option of locating a processing facility adjacent to the Earl Turcott Waste Management Facility, staff should be authorized to negotiate a long term extension to the transfer station contract, which expires in December 2022.
- Further exploration of a facility located at the Duffin Creek Plant would require the Region to consult with and obtain the required approvals from the Region of Durham.
- To improve the financial viability of the project, Regional staff should be authorized to apply for supplemental capital funding through an agency such as Infrastructure Ontario and explore energy contract options. Staff would report back to Council at the conclusion of these activities.
- Since Scenarios 3-8 include both Region-owned and contracted components, staff should be authorized to procure the contracted component of the preferred alternative in accordance with the procedures outlined in Section 6.1.

This report with full appendices is available upon request by contacting accessyork@york.ca.