## **SCHEDULE E**

## Form of Completion Report for Studies

Please do not hesitate to contact your project officer to receive an electronic copy of the template of the Completion Report for Studies.

# Upon completion of the Feasibility Study, a copy of the Final Study must be submitted along with this Completion Report for Studies.

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# How to complete the Completion Report for Studies

The purpose of the Completion Report for Studies is simple: to share the story of your community's experience in undertaking a Feasibility Study with others seeking to address similar issues in their own communities.

Please write the report in plain language that can be understood by people who are not specialists on the subject. A Completion Report for Studies is typically in the range of 5–10 pages, but may be longer or shorter, depending on the complexity of the Feasibility Study.

GMF grant recipients must enclose **final** copies of the Completion Report for Studies and the Final Study, both in electronic format, with their final Request for Contribution. The reports, including all attachments and appendices, must be submitted in PDF format with searchable text functionality. Reports that are not clearly identifiable as final reports, such as those displaying headers, footers, titles or watermarks containing terms like "draft" or "for internal use only," will not be accepted by GMF. Additionally, reports must be dated. If you have questions about completing this report, please consult GMF staff.

<sup>&</sup>lt;sup>1</sup> <u>http://www.fcm.ca/home/programs/green-municipal-fund.htm</u>

## **Completion Report for Studies**

GMF number	15140
Name of lead applicant (municipality or other partner)	Regional Municipality of Peel (Region)
Name, title, full address, phone, fax and e-mail address of lead technical contact for this study	Pamela Membreño Project Manager, Waste Management, Infrastructure Development 10 Peel Centre Drive, Suite A, 4 <sup>th</sup> Floor Brampton, ON L6T 4B9 Tel: (905) 791-7800 ext. 4512 Cel: (416)938-0558 pamela.membreno@peelregion.ca
Date of the report	April 6, 2018

## 1. Introduction

a. Who was involved in doing the Feasibility Study, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineers and other consultants, a representative from a non-governmental organization, and others.

The Anaerobic Digestion (AD) Facility Study was conducted by GHD Ltd., the consulting firm selected as engineering and financial consultants for the Region's AD Facility<sup>2</sup> development, under oversight of the Region's Project Team.

Region's Project Team

- Brian Van Opstal: Manager Infrastructure Development /Waste Management Division T: +1 905 791 7800 x 4534 | E: <u>Brian.VanOpstal@peelregion.ca</u>
- Daina LeBourdais: Program Manager Infrastructure Development /Waste Management Division T: +1 905 791 7800 | E: <u>Daina.LeBourdais@peelregion.ca</u>
- Tom McLenaghan, P. Eng.: Project Manager Infrastructure Development /Waste Management Division T: +1 905 791 7800 x 4684 | E: <u>Tom.Mclenaghan@peelregion.ca</u>
- Pamela Membreño, M.Sc., P. Eng.: Project Manager Infrastructure Development /Waste Management Division T: +1 905 791 7800 x 4512 | E: <u>Pamela.Membreno@peelregion.ca</u>

<u>GHD - Engineering and financial consultants for the Region's AD Development</u>

- Mike Muffels, M.Sc., P. Eng., Project Manager/GHD T: +1 905 814 4336 | E: mike.muffels@ghd.com
- Tej Gidda, Ph. D., P. Eng., Principal/GHD T: +1 519 884 0510 | E: <u>tej.gidda@ghd.com</u>

<sup>&</sup>lt;sup>2</sup> AD Facility means the equipment (processing and conveyance) and structures which, combined together, form a series of sequential processing operations for the purpose of processing Organics, utilizing anaerobic digestion to produce a marketable digestate product for beneficial use and to produce biogas for use in the AD Facility and refined to renewable natural gas (RNG).

## 2. The Feasibility Study

a. Describe the process that you undertook to make this feasibility study a reality, from concept, to council approval, to RFP, to final deliverable.

In 2014, Regional Council (Council) set a Reduce, Reuse and Recycle (3Rs) target of 60% diversion by 2034, which was set out in the Waste Reduction and Resource Recovery Strategy. To achieve this target, the Region adopted a multi-pronged strategy, initially focusing on increasing Organics<sup>3</sup> collection and processing. In 2015, Council increased the 3Rs target to 75% by 2034 and also directed staff to develop a new Anaerobic Digestion (AD) Facility on a Design, Build, Operate and Maintain (DBOM) contract model, to be located in either the City of Brampton or the City of Mississauga, where direct delivery of Organics can be achieved.

The AD Facility Study identified options for consideration, assessed the viable options (technical, regulatory, environmental and economic considerations) and recommended preferred options. Technically, the AD Facility Study investigated the optimum feedstock mix, specific AD technologies, and biogas, digestate and residue utilization and management options. The Study identified which major components of the AD Facility operation would be the responsibility of the Project Company and which operations would remain the responsibility of the Region.

Results of the AD Facility Study were presented to the Waste Management Strategic Advisory Committee on November 30, 2017. The report, titled 'Strategic Terms for the Anaerobic Digestion Facility Project', was accepted on November 30, 2017 and recommended to be endorsed by Council. Council approved the report 'Strategic Terms for the Anaerobic Digestion Facility Project' on December 14, 2017 (Resolution 2017-94).

Next steps include the procurement process, which was started with issuance of the Request for Pre-qualification (RFPQ) on February 7, 2018. The RFPQ will result in qualifying DBOM teams and technologies for the development of the AD Facility. Then a Request for Proposal (RFP) will be issued to select the DBOM project company. It is expected contract award will be completed by early 2020 and the facility will be operational by early 2024.

b. What were the objectives of the Feasibility Study (what was it seeking to determine)?

The Region undertook this AD Facility Study in order to optimize the development of the AD Facility, maximize benefits, and minimize risks to the Region. This Study assisted confirming the Region's objectives for the AD Facility and answering strategic questions with respect to the scope and development of the AD Facility, including the design, functional and performance specifications of key aspects of the AD Facility. The Study also informed the development of the DBOM procurement and Project Agreement documents.

<sup>&</sup>lt;sup>3</sup> Organics means the mixture of solicited organic materials, bin liners and contaminant materials separated from other components of the solid non-hazardous waste stream by the waste generator, generally in accordance with directions provided by the Region, that is collected by or on behalf of the Region and may also include source separated industrial, commercial and institutional organics and source separated residential (curbside and multi-residential) organics from other municipalities in Ontario, supplied by the Agency to the AD Facility for processing.

Specific to biogas utilization, the AD Facility Study will support the development of the AD Facility agreement between the Region and Enbridge Gas Distribution Inc. (Enbridge) for the development of the Biomethane System (BMS) Facility (BMS Facility). The BMS will produce biomethane, also known as renewable natural gas (RNG), which will be injected into the natural gas distribution system operated by Enbridge. Biogas that is not supplied to Enbridge will be managed by the Region.

c. What approach (or methodology) was used in the Feasibility Study to meet these objectives?

For each component of Study, the general approach was to define key aspects; identify and investigate options; use criteria to evaluate options; identify the preferred option; and consider DBOM contract issues (e.g. risks) and procurement strategy. The AD Facility Study was comprised of the AD study plus two additional engineering studies.

- Policy and Market Scan identified relevant environmental, economic, regulatory and social policy initiatives; identified current industry and market trends; identified potential Institutional, Commercial and Industrial (IC&I) organics that could be processed through the AD Facility; explained how these initiatives and trends will impact development and operation of the AD Facility; and, identified ways in which the Region can maximize opportunities and minimize risks through the development and operation of the AD Facility.
- Assessment of AD Technologies determined whether to include or exclude any AD processing technologies for use in the AD Facility; and if a technology prequalification process would be required.
- Assessment of Biogas Utilization Options determined whether the DBOM Project Company's scope, related to biogas management and utilization, should be limited; whether to include specific biogas utilization options in the scope of the DBOM contract; whether biogas utilization should be included in the DBOM contract as DBOM Project Company's scope of work; how to deliver the scope of biogas utilization if excluded from the DBOM contract; and, whether if it is necessary to secure a biogas market before the DBOM RFP is issued.
- Assessment of Digestate, Wastewater and Residue Management Options determined whether the DBOM Project Company's scope, related to digestate, wastewater and residue management, should be limited; whether to include digestate management in the scope of the DBOM contract; whether to include wastewater treatment in the scope of the DBOM contract; and, whether to include residue management in the scope of the DBOM contract.
- Assessment of AD Facility Implementation Options determined the initial capacity of the Region's AD Facility; the ultimate capacity of the Region's AD Facility; how to plan for a future expansion (if required); and, if such expansion should be included in the DBOM contract.
- Biogas Utilization Servicing Study obtained an understanding of all technical, market and regulatory requirements associated with executing a biogas utilization approach and informed the technical specifications with respect to the DBOM Project Company's work to implement the biogas utilization option.
- Odour Control and Heating, Ventilation and Air Conditioning (HVAC) System Study determined any odour treatment technologies to be considered for use in the AD Facility; and any HVAC systems or approaches to be used in the AD Facility.

d. Please describe any public consultations conducted as part of the Feasibility Study and their impact on the Study.

Early in the planning stage of the AD Facility Project, a Request for Information and Expression of Interest (RFI&EOI) was issued to seek information from respondents with an interest and in pursuing procurement opportunities with respect to the development of the AD Facility. Key objectives were to provide preliminary information on the project to the market; to understand the experience in the industry with similar facilities, technologies or projects; identify possible range of technologies; identify possible range of uses of AD facilities outputs; understand roles for managing the facility and the outputs; and to get market feedback from the industry on the planned approach for the development of the AD Facility.

Consultation was also conducted internally within the Region's different key stakeholders in the Region's IC&I sector to define the type and amount of organics produced within the Region by IC&I generators and investigate market and corporate issues which determine how organics are managed.

Additionally the Region's Project team engaged the Region's real property, legal, and financial departments for land acquisition, financing and procurement elements of the project; energy sector to determine corporate energy needs; waste collections and operations departments' for operations and maintenance input; and the communications department to devise a stakeholder engagement strategy and plan. The AD Facility implementation project will be guided by an advisory group with representatives from these Regional departments.

There were discussions with the Ontario Ministry of Agriculture and Rural Affairs (OMAFRA), Ontario Farmers Association (OFA), the Ontario Soil and Crop Improvement Association (OSCIA), the Peel Agriculture Advisory Working Group (PAAWG) and the Canadian Food Inspection Agency (CFIA) to discuss digestate management options. The Region subsequently engaged in a market sounding exercise with farmers and digestate land applicators to understand the characteristics of the industry, requirements and limitations for digestate land application.

Energy stakeholders such as the Ontario's Independent Electricity System Operator (IESO) and Enbridge Gas Distribution Limited (EGDL) were approached to discuss options for biogas management.

Different planning stakeholders were involved in the land acquisition process, such as the Toronto and Region Conservation Authority (TRCA), Credit Valley Conservation Authority (CVC), Greater Toronto Airports Authority (GTAA), Ministry of Environment and Climate Change (MOECC) and municipal planning departments, to define permitting requirements and site selection criteria.

There was discussion with the academia in regards to nutrient recovery possibilities. These and other public and relevant stakeholders will be identified and engaged during the AD Facility procurement process.

#### 3. Feasibility Study Findings and Recommendations

a. What were the environmental findings related to the options explored in the Feasibility Study? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

Specific to the Region's AD development conditions – being these potential available site restrictions (size, location and land-use limitations), organics sources, organics composition and transportation, local regulatory constraints and others – the following environmental findings were identified:

- Generation of Greenhouse gas (GHG) emissions reductions:
  - The AD Facility will produce renewable, low-carbon energy, whereas the existing practice of composting does not. Calculations of the potential offset credits available from the generation of RNG from the AD Facility and estimated the potential offsets created from two different facility capacities; 90,000 tonnes per year (tpy) and 120,000 tpy which would generate 5.6 Mm<sup>3</sup> and 7.4 Mm<sup>3</sup> of RNG annually, respectively. With the generation of 7.4 Mm<sup>3</sup> of RNG, the approximate emissions offsets amount to 13,884 tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e) annually, whereas with the generation of 5.6 Mm<sup>3</sup> the approximate emission offsets would be 10,413 tCO<sub>2</sub>e annually. *Biogas Utilization Servicing Study, page 35*.
  - Options assessed for biogas utilization included: co-generation of electricity and heat; production of RNG suitable for injection into the natural gas grid; production of biomethane compressed natural gas (Bio-CNG) suitable for use as vehicle fuel; industrial/commercial heating; industrial process needs and flaring (do nothing). Through comparison and assessment of the biogas utilization options considered, it was recommended that the following options be carried forward for further consideration: RNG, Bio-CNG (vehicles located offsite), and industrial process needs (site specific consideration). – Anaerobic Digestion Study Report, page 20.
  - For biogas utilization, on an annual basis the AD Facility is expected to generate roughly 54 percent of the ROP's current natural gas energy consumption. However, an AD Facility requires between 12 to 32 percent (if digestate pasteurization is required) of the energy it produces to run the facility. *Biogas Utilization Servicing Study, page i.*
- Potential to increased diversion of Organics from landfill:
  - AD technology allows broadening the scope of Organics to include diapers and pet waste. Use of AD promotes the potential ability to process organics from multi-residential programs, which can be more contaminated than other organics. *Anaerobic Digestion Study Report, page 20*.
  - In relation to organics, in the Ontario context, Bill 151/ Waste Free Ontario Act and Bill 172/Climate Change and Low-Carbon Economy Act were passed in 2016, influencing an AD facility project. Much of the ROP's early-action with respect to broadening its Organics program, implementing new AD technology, and focusing on RNG as an output product for biogas from that AD Facility, is aligned exceptionally well with legislative drivers (Bill 151 and Bill 172), existing trends in SSO processing (towards AD), and with respect to future likely trends in organics management such as harvesting organics from residual waste and multi-residential

sources. The ROP has already arrived at a number decision points that are well-considered and forward-thinking. – *Anaerobic Digestion Study Report, page 17*.

- Nutrient Recovery from digestate generated through AD:
  - Digested organics (digestate), has a high nutrient content and can be used as fertilizer. The digestate quality differs, based on technology, although all noted processes generate some kind of process effluent. Given the origin of the liquids (i.e. from SSO), the liquids will generally be high in nutrients. It is anticipated that the facility will generate approximately 169,000 cubic metres (m<sup>3</sup>) annually. *Anaerobic Digestion Study Report, page 27*.
  - The nutrient-rich digestate created from AD will be used to displace fossil-fuel based fertilizers used in crop production, achieving additional GHG emission reductions.
  - Seven digestate management options were assessed: solid versus liquid digestate, further conditioning on-site or off-site, storage, digestate market, and beneficial use.
    *Anaerobic Digestion Study Report, Table 5.1, page 25.*
- Recycling potential:
  - Residue from Organics processing, may include film plastic, contaminants, water and solicited organic materials.
  - Three streams of residue were assessed for recycling options: fine residue, film plastics and coarse residue. There is little to no opportunity to utilize the fine contaminant residue for beneficial use. There is little opportunity to utilize the film plastics for beneficial use in the current marketplace, although markets are developing for this product due to the high calorific content of this material. There is very limited opportunity to utilize the coarse contaminant Residue for beneficial use, given the small amount generated. *Anaerobic Digestion Study Report, page 29*.
- Odour Control measures:
  - For odour control and treatment, the options recommended include inorganic media biofilter, organic media biofilter, photoionization, chemical scrubber, thermal oxidation. *Odour Control and HVAC System Study, page 4.*
  - For ventilation systems, it is recommended to keep separate the administrative office and staff areas from process and mechanical building areas and process and wastewater treatment equipment. *Odour Control and HVAC System Study, page 31.*
- b. What were the financial findings related to the options explored in the Feasibility Study (for example, results of a cost-benefit analysis, financial savings identified, and so on)? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).
  - The economics drivers that are expected from Bill 151/ Waste Free Ontario Act and Bill 172/Climate Change and Low-Carbon Economy Act for an AD facility are:
    - Additional revenue from sale of offset credits or realization of Greenhouse Gas Reduction Account (GGRA) funding revenues, or both, under Bill 172.
    - Possible additional demand for digestate under Bill 172, given the carbon value of displacing petroleum-based fertilizers.
    - Increased demand from natural gas utilities due to Bill 172 emission reduction obligations imposed upon natural gas distributors.

- Possible changes in baseline management costs for organics should an organics ban be implemented under Bill 151. This would also eliminate offset credit opportunities. - Anaerobic Digestion Study Report, page 14.
- The biogas, which is produced at the AD Facility during the digestion process, can be used for heating or upgraded to produce renewable natural gas (RNG). RNG can be used to power vehicles (collection fleet and regional vehicles) or used to supplement the natural gas supply. Where pasteurization of the digestate is required (i.e. increased thermal demand), simply offsetting process heating natural gas costs represents a cost savings of approximately \$9 per tonne Organics for the AD Facility (or \$0.32/m3 NG multiplied by 3.3 million m3 of NG needed for process heat needs). *Biogas Utilization Servicing Study, page 20*.
- However, in absence of secure long-term markets for RNG, the Region's best option is to self-consume (avoids transportation and Cap and Trade changes). *Biogas Utilization Servicing Study, page 27.*
- For digestate management, demand for clean, high-quality products exceeds supply. Digestate markets are not anticipated to generate significant revenue for AD facilities owners in the foreseeable future. However, revenue may partially offset land application costs. Revenues are expected to improve over time. Digestate management should be budgeted as a cost by the ROP. *Anaerobic Digestion Study Report, page 27*.
- For residue management, the management of the fine contaminants will be an operational cost and little market opportunity exists to create a revenue source from this material. The management of the film plastics will most likely be an operational cost; however, market opportunity for the use of refuse-derived fuel (RDF) generated from the plastic film may become available as markets for alternative fuels expand and further advancements are made in waste to liquid fuels technology. The management of the coarse contaminants will be an operational cost with limited market opportunity to create a revenue source for the AD Facility. *Anaerobic Digestion Study Report, page 29*.
- IC&I food waste generators prefer shorter disposal contracts to be able to re-negotiate for better pricing on a regular basis. The level of commitment from the IC&I sector (term, tipping fees) does not support public investment in processing capacity for IC&I organics. *Anaerobic Digestion Study Report, page 35*.
- As per cost analysis for odour control and treatment options, the organic media biofilter is the lowest cost option on a net present value (NPV) basis. Inorganic media biofilter and photoionization systems are about the same price on a NPV basis and between 12 and 15 percent more expensive than the organic media biofilter. *Odour Control and HVAC System Study, page 22.*
- c. Based on the environmental and financial findings above, what does the Feasibility Study recommend?
  - Recommendations on maximizing opportunities based on regulatory changes are summarized in table 2.1, page 18 of the Anaerobic Digestion Study Report. Environmental risks and recommendations on minimizing the risks are summarized in Table 2.2, page 19 of the Anaerobic Digestion Study Report. The Project Team will consider these recommendations when pursuing future funding opportunities for the AD Facility.
  - For biogas utilization, it was recommended to carry forward the following options for further consideration: RNG, Bio-CNG (vehicles located offsite) and industrial process needs (site specific consideration).

- For digestate management, it was recommended that the AD Facility be required to have the ability to produce a solid digestate that is free from physical contamination (functional requirement) that after further conditioning or pasteurization (on or offsite) can be registered as a commercial fertilizer under the federal Fertilizers Act (performance requirement). This will minimize the regulatory burden on the customers receiving the material, maximizing its marketability.
- For wastewater management, it was recommended a performance based specification for the wastewater treatment system based on the discharge criteria and other conditions.
- For residue management, the most cost-effective means for management of the fine contaminants is disposal in landfill. The most cost- effective option for management of the film plastics is either through disposal in landfill or use in an energy-from-waste facility. There is very limited opportunity to utilize the coarse contaminant residue for beneficial use, given the small amount generated. The only viable option of management of the coarse contaminant residue is disposal in landfill.
- It is not recommended planning for the AD Facility to include IC&I food waste at this time. If market conditions change in the future, a study can be initiated to re-examine the potential based on actual available spare capacity (if any) at the AD Facility once it is operational.
- For biogas utilization, further analysis is required to assess if revenue to the Region from the sale of RNG is more attractive than self-consuming biogas, self-consuming RNG to offset natural gas, and/or GHG credits sale.
- The ROP requires that the AD Facility's HVAC and odour control and treatment systems be integrated to maintain a safe environment for workers, to prevent off-site odour impacts, to comply with the requirements of the environmental permits, and to be balanced together under one main control program to maintain the room space conditions.

# 4. Lead Applicant's Next Steps

a. Taking the Feasibility Study's recommendations into account, what next steps do you as the municipality plan to take? What potential benefits or internal municipal improvements would result from these next steps?

The AD Facility site was acquired in mid-September 2017. The selected site allows for the direct delivery of waste, optimizing hauling of organics. The site is large enough to include a small transfer station. Based on revised waste projections and updates to the Regional Waste Infrastructure Plan and Waste Management Plan, the AD Facility has been optimized to 90,000 tonnes per year facility. It is expected that a small waste transfer station will be co-located at the AD Facility site.

On November 30, 2017 the project team presented the report 'Strategic Terms for the Anaerobic Digestion Facility Project' to the Waste Management Strategic Advisory Committee to inform Regional Council on strategic decisions:

- Infrastructure upgrades required for the selected AD Facility site.
- Strategic decisions for the AD Facility project scope, capacity and feedstock, biogas management and utilization, digestate management and utilization, procurement and community engagement.

- Discussion of potential contractual terms with Enbridge Gas Distribution (EGD), the utility company, to determine best biogas management options for the Region.
- Procurement Plan based on a two-step procurement: Request for Pre-qualification (RFPQ) for teams and technologies, Request for Proposal (RFP) for the Design-Build-Operate-Maintain (DBOM) project company to develop the AD Facility.

The recommendations, as presented on the above report, were endorsed by Council on December 14, 2017. The RFPQ was issued on February 7, 2018. It is expected to issue the RFP by late 2018 and award the DBOM Project Company by late 2019. Design, construction and commissioning should start in 2020 and it is expected to have the facility operational in 2023.

#### 5. Lessons Learned

In answering the questions in this section, please consider all aspects of undertaking the Study — from the initial planning through each essential task until the Final Study was prepared.

a. What would you recommend to other municipalities interested in doing a similar Feasibility Study? What would you do differently if you were to do this again?

To develop a facility of this magnitude, it is necessary to spend the time and resources to complete preliminary studies as the ones completed by the Region for the AD Facility Study.

The Region has gone through a detailed and systematic process to be able to support and make sound decisions that will bring the best option forward. The definition of the scope of work for the consultant to undertake these preliminary studies was fundamental, and required input from all different stakeholders involved in waste management within the different departments of the Region. This allowed for a strong understanding of the Region's objectives that was clearly transmitted to the consultant throughout the development of the preliminary studies. The participation of these different stakeholders involved in waste management through the revision and finalization of these studies was also very important, taking a holistic approach while making strategic decisions. Incorporating the input from key stakeholders for the management of the facility outputs in the decision making was also essential, as ultimately these will be the stakeholders who will benefit from these outputs, being these energy generation (RNG) and soil amendment products (fertilizer).

b. What barriers or challenges (if any) did you encounter in doing this Feasibility Study? How did you overcome them?

One of the main challenges encountered during the completion of the AD Facility Study was the legislative and regulatory uncertainty relevant to the AD Facility development. To date the *Waste Free Ontario Act, 2016 (Bill 151)* and the accompanying *Strategy for a Waste Free Ontario: Building the Circular Economy Strategy* outline the province's framework for organic waste management. However the province still needs to develop specifics to define regulatory actions (e.g. source separation, organic bans). Additionally, the *Climate Change and Low-Carbon Economy Act, May 2016 (Bill 172)* focuses on the reduction of GHG emissions in Ontario. However an approved protocol specific to the generation of RNG from municipal source separated organics AD has not been released.

Market conditions for RNG have also been identified as a barrier. Uncertainty on the industry and market trends in relation to revenue generation opportunities including the sale of residuals, digestate/fertilizer, nutrients, biogas/RNG and potentially carbon offsets.

Another challenge related to the development of the AD Facility was the site acquisition. The site had not be acquired prior to the development of the AD Facility Study, and while the studies were not site specific, location of the site affected the waste management infrastructure plan, and consequently the AD Facility as a component of all waste management infrastructure. Site acquisition was time dependant, and the timeline initially planned for the AD Facility development was extended to accommodate the longer process for completion of site acquisition.

#### 6. Knowledge Sharing

a. Is there a website where more information about the Feasibility Study can be found? If so, please provide the relevant URL.

Project website not available yet; coming shortly @ peelregion.ca/waste.

b. In addition to the Feasibility Study results, has your Feasibility Study led to other activities that could be of interest to another municipality (for example, a new policy for sustainable community development, a series of model by-laws, the design of a new operating practice, a manual on public consultation or a measurement tool to assess progress in moving toward greater sustainability)? If so, please list these outcomes, and include copies of the relevant documents (or website links).

Not applicable.

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