

# Appendix F

## TM5 - Evaluation Methodology



**The Regional Municipality of Waterloo**

**Wastewater Treatment Master Plan Update**

**Technical Memorandum No. 5:  
Evaluation Methodology**

**Final**



**5935 Airport Road, Suite 500  
Mississauga, Ontario  
L4V 1W5  
Canada  
Phone: (905) 695-1005  
Fax: (905) 695-0525  
[www.cima.ca](http://www.cima.ca)**

**February 2017**

T000478A

Alternate formats of this document are available upon request. Please contact Nicole Sapeta at [nsapeta@regionofwaterloo.ca](mailto:nsapeta@regionofwaterloo.ca), 519-575-4400 ext. 3682, TTY: 519-575-4608 to request an alternate format.

## Preparation and Review Log

Version	Date	Prepared by (Deliverable Lead)	QC Reviewer	Project Manager Sign-off
Draft	May 2016	S. Romas	E. Longworth, S. Rodriguez	T. Briggs
Final	February 2017	S. Romas	E. Longworth	T. Briggs

## Table of Contents

<b>1. Introduction .....</b>	<b>1</b>
<b>1.1 Background .....</b>	<b>1</b>
<b>2. Master Planning Process.....</b>	<b>2</b>
<b>3. Proposed Decision-Making Model .....</b>	<b>3</b>
<b>3.1 Description of Decision-Making Model .....</b>	<b>3</b>
<b>3.2 Decision-Making Criteria and Rationale.....</b>	<b>3</b>
<b>3.3 Evaluation Methodology.....</b>	<b>7</b>
<b>4. References .....</b>	<b>8</b>

## List of Tables

Table 1	Decision-Making Criteria and Rationale .....	5
---------	--	---

## **1. Introduction**

### **1.1 Background**

The Regional Municipality of Waterloo (Region) is an upper tier municipal government, providing municipal services to seven lower-tier municipalities with a total population of approximately 550,000 people. The Region owns thirteen (13) wastewater treatment plants (WWTPs), one (1) wastewater residuals processing facility, six (6) wastewater pumping stations, and two (2) wastewater collection systems (Ayr in the Township of North Dumfries and Wellesley in the Township of Wellesley), treating 66 million cubic meters annually. Wastewater facilities are operated and maintained by the Ontario Clean Water Agency (OCWA) under contract to the Region. Most of the collection systems and pumping station infrastructure that convey wastewater to the Region's treatment facilities are owned, managed and operated by the area municipalities (City of Cambridge, City of Kitchener, City of Waterloo, Township of Wilmot and Township of Woolwich).

The Region has experienced steady residential and industrial/commercial/institutional (ICI) growth for many years, and anticipates that this trend will continue due to a strong local economy, the Province of Ontario's Places to Grow Act and major Regional and Provincial transportation initiatives that are underway. The Region completed a Wastewater Treatment Master Plan (WWTMP) in 2007 (Earth Tech, 2007) to plan for future growth and provision of treatment capacity throughout the Region. In light of changes to population projections, wastewater flows and environmental regulations, the Region has initiated an update to its WWTMP.

This Technical Memorandum (TM No. 5) has been prepared to present the methodology and criteria that will be used to complete a comparative evaluation of the wastewater treatment alternatives in order to identify the best alternative which balances the goals of minimizing environmental, social, technical and economic impacts.

## **2. Master Planning Process**

The purpose of the WWTMP Update is to define a long-range plan for wastewater treatment into the future, which will consist of a number of projects required to implement the plan over the planning period (2051). Various individual projects could also be combined to form a specific strategy.

The 2007 Master Plan project followed Approach 1 of the Municipal Engineers Association (MEA) Master Planning Process. Approach 1 involves the preparation of a Master Plan document at the conclusion of Phases 1 and 2 of the Municipal Class EA process. The Master Plan document is to be made available for public comment before being adopted. Under Approach 1, any specific Schedule B or C projects identified within the Master Plan would require more detailed investigations at the project-specific level to fulfill the Class EA requirements.

Consistent with the original WWTMP process, this Master Plan Update will address Phase 1 (Needs and Opportunities Statement) and Phase 2 (Identify and Evaluate Alternative Solutions), as identified in the (MEA) Class EA document (2000, as amended in 2007 and 2011), and provide a listing of individual treatment projects to be implemented over the projected planning period.

### 3. Proposed Decision-Making Model

#### 3.1 Description of Decision-Making Model

The 2007 WWTMP followed a decision-making model centred on a multi-criteria analysis (MCA). The MCA provides a structured approach to determine overall benefits among alternative options, where the options accomplish several objectives. This evaluation methodology requires specification of desirable objectives and identification of corresponding indicators, which are then used to measure/assess the ability of each alternative option to meet a specific objective. The same decision-making model used in the 2007 WWTMP will be used for this WWTMP Update.

Since the scope of the Master Plan is rather broad, it is expected that a variety of both monetary and nonmonetary objectives will be developed and ultimately influence the decision-making process. As such, a variety of environmental and social indicators will be developed side by side with economic costs and benefits. Indicators will provide a measurable tool to assess a wide range of qualitative categories and criteria, and compare and rank the alternative options against each specific objective.

The MCA approach includes the following major components:

- + **Evaluation Criteria:** A set of evaluation criteria is developed to reflect all aspects of factors of importance for a specific project. Alternative options are assessed and compared relative to the others against the evaluation criteria.
- + **Qualitative Rating:** Each alternative option is assigned a rating that reflects its ability to meet each evaluation criterion relative to the performance of the other alternative options.

#### 3.2 Decision-Making Criteria and Rationale

The 2007 WWTMP evaluation approach followed a typical evaluation of impacts to a wide range of criteria that included natural, socio/cultural, financial and technical environments, as well as legal/jurisdictional and technical factors. The criteria used in the 2007 WWTMP were used as a basis for this WWTMP Update, with some modifications to enhance the criteria. The modifications focused on adding criteria to make the evaluation more robust, and consolidating criteria where there were potential overlaps. The decision-making criteria and rationale is provided below and summarized in Table 1.

+ Environmental Factors:

- Surface water protection
- Wells and aquifer protection
- Protection of natural features
- Climate change

+ Social Factors:

- Health and safety
- Short and long-term growth
- Land use
- Community impacts (odour, noise, truck traffic)
- Cultural and archaeological heritage
- First Nations considerations

+ Legal/Jurisdictional Factors:

- Approvals
- Land requirements

+ Financial Factors:

- Life-cycle cost
- Cost to ratepayers
- Financial sustainability

+ Technical Factors:

- Energy use and greenhouse gas generation
- Constructability
- Optimization of existing infrastructure
- Innovation
- Security, reliability and robustness.

**Table 1 Decision-Making Criteria and Rationale**

<b>Category</b>	<b>Criteria</b>	<b>Rationale and Measures</b>
<b>Environmental Factors</b>	<b>Surface Water Protection</b>	<ul style="list-style-type: none"> <li>• Maximize reliability in achieving effluent quality limits</li> <li>• Protect fisheries and aquatic health</li> <li>• Use a watershed approach to protect surface waters</li> </ul>
	<b>Wells and Aquifer Protection</b>	<ul style="list-style-type: none"> <li>• Protect groundwater and respect Clean Water Act requirements</li> </ul>
	<b>Protection of Natural Features</b>	<ul style="list-style-type: none"> <li>• Minimize the potential impact from construction and operation to existing terrestrial habitats/features, vegetation, wetlands, and woodlots</li> <li>• Protect Greenlands Network, identified in Regional Official Plan (ROP) to include environmental features, ecological buffers, and linkages</li> </ul>
	<b>Climate Change</b>	<ul style="list-style-type: none"> <li>• Resiliency to extreme conditions</li> </ul>
<b>Social Factors</b>	<b>Health and Safety</b>	<ul style="list-style-type: none"> <li>• Minimize the potential risk to public health and safety, particularly on downstream users (including for recreation and tourism)</li> </ul>
	<b>Short and Long Term Growth</b>	<ul style="list-style-type: none"> <li>• Minimize potential negative effects on short term and long term community growth and development</li> <li>• Meet Region’s growth objectives outlined in ROP</li> </ul>
	<b>Land Use</b>	<ul style="list-style-type: none"> <li>• Maximize land use to preserve site area for any future requirements and minimize construction beyond the current footprint</li> </ul>
	<b>Community Impacts (Odour, Noise, Truck Traffic)</b>	<ul style="list-style-type: none"> <li>• Minimize odours, noise and truck traffic affecting the community during construction and plant operation</li> </ul>
	<b>Cultural and Archaeological Heritage</b>	<ul style="list-style-type: none"> <li>• Minimize potential impact to historical, cultural, archaeological and architecturally significant features</li> </ul>
	<b>First Nations Considerations</b>	<ul style="list-style-type: none"> <li>• Minimize the potential impact to First Nations communities</li> </ul>

<b>Category</b>	<b>Criteria</b>	<b>Rationale and Measures</b>
<b>Legal/ Jurisdictional Factors</b>	<b>Approvals</b>	<ul style="list-style-type: none"> <li>Minimize the complexity and time spent to obtain approvals considering current and future regulatory environment</li> </ul>
	<b>Land Requirements</b>	<ul style="list-style-type: none"> <li>Potential need to acquire land for additional treatment works and ownership requirements</li> </ul>
<b>Financial Factors</b>	<b>Life Cycle Cost</b>	<ul style="list-style-type: none"> <li>Minimize capital, operation and maintenance (life cycle) costs over the planning period</li> </ul>
	<b>Cost to Ratepayers</b>	<ul style="list-style-type: none"> <li>Impact to existing ratepayers for user rates</li> </ul>
	<b>Financial Sustainability</b>	<ul style="list-style-type: none"> <li>Balance infrastructure needs with ability to pay (user rates and development charges)</li> </ul>
<b>Technical Factors</b>	<b>Energy Use and Greenhouse Gas Generation</b>	<ul style="list-style-type: none"> <li>Minimize GHG emissions, net energy use, and sludge volumes</li> <li>Maximize biogas generation for cogeneration and biofuel opportunities</li> </ul>
	<b>Constructability</b>	<ul style="list-style-type: none"> <li>Flexibility of scheduling works is of key concern due to uncertainty in timing of growth</li> <li>Minimize complex construction and maximise ability to maintain adequate treatment during construction</li> </ul>
	<b>Optimization of Existing Infrastructure</b>	<ul style="list-style-type: none"> <li>Optimize existing infrastructure investment and treatment capacity</li> </ul>
	<b>Innovation</b>	<ul style="list-style-type: none"> <li>Maximize use of innovative technologies and processes to enhance level of treatment or treatment efficiency</li> <li>Resource recovery</li> </ul>
	<b>Security, Reliability and Robustness</b>	<ul style="list-style-type: none"> <li>Lesser likelihood of process upset or mechanical breakdown</li> <li>Ability to meet performance objectives under a range of conditions</li> </ul>

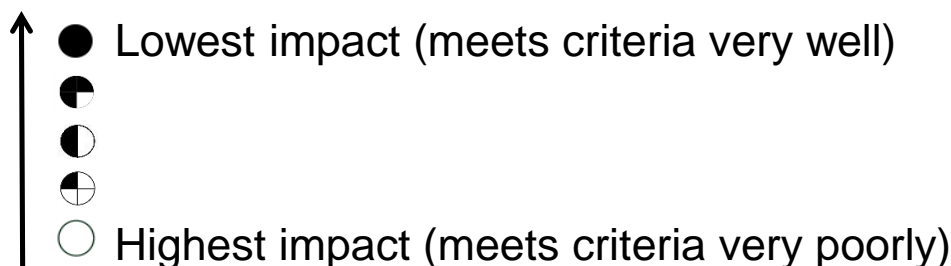
### 3.3 Evaluation Methodology

The proposed evaluation methodology consists of a descriptive or qualitative evaluation of alternative solutions/strategies and identification of advantages and disadvantages of each alternative option with respect to the evaluation criteria. In this respect, comparisons and trade-offs can be made between alternatives. Trade-offs can involve forfeiting an advantage or accepting a disadvantage to address a higher priority consideration.

Some criteria will be evaluated using quantitative means, including costs and greenhouse gas generation. High-level estimates will be generated for these criteria and they will be evaluated using a relative rating provided for each alternative as it compares to each of the other alternatives.

An evaluation matrix will be prepared describing the specific advantages and disadvantages that each alternative option offers for each criterion under consideration. For each option, detailed information will be provided with a description of:

- + Risk and/or potential impacts for each criterion
- + Approaches to mitigating risks and/or impacts
- + Scoring rationale, based on degree of risk and/or mitigation required
- + Scores will be assigned as follows:



## **4. References**

1. Earth Tech Canada Inc. (2007). Regional Municipality of Waterloo Wastewater Treatment Master Plan Final Report, August 2007.