Final Report for
Region of Waterloo
Biosolids Management
Master Plan
September 2011

Prepared for
Region of Waterloo
Prepared by
CH2M HILL
Final Report

Region of Waterloo Biosolids Management Master Plan

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Executive Summary

Introduction

The Region of Waterloo (Region) initiated a study in 2010 to update the previous Biosolids Master Plan (BMP) completed in 2003. The 2003 BMP directed biosolids management activities in the Region to the year 2021. The objective of the 2003 BMP was to develop a biosolids management strategy that would be environmentally sound, cost effective, and able to adapt to changing requirements and conditions over the next 20 years.

The Region is updating its BMP in light of the Region’s recent growth, changes to the regulatory environment, climate change, available treatment technologies and disposal alternatives, their adoption of a new Environmental Sustainability Strategy, and the 2003 BMP’s recommendation that regular reviews are undertaken to confirm its applicability. The BMP update will help the Region to assess the status of its biosolids treatment, management, and disposal facilities; and reconfirm or develop a preferred biosolids management strategy, to the year 2041. This biosolids management strategy will be environmentally sustainable, economically viable, and maintainable over the long term. The Region retained CH2M HILL Canada Limited (CH2M HILL) to assist them with the BMP update.

The Region is located in Southern Ontario. It comprises the urban municipalities of Cambridge, Kitchener, and Waterloo, as well as the rural townships of North Dumfries, Wellesley, Wilmot, and Woolwich. The total land area in the Region is 138,314 hectares (ha). These communities have a collective population of approximately 525,000, and the Region is one of the fastest growing areas in Ontario, as well as the fourth largest urban centre in Ontario (and the tenth largest in Canada). The Region is known for its leading-edge technology and advanced manufacturing industries, educational institutions, and vibrant agricultural communities.

Master Plan Development

The detailed decision-making process follows Phases 1 and 2 of the Municipal Class EA process. The approach prescribed for these phases was further refined to assist in the master planning process for the Region’s BMP. Key components of the decision-making process included:

- Problem definition
- Review and documentation of existing conditions
- Future needs and constraints
- Development and evaluation of alternatives
- Recommended alternatives
- Recommended strategy
- Development of the BMP

Consultation with stakeholders and the public was a critical component of the master planning process, from the initial stages through to the final recommended strategy. The key consultation milestones have been integrated with the decision-making process.
Phase 1 technical activities included initial data gathering to determine the current biosolids management situation in the Region, and future capacity requirements. This information was used to help define the BMP’s goals and objectives. The key project initiation activities in Phase 1 included developing and launching the public consultation program. Public consultation activities included publishing a Notice of Master Plan Commencement, notifying key government review agencies and forming the Project Team (PT), a Project Steering Committee (PSC) and a Stakeholder Advisory Committee (SAC). Appendix A provides the agency and project mailing lists, as well as materials related to the Notice of Master Plan Commencement.

Phase 2 activities included several component tasks focused on the development of a preferred management strategy. First, a long list of potential biosolids end use alternatives, products and treatment options was screened to identify those appropriate to develop management strategies. A long list of biosolids management strategies were developed by selecting end use alternatives, the appropriate biosolids products for the end use and developing processing trains to produce the product by combining treatment technologies. The long list of management strategies was evaluated to determine a short list of management strategies that was further evaluated to select a preferred management strategy. The steps in selecting the preferred management strategy were as follows:

1. Develop screening criteria and apply these criteria to the long list of end use, product and processing alternatives. This was a “fatal flaw” analysis in which an end use, product or alternative treatment technology had to meet all of the fatal flaw criteria to be carried forward to the detailed evaluation.

2. Develop a long list of management strategies – twelve (12) strategies were developed, each strategy incorporated all thirteen WWTPs. Develop evaluation criteria and weightings for the criteria for the detailed evaluation and score criteria for each strategy. The detailed evaluation utilized a multi-criteria decision analysis, which ranked each strategy. Based on the ranking, select management strategies for further evaluation.

3. Develop a short list of biosolids management strategies. The strategies were evaluated using life cycle assessment (LCA), risk impact, and financial analysis to select the preferred strategy. The four short listed alternative strategies include:
   - Strategy I: Contracted Disposal and Land Application
   - Strategy II: Multiple Heat Drying Facilities and Land Application
   - Strategy III: Other Stabilization and Land Application
   - Strategy IV: Single Heat Drying Facility and Land Application
   - All strategies employ the advanced ATAD process (located at the Ayr WWTP) to treat biosolids from the Hespeler and New Hamburg WWTPs

The master plan strategy included the development of an implementation plan and recommendations.

The planning and decision-making process has been documented in the Master Plan report. All technical analyses and public correspondence are appended to the report. The Master Plan
provides the basis for biosolids management activities in the Region to the year 2041 and must continue to be reviewed and updated regularly (every 5 years with consideration for biosolids contract dates).

**Stakeholder Contributions to the Study**

The participation of stakeholder groups was undertaken in the development of this BMP through the formation of the PT, PSC, and SAC, which role was to advise the study team.

The PT was responsible for managing the project, advising on the master planning process, and contributing to key deliberations on recommendations. PT members included representatives from the Region and CH2M HILL.

The purpose of the PSC was to provide advice and feedback to the PT at key milestone points during the study. The PSC members provided representation from the Region, the Cities, and the Townships within the Region. The SAC was established with the mandate to provide the public perspective on the BMP throughout its development. This committee was responsible for providing advice and feedback to the PT at key milestones over the course of the study, including providing feedback on the following components:

- The Master Plan Mission Statement
- Key issues and context for the BMP decision-making process
- Existing conditions and current biosolids management practices
- Master plan evaluation methodology and decision-making criteria
- Consultation activities and results
- Related project issues and items as may have been identified through the study

Two Public Information Centres were held over the course of the planning process to present progress on the management plan development, strategy development, and preliminary recommendations and to solicit input from stakeholders.

**Recommended Strategy**

Based on the evaluation of biosolids management strategies, the recommended strategy includes the following components:

- Processing of the Region’s biosolids into Class A products.
- Installation of second-generation ATAD at the Ayr WWTP to process solids from the Ayr, New Hamburg, and Hespeler WWTPs into a Class A biosolids product that can be land applied or marketed as a fertilizer.
- Installation of a centralized heat drying facility to process dewatered biosolids from the Kitchener, Galt, and Waterloo WWTPs. This facility will be located on Regional property such that it can recover waste heat from local industry or cogeneration facilities. This process will produce a Class A heat dried product that can be land applied, marketed as a fertilizer, or used as a fuel in cement kilns.
- Implementation of CHP/cogeneration at the Kitchener, Galt, and Waterloo WWTPs.
Implementation Plan

In the short-term (first 10 years of the implementation of the BMP) it is recommended that the majority of the capital improvements be initiated by the Region. These include the following:

- Implementation of CHP/cogeneration at the Kitchener, Galt, and Waterloo WWTPs
- Addition of thickening and the advanced ATAD process at the Ayr WWTP
- Addition of thickening at the Hespeler WWTP
- Ayr WWTP to begin receiving biosolids from the New Hamburg and Hespeler WWTPs.
- Implementation of a centralized heat drying facility located on Regional property (landfill) where it can use heat recovery from either local industry or a cogeneration station.
- It is recommended that the Region consider alternative delivery methods such as DB, DBO, DBOF in the execution of the capital improvement project related to implementing the recommended management strategy.
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Glossary, Symbols, Abbreviations

Glossary

**Beneficial Use**: A disposal process that takes advantage of at least one of the nutrient, soil conditioning, or fuel properties of sludge. Beneficial use practices include land application of biosolids as a soil amendment or fertilizer supplement, and various procedures that derive energy from biosolids or convert them to useful products.

**Biochemical oxygen demand (BODs)**: The amount of oxygen utilized for the biochemical degradation of organic products during a 5-day incubation period.

**Biosolids**: Primarily organic solid product produced by wastewater treatment processes. Biosolids are of a quality that can be beneficially used.

**Market**: The end use for the biosolids product, or the utilization site.

**Pathogen**: A disease-causing organism found in wastewater and sludge.

**Sludge**: Solids removed from wastewater by mechanical or biological means. Sludge and biosolids, as used in the text, have the same meaning.

**Wastewater**: The spent or used water of a community or industry. Wastewater contains dissolved or suspended matter. It is a general term for untreated discharge.

**Water Treatment Plant Residuals**: The inorganic material that remains after water is treated at a water treatment plant (WTP).

Symbols and Abbreviations

**Units of Engineering Expression**

- ac/yr: acres per year
- CFU/g: colony forming units per gram
- cm: centimetre(s)
- D or d: day
- dt: dry tonne
- dt/ha: dry tonne(s) per hectare
- dt/year: dry tonne(s) per year
- gpcd: Grams per capita per day
- H+: hydrogen ion
- ha: hectare
- Igal: Imperial gallons
- kg: kilograms
- L: litre
- Lpc.d: Litres per capita per day
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>m</td>
<td>metres</td>
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<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>mg/kg</td>
<td>milligram(s) per kilogram</td>
</tr>
<tr>
<td>mg P/L</td>
<td>milligrams of phosphorus per litre</td>
</tr>
<tr>
<td>ML/d</td>
<td>megalitres per day</td>
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<tr>
<td>MLD</td>
<td>megalitres per day</td>
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<tr>
<td>m³</td>
<td>cubic metre</td>
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<tr>
<td>ng</td>
<td>nanogram</td>
</tr>
<tr>
<td>OU/m³</td>
<td>odour units per cubic metre</td>
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<tr>
<td>pH</td>
<td>non-dimensional measure of acidity or alkalinity of a fluid</td>
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<tr>
<td>ppm</td>
<td>parts per million</td>
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<tr>
<td>ppmv</td>
<td>parts per million by volume</td>
</tr>
<tr>
<td>t</td>
<td>tonne (metric ton) or 1,000 kg</td>
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<tr>
<td>y or yr</td>
<td>year</td>
</tr>
<tr>
<td>°C</td>
<td>degrees Celsius</td>
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<tr>
<td>µg</td>
<td>microgram</td>
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### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AASAD</td>
<td>Advanced Alkaline Stabilization with Assisted Drying</td>
</tr>
<tr>
<td>APC</td>
<td>Air Pollution Control</td>
</tr>
<tr>
<td>AATAD</td>
<td>Advanced Autothermal Thermophilic Aerobic Digestion</td>
</tr>
<tr>
<td>ASP</td>
<td>Aerated Static Pile</td>
</tr>
<tr>
<td>AST</td>
<td>Aboveground storage tank</td>
</tr>
<tr>
<td>ATAD</td>
<td>Autothermal Thermophilic Aerobic Digestion</td>
</tr>
<tr>
<td>BEAM</td>
<td>Biosolids Emissions Assessment Model</td>
</tr>
<tr>
<td>BMP</td>
<td>Biosolids Management Master Plan</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practices</td>
</tr>
<tr>
<td>BNQ</td>
<td>Bureau de Normalisation du Québec</td>
</tr>
<tr>
<td>BTG</td>
<td>Biosolids Task Group</td>
</tr>
<tr>
<td>C of A</td>
<td>Certificate of Approval issued by the MOE</td>
</tr>
<tr>
<td>CAS</td>
<td>Conventional Activated Sludge</td>
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<tr>
<td>CCME</td>
<td>Canadian Council of Ministers of the Environment</td>
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<tr>
<td>CFIA</td>
<td>Canadian Food Inspection Agency</td>
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<tr>
<td>CFU</td>
<td>Colony forming units</td>
</tr>
<tr>
<td>CH2M HILL</td>
<td>CH2M HILL Canada Limited</td>
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<tr>
<td>CHP</td>
<td>Combined heat and power</td>
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<tr>
<td>Class EA</td>
<td>Class Environmental Assessment</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CO₂e</td>
<td>Carbon dioxide equivalent</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical oxygen demand</td>
</tr>
<tr>
<td>CPI</td>
<td>Consumer Price Index</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>DAF</td>
<td>Dissolved air flotation</td>
</tr>
<tr>
<td>DB</td>
<td>Design-Build</td>
</tr>
<tr>
<td>DBO</td>
<td>Design-Build-Operate</td>
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<tr>
<td>DBOF</td>
<td>Design-Build-Operate-Finance</td>
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<tr>
<td>EA</td>
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<td>EAA</td>
<td>Environmental Assessment Act</td>
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<tr>
<td>EBR</td>
<td>Environmental Bill of Rights</td>
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<td>EC</td>
<td>Emerging Contaminants</td>
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<tr>
<td>EMS</td>
<td>Environmental Management System</td>
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<td>Environmental Protection Act</td>
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<td>FFA</td>
<td>Federal Fertilizers Act</td>
</tr>
<tr>
<td>FBI</td>
<td>Fluidized Bed Incinerator</td>
</tr>
<tr>
<td>GEA</td>
<td>Green Energy Act</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
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<tr>
<td>HRT</td>
<td>Hydraulic Retention Time</td>
</tr>
<tr>
<td>I/I</td>
<td>Inflow/infiltration</td>
</tr>
<tr>
<td>IRSA</td>
<td>Industrial Road Service Area</td>
</tr>
<tr>
<td>LCA</td>
<td>Life Cycle Assessment</td>
</tr>
<tr>
<td>MAD</td>
<td>Mesophilic Anaerobic Digestion</td>
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<tr>
<td>MAS</td>
<td>Modified activated sludge</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry of the Environment</td>
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<tr>
<td>MPN</td>
<td>Most probable number</td>
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<tr>
<td>MSW</td>
<td>Municipal Solid Waste</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen</td>
</tr>
<tr>
<td>NASM</td>
<td>Non-agricultural source material</td>
</tr>
<tr>
<td>NH₃</td>
<td>Ammonia</td>
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<td>NMA</td>
<td>Nutrient Management Act</td>
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<td>NPV</td>
<td>Net Present Value</td>
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<tr>
<td>NU</td>
<td>Nutrient unit</td>
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<tr>
<td>O&amp;M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>OMAFRA</td>
<td>Ontario Ministry of Agriculture, Food and Rural Affairs</td>
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<tr>
<td>OU</td>
<td>Odour units</td>
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<tr>
<td>OWRA</td>
<td>Ontario Water Resources Act</td>
</tr>
<tr>
<td>PFRP</td>
<td>Processes to Further Reduce Pathogens</td>
</tr>
<tr>
<td>PIC</td>
<td>Public Information Centre</td>
</tr>
<tr>
<td>PPP</td>
<td>Private, Public Partnership</td>
</tr>
<tr>
<td>PSRP</td>
<td>Processes to Significantly Reduce Pathogens</td>
</tr>
<tr>
<td>QA/QC</td>
<td>Quality Assurance/ Quality Control</td>
</tr>
<tr>
<td>QMP</td>
<td>Quality Management Plan</td>
</tr>
<tr>
<td>RBC</td>
<td>Rotating biological contractors</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>Region</td>
<td>Waterloo Region</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
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<tr>
<td>RMP</td>
<td>Risk Management Plan</td>
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<td>SAR</td>
<td>Standardized Approvals Regulation</td>
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<tr>
<td>SDWA</td>
<td>Safe Drinking Water Act</td>
</tr>
<tr>
<td>SRT</td>
<td>Solids retention time</td>
</tr>
<tr>
<td>SULIM</td>
<td>Sewer use limits</td>
</tr>
<tr>
<td>SWSSA</td>
<td>Sustainable Water and Sewage Systems Act</td>
</tr>
<tr>
<td>THC</td>
<td>Total hydrocarbon</td>
</tr>
<tr>
<td>THP</td>
<td>thermal hydrolysis process</td>
</tr>
<tr>
<td>TKN</td>
<td>Total Kjeldahl Nitrogen</td>
</tr>
<tr>
<td>TM</td>
<td>Technical Memorandum</td>
</tr>
<tr>
<td>TP</td>
<td>Total phosphorus</td>
</tr>
<tr>
<td>TS</td>
<td>Total solids</td>
</tr>
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<td>Technical steering committee</td>
</tr>
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<td>UV</td>
<td>Ultra-violet</td>
</tr>
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<td>VSS</td>
<td>Volatile Suspended Solids</td>
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<tr>
<td>WAS</td>
<td>Waste Activated Sludge</td>
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<tr>
<td>WPCP</td>
<td>Water pollution control plant</td>
</tr>
<tr>
<td>WTP</td>
<td>Water treatment plant</td>
</tr>
<tr>
<td>WWTP</td>
<td>Wastewater treatment plant</td>
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</table>
1. Introduction and Background

1.1 Introduction

The Region of Waterloo (Region) initiated a study in 2010 to update the previous Biosolids Master Plan (BMP) completed in 2003. The 2003 BMP directed biosolids management activities in the Region to the year 2021. The objective of the 2003 BMP was to develop a biosolids management strategy that would be environmentally sounds, cost effective, and able to adapt to changing requirements and conditions over the next 20 years.

The Region is updating its BMP in light of the Region’s recent growth, changes to the regulatory environment, climate change, available treatment technologies and disposal alternatives, their adoption of a new Environmental Sustainability Strategy, and the 2003 BMP’s recommendation that regular reviews are undertaken to confirm its applicability. The BMP update will help the Region to assess the status of its biosolids treatment, management, and disposal facilities; and reconfirm or develop a preferred biosolids management strategy, to the year 2041. This biosolids management strategy will be environmentally sustainable, economically viable, and maintainable over the long term.

1.1.1 Description of the Region of Waterloo

The Region is located in Southern Ontario. It comprises the urban municipalities of Cambridge, Kitchener, and Waterloo, as well as the rural townships of North Dumfries, Wellesley, Wilmot, and Woolwich. The total land area in the Region is 138,314 hectares (ha). These communities have a collective population of approximately 525,000, and the Region is one of the fastest growing areas in Ontario, as well as the fourth largest urban centre in Ontario (and the tenth largest in Canada). The Region is known for its leading-edge technology and advanced manufacturing industries, educational institutions, and vibrant agricultural communities.

1.2 Class Environmental Assessment Requirements

Ontario’s Environmental Assessment Act, 1975 (EAA) was passed in 1975 and first applied to municipalities in 1981. The EAA requires the study, documentation, and examination of the environmental effects that could result from various projects or activities.

The EAA’s objective is to consider the possible effects of these projects early in the planning process, when concerns can be easily resolved, and to select the preferred alternative with the fewest identified impacts.

The EAA defines “environment” very broadly as:

a) Air, land, or water

b) Plant and animal life, including humans

c) Social, economic, and cultural conditions that influence the life of humans or a community

d) Any building, structure, machine, or other device or thing made by humans
e) Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities

f) Any part or combination of the foregoing, and the interrelationships between any two or more of them, in or of Ontario

In applying the requirements of the EAA to projects, two types of Environmental Assessment (EA) planning and approval processes are identified:

1. **Individual EAs (Part II of the EAA):** Projects for which Terms of Reference and an individual EA are carried out and submitted to the Minister of the Environment for review and approval.

2. **Class EAs:** Projects are approved subject to compliance with an approved Class EA process. Provided that the appropriate Class EA approval process is followed, a proponent will be compliant with the requirements of the EAA.

The *Municipal Class Environmental Assessment* (Class EA) document prepared by the Municipal Engineer’s Association (MEA) in October 2000, as amended in 2007 is an approved Class EA process. There are five phases of assessment in the Class EA document. The five phases include:

- **Phase 1** Definition of the Problem
- **Phase 2** Identification and Assessment of Alternative Solutions, and Selection of a Preferred Solution
- **Phase 3** Identification and Assessment of Alternative Sites/Design Concepts, and Selection of a Preferred Site/Design
- **Phase 4** Preparation of an Environmental Study Report (ESR)
- **Phase 5** Implementation

The Class EA process as outlined in the *Municipal Class Environmental Assessment* document is shown in Exhibit 1-1.

The Class EA document places projects into three possible schedules, ‘A’, ‘B’, or ‘C’, depending on the project’s characteristics. The schedule under which a project falls determines the planning and design phases that must be followed.

**Schedule A** projects are minor operational and upgrade activities and may go ahead without further assessment once Phase 1 of the Class EA process is complete (that is, the problem is reviewed and a solution is confirmed). Schedule A+ projects are similar to Schedule A projects, but require stakeholder notification before implementation.

**Schedule B** projects must proceed through the first two phases of the process. Proponents must identify and assess alternative solutions to the problem, inventory impacts, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided that no significant impacts are found and no requests are received to elevate the project to Schedule C or undertake the project as an Individual EA (Part II Order), the project may proceed to detailed design (Phase 5).
Exhibit 1-1
Municipal Class Environmental Planning and Design Process
[From: MEA (October 2000, as amended in 2007)]

 NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA

---

![Flowchart Image]
Schedule C projects require more detailed study, public consultation, and documentation, as they may have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of assessment. An ESR must be completed and available for a 30-day public review period, prior to proceeding to implementation (Phase 5).

1.2.1 Master Planning Process

Master plans are long-range plans that examine the current and future requirements of a given infrastructure system using EA planning principles. At a minimum, master plans must address Phases 1 and 2 of the Class EA process as described above and shown in Exhibit 1-1. Master plans provide a framework for planning a group of related projects that are required to accommodate demands on a system over a long period of time.

The master planning process allows a municipality to identify the need for specific projects under a broad planning framework. A master plan should be reviewed every 5 years to determine the need for detailed review and updates. Specific projects identified in the master plan may require additional Class EA planning and approvals prior to their implementation.

1.3 Project Approach

The BMP was completed in a comprehensive, integrated manner. A detailed decision-making process and consultation plan were developed to incorporate various influences, considerations, and stakeholder input into the master planning process.

The detailed decision-making process follows Phases 1 and 2 of the Municipal Class EA process. The approach prescribed for these phases was further refined to assist in the master planning process for the Region’s BMP. The refined processes used in the development of the BMP are illustrated in Exhibit 1-2. Key components of the decision-making process included:

- Problem definition
- Review and documentation of existing conditions
- Future needs and constraints
- Development and evaluation of alternatives
- Recommended alternatives
- Recommended strategy
- Development of the BMP

Consultation with stakeholders and the public was a critical component of the master planning process, from the initial stages through to the final recommended strategy. The key consultation milestones have been integrated with the decision-making process in Exhibit 1-2.

Phase 1 technical activities included initial data gathering to determine the current biosolids management situation in the Region, and future capacity requirements. This information was used to help define the BMP’s goals and objectives. The key project initiation activities in Phase 1 included developing and launching the consultation program. Public consultation activities included publishing a Notice of Master Plan Commencement, notifying key government review agencies and forming the Project Team (PT), a Project Steering Committee (PSC) and a Stakeholder Advisory Committee (SAC). Appendix A provides the agency and project mailing lists, as well as materials related to the Notice of Master Plan Commencement.
Exhibit 1-2
Planning Process for the Region of Waterloo Master Plan Approach

Class EA Phase 1

<table>
<thead>
<tr>
<th>Problem Definition</th>
<th>Review and Documentation of Existing Conditions</th>
<th>Future Needs &amp; Constraints</th>
<th>Develop and Evaluate Alternatives</th>
<th>Recommend Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement Process</td>
<td>Detailed Data Collection</td>
<td>BioWin GHG Worksheets</td>
<td>Technical, Environmental, Social, Economic Impacts</td>
<td>BMP Tool Kit®</td>
</tr>
<tr>
<td>Identify Purpose, Objectives, Approach</td>
<td>Assess Current and Future Biosolids Generation</td>
<td>Current and Short Term Biosolids</td>
<td>Define Evaluation Criteria</td>
<td>Confirm Recommended</td>
</tr>
<tr>
<td>Initial Data Collection and Review</td>
<td>Determine Future Land Availability</td>
<td>Situation</td>
<td>Screen Long-List of BM Alternatives</td>
<td>BM Strategy</td>
</tr>
<tr>
<td>Project Team Meeting No. 1 - Kick-off</td>
<td>Tech. Memo No. 1</td>
<td>BioWin GHG Analysis of Alternatives</td>
<td>Define Preferred BM Alternatives</td>
<td>Alternatives</td>
</tr>
<tr>
<td>Establish Steering Committee</td>
<td>Current and Short Term</td>
<td>Evaluation of Definable Options</td>
<td>Develop Implementation Plan</td>
<td></td>
</tr>
<tr>
<td>Steering Committee Meeting No. 1</td>
<td>Biosolids Management</td>
<td>Long-List Workshop</td>
<td>Develop Risk Management Plan</td>
<td></td>
</tr>
<tr>
<td>Project Team Meeting No. 2</td>
<td>Review Biosolids Management</td>
<td>Detailed LCA Evaluation of Long-List</td>
<td>Project Team Meeting No. 11</td>
<td></td>
</tr>
<tr>
<td>Establish Stakeholder Group and Contact List</td>
<td>Information Gap Analysis</td>
<td>Tech. Memo No. 7</td>
<td>Project Team Meeting No. 12</td>
<td></td>
</tr>
<tr>
<td>Project Team Meeting No. 3</td>
<td>Project Team Meeting No. 4</td>
<td>Project Team Meeting No. 13</td>
<td>Project Team Meeting No. 13</td>
<td></td>
</tr>
<tr>
<td>Project Team Meeting No. 5</td>
<td>Steering Committee Meeting No. 2</td>
<td>Project Team Meeting No. 10</td>
<td>Project Team Meeting No. 14</td>
<td></td>
</tr>
<tr>
<td>Project Team Meeting No. 6</td>
<td>Stakeholder Meeting No. 1</td>
<td>Stakeholder Meeting No. 2</td>
<td>Steering Committee Meeting No. 5</td>
<td></td>
</tr>
<tr>
<td>Project Team Meeting No. 7</td>
<td>PIC No. 1 - Project Overview</td>
<td>Steering Committee Meeting No. 4</td>
<td>Steering Committee Meeting No. 3</td>
<td></td>
</tr>
<tr>
<td>Newsletter No. 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Documentation

- Prepare Draft Master Plan Report
- Prepare Final Master Plan Report
- Project Team Meeting No. 14
- Project Team Meeting No. 15
- Project Team Meeting No. 16
- Steering Committee No. 6
- Stakeholder Meeting No. 3
- EA Master Plan Completion

Legend
- Task
- Meeting
- Consultation

January 2010

- Project Overview
- Newsletter No. 1
Phase 2 activities included several component tasks focused on the development of a long list of potential biosolids treatment options, biosolids products, and end use alternatives. The screening of the long list of alternatives and the development of management strategies was accomplished by combining treatment technologies, products, and end uses, then conducting a more detailed evaluation of the resulting short list of strategy alternatives. The steps in the screening exercise were as follows:

1. Develop screening criteria and apply these criteria to the long list of alternatives. This was a “fatal flaw” analysis in which an alternative treatment technology, product, or end use had to meet all of the fatal flaw criteria to be carried forward to the detailed evaluation. The detailed evaluation utilized a wide range of criteria developed to allow the selection of a short list of technology, product, and end use options.

2. Develop biosolids management strategies using the short list of technology, product, and end use options and use a multi-criteria decision tool for a more detailed evaluation and assessment to determine a preferred strategy.

1.4 Project Organization

The PT included staff from the Region and CH2M HILL. The PSC included staff from the Region and CH2M HILL, as well as council members from the Cities of Cambridge, Kitchener, and Waterloo, the Township of Wellesley, and the Region. The SAC included staff from the Region and CH2M HILL, as well as members of the public from a variety of sectors including business/industry, environment and public health, agriculture, municipalities, and the community-at-large.

The PT worked collaboratively with the PSC and the SAC. The PT received input from the public through Public Information Centres (PICs) and the SAC. The PSC provided recommendations to the PT, who made the recommendation for endorsement of the BMP to Regional Council.

1.5 Stakeholder Participation

The development of this BMP included stakeholder participation through the formation of the SAC and the holding of PICs that informed the PT.

1.5.1 Project Team

The PT was responsible for managing the project, advising on the master planning process, and contributing to key deliberations on recommendations. PT members included representatives from the Region and CH2M HILL.

The PT included the following members:

- The Region
  - José Bicudo, Regional Project Manager (Water Services)
  - Jorge Cavalcante (Manager, Engineering and Planning, Water Services)
  - Donna Serrati (Design & Construction)
  - Trevor Brown (Manager, Wastewater Operations, Water Services)
  - Sanchari Quader (Planning – Strategic Policy Unit)
CH2M HILL

- Peter Burrowes, Technical Lead
- Tom Mahood, Project Manager
- Diana Vangelisti, Master Plan and Consultation Lead
- Monique Waller, EA and Engineering Support
- Jillian Werner, Engineering Support
- Sally Baldwin, Engineering Support
- Laura Seaman, Engineering Support

The PT held ten meetings over the course of the BMP preparation. Appendix B includes meeting materials and minutes for the PT meetings.

1.5.2 Project Steering Committee

The purpose of the PSC is to provide advice and feedback to the PT at key milestone points during the study. The PSC members provided representation from the Region, the Cities, and the Townships within the Region.

The PSC included the following members:

- The Region
  - José Bicudo, Water Services
  - Jorge Cavalcante, Water Services
  - Donna Serrati, Design & Construction
  - Sanchari Quader, Planning (Strategic Policy Unit)
  - Tracy Annett, Waste Management
  - Trevor Brown, Wastewater Operations
  - Nancy Kodousek, Director of Water Services
  - Thomas Schmidt, Commissioner of Transportation and Environmental Services
  - Kevin Kurtis, Planning, Housing and Community Services
  - Jim Wideman, Regional Councilor
  - Kim Denouden, Regional Councilor
  - Jan d’Ailly, City of Waterloo Councilor
  - Angela Vieth, City of Waterloo Councilor
  - Karl Kiefer, City of Cambridge Councilor
  - Linda Whetham, City of Cambridge Councilor
  - Frank Monteiro, City of Cambridge Councilor
  - Terry Broda, Township of Wilmot Councilor
  - Paul Hergott, Township of Wellesley Councilor

- CH2M HILL
  - Peter Burrowes, Technical Lead
  - Tom Mahood, Project Manager
  - Diana Vangelisti, Master Plan and Consultation Lead
  - Monique Waller, EA and Engineering Support
  - Jillian Werner, Engineering Support
  - Sally Baldwin, Engineering Support
The PSC held five meetings over the course of the BMP preparation. Appendix C includes meeting materials and minutes for the PSC meetings.

1.5.3 Stakeholder Advisory Committee

The SAC was established with the mandate to provide the public perspective on the BMP throughout its development. This committee was responsible for providing advice and feedback to the PT at key milestones over the course of the study, including providing feedback on the following components:

- The Master Plan Mission Statement
- Key issues and context for the BMP decision-making process
- Existing conditions and current biosolids management practices
- Master plan evaluation methodology and decision-making criteria
- Consultation activities and results
- Related project issues and items as may have been identified through the study

The SAC members are shown in Exhibit 1-3.

<table>
<thead>
<tr>
<th>Community Sector</th>
<th>Representative</th>
<th>Organization</th>
</tr>
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<tbody>
<tr>
<td>Business/Industry</td>
<td>Art Sinclair</td>
<td>Greater Kitchener-Waterloo Chamber of Commerce</td>
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<td>Corey Wells</td>
<td>Sustainable Waterloo</td>
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<td>Environment and Public</td>
<td>Dr. Wayne Parker</td>
<td>University of Waterloo</td>
</tr>
<tr>
<td>Health</td>
<td>Dave Bray/Greta Najcler</td>
<td>Ministry of the Environment, Guelph District Office</td>
</tr>
<tr>
<td></td>
<td>Mark Anderson</td>
<td>Grand River Conservation Authority</td>
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<td></td>
<td>Dave Young</td>
<td>Waterloo Region Public Health</td>
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<td></td>
<td>Stewart Cressman</td>
<td>Ontario Pork Producers</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Fred Wagner</td>
<td>Federation of Agriculture</td>
</tr>
<tr>
<td></td>
<td>Jake DeBruyn</td>
<td>Ontario Ministry of Agriculture, Food, and Rural Affairs</td>
</tr>
<tr>
<td>Community-at-Large</td>
<td>Wolfgang Pfenning</td>
<td>Waterloo Region Food Round Table</td>
</tr>
<tr>
<td></td>
<td>Dr. Owen Ward</td>
<td>University of Waterloo</td>
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<tr>
<td>Municipalities</td>
<td>Shailesh Shah</td>
<td>City of Kitchener</td>
</tr>
<tr>
<td></td>
<td>Bill Garibaldi/Denise McGoldrick</td>
<td>City of Waterloo</td>
</tr>
<tr>
<td></td>
<td>Deb Zehr</td>
<td>City of Waterloo</td>
</tr>
<tr>
<td></td>
<td>George Elliott</td>
<td>City of Cambridge</td>
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<tr>
<td></td>
<td>Roger Mordue</td>
<td>Township of North Dumfries</td>
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<td></td>
<td>Gary Charbonneau</td>
<td>Township of Wilmot</td>
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<td></td>
<td>Dan Kennaley</td>
<td>Township of Woolwich</td>
</tr>
<tr>
<td></td>
<td>Willis MacLaughlin</td>
<td>Township of Wellesley</td>
</tr>
</tbody>
</table>
Appendix D includes the Terms of Reference for the SAC; three SAC meetings were held over the course of the BMP preparation. The meeting minutes and materials can be found in Appendix C.

### 1.5.4 Public Participation

The preparation of the BMP included two sets of PICs in which the Region’s citizens could review the project’s progress and provide comments, voice concerns, and ask questions regarding the alternative strategies that were in development. Input from the public was received during informal discussions at the PICs, and from written submissions. Two sets of PICs were held over the course of the BMP preparation at three different locations within the Region for each set of PICs. Appendix E includes materials from the PICs and comments received from the public through these forums.

### 1.5.5 Agency Participation

Review agencies were notified of the BMP study and were engaged at key milestones during the BMP decision-making process. These agencies reviewed and provided feedback on study information, according to their agency mandates.

Appendix A provides agency notifications and correspondence.
2. **Rationale for the Project**

2.1 **Purpose of the Project**

The purpose of this project is to develop a BMP to direct biosolids management activities in the Region to the year 2041. The project objective statement developed for the 2003 BMP was as follows:

> Developing a Biosolids Management Strategy that will be environmentally healthy, cost effective and able to adapt to changing requirement and conditions over the next twenty years. Public acceptability will be important to ensure the continued success of the program.

In the six years following the 2003 BMP, the Region’s project objective statement has evolved to the following:

> Recommending appropriate management strategies that are environmentally sustainable, economically viable and can be maintained in the long-term. In addition, the master plan shall meet the regulatory requirements and be supported by stakeholders and the Regional Council.

This project provides the Region with the opportunity to review its biosolids management program and to plan for the future needs of the Region. Since the 2003 BMP was adopted, the regulatory environment has changed significantly (including new regulations). The Region has also grown since the 2003 BMP and has expanded its infrastructure to support this growth and implement the Environmental Sustainability Strategy. The BMP update allows the Region to:

- Respond to the changing regulatory environment and growth within the Region
- Refine the path forward for its biosolids management to take advantage of the infrastructure investments made since the 2003 BMP

2.2 **Goals and Objectives**

The goal of this study was to recommend to the Region a biosolids management strategy that is supported and endorsed by stakeholders and, ultimately, by Regional Council. This goal is accomplished by reviewing the current practices and works completed in the previous 2003 BMP, then evaluating and building on those recommendations to provide the Region with a sustainable path forward for its biosolids management program.

The objectives in meeting this goal were to facilitate the involvement of stakeholders throughout the study; to assess alternative management strategies in the context of Regional capital planning, sustainability, and diversity; and to recommend a preferred biosolids management strategy.

2.3 **Planning Period and Study Area**

This study included all lands within the Waterloo Region. Exhibit 2-1 shows the Waterloo Region and the locations of the Region’s wastewater treatment plants (WWTPs). Exhibit 2-2 shows the current biosolids management practices by corresponding WWTP.
Exhibit 2-1
Study Area and Locations of the Region's WWTPs
Exhibit 2-2
Current Biosolids Management in the Region

1. Elmira WWTP
2. Conestogo WWTP
3. Heidelberg WWTP
4. Waterloo WWTP
5. Preston WWTP
6. Galt WWTP
7. Kitchener WWTP
8. Ayr WWTP
9. Hespeler WWTP
10. St. Jacobs WWTP
11. Wellesley WWTP
12. New Hamburg WWTP
13. Foxboro Green WWTP

Legend:
- Green: WWTPs without solids stabilization
- Orange: WWTPs with Anaerobic Digestion
- Yellow: WWTPs with Aerobic Digestion
- Light Blue: Lagoons
- Purple: Onsite dewatering
- Red: Liquid biosolids
- Brown: Dewatered biosolids
- Green: Septage

Landfill Disposal
Dewatering
Storage Lagoons
Manitou Drive Transfer Station
Dewatering (under construction)
Land Application
Region's Septage
3. Existing Conditions

3.1 Wastewater Treatment Systems

3.1.1 Description of Wastewater Treatment Plants

The Region owns 13 WWTPs; a brief description of each is provided below. The WWTPs are operated under a contract by the Ontario Clean Water Agency (OCWA).

Exhibit 3-1 outlines the companies who have contracts with the Region for haulage and/or disposal of biosolids.

Exhibit 3-1
Summary of Contracted Companies for Haulage and/or Disposal of Biosolids

<table>
<thead>
<tr>
<th>Description</th>
<th>Contracted Company</th>
<th>Methodology</th>
<th>Location(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayr WWTP</td>
<td>Bio-Ag Services Inc.</td>
<td>Land Application</td>
<td>Various within the Region</td>
</tr>
<tr>
<td>Conestogo WWTP</td>
<td>Weber Septic</td>
<td>Transfer</td>
<td>Waterloo WWTP</td>
</tr>
<tr>
<td>Elmira WWTP</td>
<td>WSI</td>
<td>Landfilling</td>
<td>BFI Ridgetown Landfill 20262 Erieau Road, Blenheim, ON via Sittler Transfer Station</td>
</tr>
<tr>
<td>Foxboro Green</td>
<td>Entec/JTC</td>
<td>Transfer</td>
<td>New Hamburg WWTP</td>
</tr>
<tr>
<td>Galt WWTP</td>
<td>Waste Management</td>
<td>Landfilling</td>
<td>Waste Management Petrolia Landfill 4052 Oil Heritage Rd, Petrolia, ON</td>
</tr>
<tr>
<td>Heidelberg WWTP</td>
<td>Weber Septic</td>
<td>Transfer</td>
<td>Waterloo WWTP</td>
</tr>
<tr>
<td>Hespeler WWTP</td>
<td>JTC Group</td>
<td>Transfer</td>
<td>New Hamburg WWTP</td>
</tr>
<tr>
<td>Kitchener WWTP</td>
<td>Terratec Environmental Ltd.</td>
<td>Landfilling</td>
<td>BFI Ridgetown Landfill 20262 Erieau Road, Blenheim, ON via Sittler Transfer Station</td>
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<tr>
<td>New Hamburg WWTP</td>
<td>Bio-Ag Services Inc.</td>
<td>Land Application</td>
<td>Various within the Region</td>
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<tr>
<td>Preston WWTP</td>
<td>Wessuc Inc.</td>
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<td>American Process Group</td>
<td>Landfilling</td>
<td>Waste Management Petrolia Landfill 4052 Oil Heritage Rd, Petrolia, ON</td>
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<tr>
<td>Wellesley WWTP</td>
<td>JTC Group</td>
<td>Transfer</td>
<td>New Hamburg WWTP</td>
</tr>
</tbody>
</table>

Note 1: Sludge is withdrawn on an as-needed basis; therefore, the company is selected based on availability.
Note 2: Interim dewatering is included in the capital upgrades contract, cake disposal is subcontracted to Waste Management.

Based on 2009 influent wastewater flow rates, three plants within the Region treat 83 percent of the wastewater generated within the Region. These three plants are Kitchener, Waterloo, and
Galt which treat 39 percent, 24 percent and 20 percent, respectively. The remaining ten plants treat 17 percent of the flow.

The Region’s WWTPs are described in greater detail in *Technical Memorandum 1: Future Biosolids Generation and Assessment of Agricultural Land Inventory* (TM 1), which can be found in Appendix G. Exhibit 3-2 shows the treatment practices employed at each of the Region’s WWTPs.

**Exhibit 3-2**
Region WWTP Treatment Practices

<table>
<thead>
<tr>
<th>Treatment Goal</th>
<th>Preliminary Treatment</th>
<th>Primary Treatment</th>
<th>Secondary Treatment</th>
<th>Tertiary Treatment</th>
<th>Disinfection</th>
<th>Residuals Stabilization</th>
<th>Biosolids Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of large, coarse, heavy solids (e.g., rags, grit) to protect treatment equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of settleable solids, including scum and grease that float</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further removal of solids and nutrients; aeration is usually required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effluent polishing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kill/inactivate harmful bacteria, viruses, and other pathogens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce the mass, odours, and pathogens; energy recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce the volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 Existing Biosolids Management Plan

#### 3.2.1 What are Biosolids?

Biosolids are an end product from the processes used to treat wastewater. Biosolids are primarily organic and are of a quality that can be beneficially used for their nutrient, soil conditioning, or fuel properties. Beneficial practices include land application of biosolids as a soil amendment or fertilizer supplement, and a variety of procedures that derive energy from biosolids or convert them to useful products. The Region’s liquid biosolids are land applied to agricultural lands by contractors.

#### 3.2.2 Biosolids Management in Other Jurisdictions

The Canadian Council of Minister of the Environment (CCME) Biosolids Task Force estimates that Canada produces 660,000 dry tonnes per year (dt/year) of biosolids (CCME, 2009). In most provinces, more than 80 percent of biosolids are land applied. In Ontario, about 40 percent of biosolids are land applied, about 40 percent landfilled, and the rest incinerated. In Quebec, about 27 percent of biosolids is land applied, 31 percent landfilled and the rest – about 42 percent – is incinerated. Exhibit 3-3 summarizes the biosolids management programs used in other jurisdictions.
### Exhibit 3-3
**Summary of Biosolids Management in Other Jurisdictions**

<table>
<thead>
<tr>
<th>Jurisdictions</th>
<th>WWTP Biosolids Process &amp; Destination(s)</th>
<th>Contingency Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Region of Waterloo Neighbours</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Hamilton¹</td>
<td>The City of Hamilton generates about 19,700 dt/year of biosolids. The Woodward Ave WWTP includes waste-activated sludge (WAS) thickening, anaerobic digestion, and centrifuge dewatering processes. Biosolids are land applied. The City’s recent Biosolids Management Plan recommends incineration with energy recovery in the future.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Guelph¹</td>
<td>The City of Guelph generates about 3,650 dt/year of biosolids. Processes used at the Guelph WWTP includes WAS thickening, anaerobic digestion, belt filter press dewatering, and Lystek processing. The Lystek product is land applied seasonally and dewatered biosolids are landfilled when land application is not possible (during winter).</td>
<td>Landfill</td>
</tr>
<tr>
<td>Region of Halton²</td>
<td>The Region of Halton generates about 11,000 dt/year of biosolids. It has seven WWTPs (five anaerobic digestion and two aerobic digestion), and a Biosolids Management Centre for liquid storage. Biosolids are digested, land applied as liquid, and dewatered; dewatered cake is stored and land applied. The Region of Halton is currently finalizing its biosolids master plan.</td>
<td>Landfill</td>
</tr>
<tr>
<td>County of Oxford</td>
<td>Oxford County generates about 1,600 dt/year of biosolids. There are nine WWTPs, four are mechanical (two anaerobic, two aerobic), dewatering is installed at three of the mechanical plants. There is also a Biosolids Centralized Storage Facility. Liquid and dewatered land application of digested biosolids is the preferred disposal method.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Brantford¹</td>
<td>The City of Brantford generates about 3,000 dt/year of biosolids. Digested biosolids are land applied.</td>
<td>Contract dewatering and landfill</td>
</tr>
<tr>
<td>County of Perth</td>
<td>Biosolids in the County of Perth are managed by the various municipalities; no information was available on volumes, quantities, or destination. The Town of St. Mary’s is adopting the Lystek process at their WWTP.</td>
<td></td>
</tr>
<tr>
<td><strong>Southern Ontario</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niagara Region</td>
<td>Niagara Region generates about 9,500 dt/year of biosolids. There are 13 WWTPs in the Region. Processes used in the Region include anaerobic and aerobic digestion. There is a central storage and centrifuge dewatering facility. Liquid application and alkaline stabilization (N-Viro) (when dewatered) are the preferred methods of disposing of digested biosolids.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of London¹</td>
<td>The City of London generates about 17,000 dt/year of biosolids. There are six WWTPs. Solids are hauled as liquid to, and processed at Greenway WWTP by belt filter press dewatering and incineration.</td>
<td>Alkaline stabilization (Schwing Bioset) and landfill</td>
</tr>
<tr>
<td>City of Sarnia¹</td>
<td>The City of Sarnia produces about 10,000 dt/year of biosolids. Processes used include centrifuge dewatering and alkaline stabilization (N-Viro). The product is sold through an agricultural cooperative as a soil amendment.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Leamington¹</td>
<td>The City of Leamington generates about 11,000 dt/year of biosolids. Treatment processes used include centrifuge dewatering and alkaline stabilization (N-Viro Process). The product is sold through an agricultural cooperative as a soil amendment.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Region of Peel¹</td>
<td>The Region of Peel generates about 55,000 dt/year of biosolids. The Region has two WWTPs. Solids are processed at the Lakeview WWTP. WAS thickening, centrifuge dewatering, and fluid bed incineration are the processes used to treat biosolids. Incineration and onsite ash disposal is the preferred method of disposal.</td>
<td>Landfill</td>
</tr>
</tbody>
</table>
### Exhibit 3-3
#### Summary of Biosolids Management in Other Jurisdictions

<table>
<thead>
<tr>
<th>Jurisdictions</th>
<th>WWTP Biosolids Process &amp; Destination(s)</th>
<th>Contingency Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durham Region</td>
<td>Durham Region generates about 37,000 dt/year of biosolids. There are seven WWTPs in the Region. Processes include anaerobic and aerobic digestion, with centrifuge dewatering and fluid bed incineration with energy recovery at Duffin Creek WWTP. Digested biosolids are land applied as liquid; excess biosolids generated are stored and/or incinerated. Winter storage and incineration of biosolids which cannot be stored at Duffin Creek WWTP are also used for disposal. Ash from the incineration process is used in cement manufacturing. York Region sends most of their wastewater and biosolids from the WWTPs in York Region to the Duffin Creek WWTP for incineration as well, representing approximately 40,000 dt/year.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Windsor</td>
<td>The City of Windsor generates about 10,300 dt/year of biosolids. There are two WWTPs. Processes used to treat the biosolids include centrifuge dewatering and heat drying (Prism Berlie). Dried biosolids are land applied.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Other Ontario Centres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Kingston</td>
<td>The City of Kingston generates about 2,400 dt/year of biosolids. There are two WWTPs. Anaerobic digestion and centrifuge dewatering are the processes used to treat the biosolids. Digested, dewatered biosolids are land applied. Dewatered biosolids are stored during the winter.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Barrie</td>
<td>The City of Barrie generates about 3,000 dt/year of biosolids. The treatment processes used are anaerobic digestion and off-site storage. Digested biosolids are land applied as liquid.</td>
<td>Contract dewatering and landfill</td>
</tr>
<tr>
<td>City of Toronto</td>
<td>The City of Toronto generates about 54,500 dt/year of biosolids. Toronto has four WWTPs. The treatment processes used are anaerobic digestion, centrifuge dewatering, heat drying and multiple hearth incineration. Land application of dewatered and dried biosolids, and landfilling of ash are the preferred methods of disposal.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Ottawa</td>
<td>The City of Ottawa generates about 14,500 dt/year of biosolids. WAS thickening, anaerobic digestion, and centrifuge dewatering are the treatment processes used. Digested, dewatered biosolids are land applied.</td>
<td>Landfill</td>
</tr>
<tr>
<td>City of Sudbury</td>
<td>The City of Sudbury generates about 4,500 dt/year of biosolids. The biosolids are used in land reclamation (of mine tailing ponds) with liquid WAS from nine WWTPs. The city is currently soliciting design/build (DB) firms to construct a biosolids management facility to produce a Class A product. The City of Sudbury currently does not have winter storage.</td>
<td>NA</td>
</tr>
<tr>
<td>Other Canadian Centres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancouver, BC</td>
<td>Vancouver generates about 21,000 dt/year of biosolids. There are five WWTPs. The biosolids are treated through thermophylic and mesophylic anaerobic and aerobic digestion, and dewatering. Disposal options include land application of cake, land reclamation, and landfilling. Metro Vancouver is evaluating their long-term strategy.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Calgary, AB</td>
<td>Calgary generates about 24,500 dt/year of biosolids. There are three WWTPs. Biosolids are treated via anaerobic digestion, with off-site biosolids storage. Treated material is land applied as liquid.</td>
<td>Contract dewatering and landfill</td>
</tr>
<tr>
<td>Edmonton, AB</td>
<td>Edmonton generates about 27,000 dt/year of biosolids. There are two WWTPs. Treatment processes include anaerobic digestion and there is a waste management centre for storage and dewatering. There is also a full scale demonstration Ostara unit for the recovery of phosphorous. Treated material is land applied and co-composted with municipal solid waste (MSW).</td>
<td>Landfill</td>
</tr>
</tbody>
</table>
### Exhibit 3-3
**Summary of Biosolids Management in Other Jurisdictions**

<table>
<thead>
<tr>
<th>Jurisdictions</th>
<th>WWTP Biosolids Process &amp; Destination(s)</th>
<th>Contingency Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winnipeg, MB¹</td>
<td>Winnipeg generates about 14,500 dt/year of biosolids. There are three WWTPs. Anaerobic digestion and centrifuge dewatering are the treatment processes used. Dewatered, digested biosolids are land applied, year-round.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Moncton, NB¹</td>
<td>Moncton generates about 3,000 dt/year of biosolids. Biosolids are dewatered by centrifuge, lime stabilized, and most biosolids are land applied. Some biosolids are composted at commercial sites. The compost product is marketed directly by the commercial compost facility.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Montreal, QC¹</td>
<td>Montreal generates about 100,000 dt/year of biosolids. The biosolids are treated through filter press and rotary press dewatering. Heat drying and incineration of biosolids are the preferred methods of disposal.</td>
<td>Landfill</td>
</tr>
<tr>
<td>Laval, QC</td>
<td>Laval produces about 13,000 dt/year of biosolids. There are three WWTPs. The material is treated through rotary press dewatering and heat drying. The product is distributed by a third party contractor.</td>
<td>Landfill</td>
</tr>
</tbody>
</table>

**Notes:**

Biosolids management in other jurisdictions is discussed in greater detail in Technical Memorandum 2.0: Current and Short-term Biosolids Situation (TM2), which can be found in Appendix H.

### 3.2.3 Biosolids Quality

Under the Nutrient Management Act (NMA) the Region is permitted to land apply biosolids that meet specified quality criteria in a manner consistent with the practices acceptable under the NMA and its regulations.

Key amendments that took effect on January 1, 2011 include an agronomic-based application rate (based on matching the nitrogen and phosphorus crop requirements with the nitrogen and phosphorus supplied by the biosolids) and setbacks from sensitive features, including wells, residences, surface water, and groundwater inlets. Moving from a solids-based application rate (most programs are familiar with the current limit of 8 dry tonnes per hectare [dt/ha] every 5 years) to an agronomic approach will result in greater application volumes in some scenarios and lesser in others (with a maximum limit of 22 dt/ha every 5 years for biosolids).

Exhibit 3-4 displays the biosolids quality data for the Region’s WWTPs as recorded by the operator. Exhibit 3-5 displays the quality requirements for CM1 and CM2 biosolids land application categories and indicates if the Region’s biosolids meet the quality requirements. The definitions of these categories are discussed in detail in Technical Memorandum 4: Opportunities and Constraints (TM4), which can be found in Appendix I.

Exhibit 3-5 shows that the Region’s biosolids meet the requirements for category CM1, indicating that the biosolids can be applied at a maximum rate of 22 dt/ha.
### Exhibit 3-4

2007 – 2009 Maximum and Average Concentration of Metals for the Region’s WWTPs

<table>
<thead>
<tr>
<th></th>
<th>Arsenic</th>
<th>Cadmium</th>
<th>Cobalt</th>
<th>Chromium</th>
<th>Copper</th>
<th>Mercury</th>
<th>Molybdenum</th>
<th>Nickel</th>
<th>Lead</th>
<th>Selenium</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Avg</td>
<td>Max</td>
<td>Avg</td>
<td>Max</td>
<td>Avg</td>
<td>Max</td>
<td>Avg</td>
<td>Max</td>
<td>Avg</td>
<td>Max</td>
</tr>
<tr>
<td>Heidelberg</td>
<td>0.63</td>
<td>0.26</td>
<td>0.10</td>
<td>0.11</td>
<td>1.75</td>
<td>0.42</td>
<td>25.20</td>
<td>11.10</td>
<td>0.01</td>
<td>0.00</td>
<td>0.12</td>
</tr>
<tr>
<td>Ayr - Lagoons</td>
<td>0.63</td>
<td>0.28</td>
<td>0.10</td>
<td>0.11</td>
<td>6.89</td>
<td>1.65</td>
<td>33.70</td>
<td>12.67</td>
<td>0.07</td>
<td>0.01</td>
<td>0.63</td>
</tr>
<tr>
<td>Conestogo</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>3.55</td>
<td>1.48</td>
<td>16.60</td>
<td>5.87</td>
<td>0.40</td>
<td>0.09</td>
<td>0.10</td>
</tr>
<tr>
<td>Galt</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>3.09</td>
<td>0.27</td>
<td>6.71</td>
<td>3.47</td>
<td>0.02</td>
<td>0.01</td>
<td>0.52</td>
</tr>
<tr>
<td>Hespeler</td>
<td>0.20</td>
<td>0.19</td>
<td>0.10</td>
<td>0.10</td>
<td>1.98</td>
<td>0.73</td>
<td>17.80</td>
<td>6.85</td>
<td>0.03</td>
<td>0.01</td>
<td>0.41</td>
</tr>
<tr>
<td>Kitchener (Lagoon)</td>
<td>0.24</td>
<td>0.20</td>
<td>0.12</td>
<td>0.10</td>
<td>0.18</td>
<td>0.11</td>
<td>7.15</td>
<td>3.12</td>
<td>0.30</td>
<td>0.03</td>
<td>0.45</td>
</tr>
<tr>
<td>Kitchener (Digester)</td>
<td>0.20</td>
<td>0.20</td>
<td>0.11</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>2.44</td>
<td>1.11</td>
<td>0.33</td>
<td>0.03</td>
<td>0.36</td>
</tr>
<tr>
<td>New Hamburg</td>
<td>0.30</td>
<td>0.20</td>
<td>0.10</td>
<td>0.11</td>
<td>0.18</td>
<td>0.11</td>
<td>2.02</td>
<td>0.99</td>
<td>16.48</td>
<td>8.41</td>
<td>14.13</td>
</tr>
<tr>
<td>Preston</td>
<td>3.89</td>
<td>0.30</td>
<td>0.10</td>
<td>0.10</td>
<td>0.16</td>
<td>0.10</td>
<td>2.18</td>
<td>1.11</td>
<td>30.47</td>
<td>10.25</td>
<td>0.01</td>
</tr>
<tr>
<td>St. Jacobs</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>0.12</td>
<td>0.10</td>
<td>1.38</td>
<td>0.92</td>
<td>23.10</td>
<td>14.85</td>
<td>0.01</td>
</tr>
<tr>
<td>Waterloo</td>
<td>0.24</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>0.43</td>
<td>0.15</td>
<td>2.57</td>
<td>1.53</td>
<td>43.60</td>
<td>27.87</td>
<td>0.05</td>
</tr>
<tr>
<td>Wellesley</td>
<td>0.63</td>
<td>0.35</td>
<td>0.10</td>
<td>0.10</td>
<td>0.19</td>
<td>0.11</td>
<td>1.75</td>
<td>0.31</td>
<td>46.90</td>
<td>12.45</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**Notes:**
1. No biosolids data was provided for the Elmira or Foxboro Green WWTPs.
2. All units are in milligrams per kilogram (mg/kg).
### Exhibit 3-5
Review of Region’s Biosolids Quality Data with Respect to the NMA 2011 quality requirements (Maximum of monthly samples for 2007-2009)

<table>
<thead>
<tr>
<th></th>
<th>Arsenic</th>
<th>Cadmium</th>
<th>Cobalt</th>
<th>Chromium</th>
<th>Copper</th>
<th>Mercury</th>
<th>Molybdenum</th>
<th>Nickel</th>
<th>Lead</th>
<th>Selenium</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM1</td>
<td>13</td>
<td>3</td>
<td>34</td>
<td>210</td>
<td>100</td>
<td>0.8</td>
<td>5</td>
<td>62</td>
<td>150</td>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td>CM2</td>
<td>170</td>
<td>24</td>
<td>340</td>
<td>2,800</td>
<td>1,700</td>
<td>11</td>
<td>94</td>
<td>420</td>
<td>1,100</td>
<td>34</td>
<td>4,200</td>
</tr>
</tbody>
</table>

Heidelburg | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Ayr - Lagoons | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Conestogo | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Galt | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Hespeler | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Kitchener (Lagoon) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Kitchener (Digester) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
New Hamburg | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Preston | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
St. Jacobs | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Waterloo | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
Wellesley | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Notes:**
1. The four sample rolling average for the maximum mercury value exceeded CM1 requirements; however, the typical rolling average for New Hamburg meets CM1 requirements. It is likely that this data point is an outlier.
2. One data point exceeded the CM1 limit, the four sample rolling average for this data point was below the CM1 limit and therefore would meet the category requirements. It is likely that this maximum data point is an outlier.
3. No biosolids data was provided for the Elmira or Foxboro Green WWTPs.
4. All units are in mg/kg.
5. A check mark (✓) indicates metals which meet both CM1 and CM2 requirements, an “M” indicates the parameter meets CM2 only, and an “E” indicates that the parameter exceeds the requirements.
3.2.4 Biosolids Management Program

The Region generally uses, or is currently constructing, anaerobic digestion and dewatering processes at the larger WWTPs, and aerobic digestion at the smaller WWTPs. Aerated biosolids are stored in lagoons when practical, or re-treated at the larger WWTPs when feasible, to take advantage of existing treatment capacity and more cost-effective haulage. Figure TM2.0-1 summarizes the WWTP treatment practices.

Technical Memorandum 2: Current and Short-term Biosolids Situation (TM2) describes in detail the biosolids management practices at each of the Region’s WWTPs. The following lists summarize the relevant features of the Region biosolids management practices.

Biosolids are land applied or landfilled directly from the following WWTPs:

- Ayr WWTP – liquid biosolids are stored on site, then land applied
- Elmira WWTP – biosolids are dewatered on site and landfilled
- Galt WWTP – biosolids are dewatered on site and landfilled
- Kitchener WWTP – biosolids are temporarily dewatered on site and landfilled; a dewatering facility is under construction
- New Hamburg WWTP – liquid biosolids are stored on site and land applied
- Waterloo WWTP – biosolids are temporarily dewatered on site and landfilled; a dewatering facility is under construction

Biosolids from the following WWTPs are stored, processed, or re-treated at another Region WWTP:

- Conestogo WWTP – biosolids are re-treated at the Waterloo WWTP
- Foxboro Green WWTP – biosolids are transferred to the New Hamburg septage lagoon and intermittently land applied.
- Heidelberg WWTP – biosolids are re-treated at the Waterloo WWTP
- Hespeler WWTP – biosolids are transferred to New Hamburg for storage and subsequent land application
- Preston WWTP – biosolids are transferred to Galt for dewatering, then landfilled
- St. Jacobs WWTP – biosolids are transferred to New Hamburg for storage and subsequent land application
- Wellesley WWTP – biosolids are transferred to New Hamburg for storage and subsequent land application

Land Application Program

The Region’s land application program is contracted to subcontractors who procure application sites and apply the Region’s liquid biosolids to land after obtaining the required C of As and preparing the respective farm NASM plans. Approximately 70 percent of the
biosolids generated in the Region is land applied in neighbouring municipalities. This is shown in Exhibit 3-6.

Exhibit 3-6
Destination of Land Applied Biosolids in 2008

This distribution changes annually as biosolids can only be applied to an area once every five years under the NMA.

Land Availability
A land inventory was conducted to determine if there is land available within the Region to accommodate the future (to 2041) biosolids generated in the Region. This assessment identified the area of suitable land within the Region, the quantity of agricultural source material generated in the Region, and the percentage of nutrient requirements met by agricultural source material.

This land inventory determined that the agricultural source material produced within the Region is able to meet 98 percent of the agricultural community’s nitrogen needs with approximately 877 ha remaining available for the land application of municipal biosolids. The Region would need approximately 12,000 ha on a 5-year rotating basis for the continued land application of its biosolids. This assessment concluded that there is insufficient land available to accommodate the land application of both the Region’s municipal biosolids and livestock wastes (e.g. manure) to the planning horizon of 2041 within the Region.

3.3 Regulatory Environment

Since the completion of the 2003 BMP, new legislation has been developed in Ontario to address the recommendations of the Walkerton Inquiry. The relevant regulations and statutes are discussed in detail in Technical Memorandum 4: Opportunities and Constraints (TM4) (Appendix I).
In all biosolids disposal and utilization alternatives, the product must meet regulatory requirements to protect the environment and human health. Utilization of biosolids as a soil amendment and/or fertilizer in Canada comes under both federal and provincial jurisdiction. The sale of biosolids and biosolids-based products as fertilizers and soil amendments is within the purview of the Federal Fertilizers Act (FFA) (R.S., 1985, c. F-10) and Fertilizers Regulations (C.R.C., c. 666) administered by the Canadian Food Inspection Agency (CFIA) and a Federal Trade Memorandum, T-4-93, which was developed to regulate this activity. However, utilization of biosolids supplied free of charge is within Provincial jurisdiction. TM4 (Appendix I) summarizes this in greater detail.

In Ontario, wastewater treatment, which includes biosolids treatment and processing at a WWTP, is regulated by the Ontario Water Resources Act (OWRA) (R.S.O. 1990, c. O.40). The processing of biosolids at a site other than the WWTP, the transportation of biosolids, and the utilization/disposal of biosolids are regulated by the Environmental Protection Act (EPA) R.S.O. 1990, c. E.19 and Ontario Regulation (O. Reg.) 347 (R.R.O. 1990) (Ontario Waste Management Regulation). The NMA (S.O. 2002, c. 4) and O. Reg. 267/03 address several aspects relating to the land application of nutrient products in Ontario, including biosolids. TM4 (Appendix I) summarizes these Acts.

The Ontario Ministry of the Environment (MOE) administers the OWRA. A certificate of approval (C of A) is required for the construction and operation of facilities that treat wastewater and biosolids, and for biosolids processing. C of As are a legal instrument under the OWRA and normally contain enforceable conditions that regulate the operation of the treatment facility. TM4 (Appendix I) further summarizes this Act.

The MOE develops enforceable guidelines to assist themselves and proponents in meeting the requirements of these Acts and Regulations. Further, the Canadian Council of Ministers of the Environment (CCME) and the Bureau de Normalisation du Québec (BNQ) have prepared additional guidelines for compost quality. The BNQ has also developed standards for soil amendments, including compost, alkaline, and dried municipal biosolids. These guidelines are not enforceable, unless they are specifically adopted by the MOE or other governing body. The following sub-sections provide more detail about the Acts, Regulations, and guidelines mentioned above. The BNQ standards are summarized in TM4 (Appendix I).

### 3.3.1 Biosolids Utilization on Agricultural Land

The transportation of biosolids, and their utilization and disposal require additional certification and approval under acts and regulations such as the NMA (S.O. 2002, c. 4), O. Reg. 267/03, and O. Reg. 347 (under the EPA), depending on the product’s destination.

The NMA, and O.Reg. 267/03 address the land application of materials that contain nutrients, with the aim of reducing the risk of these materials entering surface or groundwater in Ontario. Under the NMA, nutrients are defined as materials, such as manure, sludge, and biosolids, that are land applied for the purpose of improving crop growth. Materials are defined as agricultural source materials (such as manure from livestock operations) and non-agricultural source material (NASM), which includes leaf and yard waste, fruit and vegetable peels, food processing waste, pulp and paper biosolids, sewage biosolids, and any other material that is not from an agricultural source, and that is intended to be applied to agricultural land as a nutrient.
The NMA and its regulations provide for the review and approval of nutrient management strategies (for nutrient producers) and plans (for nutrient users), for land application standards, for the certification of land applicators, and for a registry system for land applications. The regulations also contain requirements for brokers (those who transfer the nutrient product); for example, brokers must be certified and the person applying the product must possess a nutrient application technician license. The applicability of these regulations to various agricultural operations and facilities is determined based on their nutrient production value, which is standardized using the “Nutrient Unit” (NU). One NU is defined as the amount of manure equivalent to the commercial fertilizer replacement value of the lower of 43 kilograms (kg) of nitrogen or 55 kg of phosphate. Requirements for NASM producers to prepare strategies were implemented in a phased approach under the NMA, starting with the largest wastewater facilities.

The NMA’s land application standards describe procedures for land application, including setback distances, application rates, application methods, application timing, and harvest and grazing waiting periods. Specifically, the following prohibitions apply to the agricultural use of NASM:

- Application within 20 metres (m) of surface water
- Application within prescribed setbacks from residential units and areas
- Application on soil that has an unsaturated zone less than 30 centimetres (cm) deep
- Application onto soil that is snow-covered or frozen
- Application to land of an established golf course
- Application to land on which tobacco and other sensitive crops are grown

Other restrictions relating to the application of NASM to land relate to the product quality. Exhibit 3-7 shows the NMA’s standards for regulated metals in sewage biosolids. If metals concentration in the biosolids product or soil exceeds these standards, application of sewage biosolids to land is prohibited. Prohibitions also exist for sewage biosolids that exceed other quality standards, including phosphorus (60 milligrams of phosphorus per litre (mg P/L) of soil) and E. coli \( (2 \times 10^6 \text{ CFU/g total solids [TS], dry weight}) \), and the pH of the soil on which the product is applied.
A proposal to amend O. Reg. 267/03 was posted on the Ontario Environmental Registry in June 2009, and was open to public consultation until the end of July 2009. Amendments to the regulations were filed on September 18, 2009. These amendments took effect on January 1, 2011.

Previously, NASM was considered a waste product under Part V of the EPA and had associated approval requirements related to its management, transportation, and land application under both the NMA and the EPA. The amendments to O. Reg. 267/03 that specifically relate to biosolids are:

- To allow for the management of NASM on agricultural land as a beneficial nutrient without duplication of regulatory restrictions under the EPA
- To establish and revise existing standards and approval requirements for NASM (under the NMA) to focus on the quality of the materials
- To streamline the regulatory process by removing overlapping approvals
- To require notification to the local district office of the MOE prior to the land application of NASM (but phase out the requirement of land application site C of As)
- To ensure environmental protection by extending the existing framework to include all agricultural land where NASM is applied in Ontario, as opposed to just those farms that have already been phased in to be required to have a nutrient management strategy
- To require approval for a farm nutrient management plan under the NMA for the application on agricultural land of those materials with higher metal or pathogen
concentrations, that are still within acceptable levels (for example, sewage biosolids and pulp and paper biosolids)

- To eliminate the requirement for 240 days of storage (240 days of storage is considered a best management practice).

With the implementation of the amendments, the MOE will continue to provide compliance and enforcement activities under the EPA, NMA, and OWRA.

Although land applied NASM will no longer be considered a waste and will not require a site C of A for land application, under the new regulatory framework, those NASMs that are higher in pathogens and metals, such as sewage biosolids or pulp and paper biosolids, will require the approval of a farm NASM plan. A summary of the changes to the regulations is provided below (Government of Ontario, 2009).

- **Generators:** NASM generators will no longer be required to prepare a nutrient management strategy, but will continue to be subject to approval requirements under the EPA or OWRA where those requirements apply. Sewage biosolids generators will no longer require 240 days of biosolids storage, although this will continue to be encouraged as a best management practice.

- **Haulers/Brokers:** NASM brokers/haulers will continue to require a waste management system C of A under Part V of the EPA; however, the requirement to obtain a broker’s certificate will be removed.

- **Land Application:**
  - A farm NASM plan must be developed when land applying certain NASMs. NASM Plans will be prepared by a certified person and will provide detailed information on how the NASM is to be efficiently applied on a single plot of agricultural land to optimize the nutrient benefit and minimize the adverse environmental impacts.
  
  - Neither a new organic soil conditioning site C of A under the EPA nor a general nutrient management plan to land apply NASM is required for farm operations. C of As for existing sites will remain in effect until they expire, at which time the application will fall under the new requirements.
  
  - NASM plans will identify fields where NASM will be applied as well as associated on-farm storages and will provide details on how the NASM is to be applied and incorporated to optimize the agronomic benefit and minimize adverse environmental impacts. In many cases, NASM plans will have to be approved by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The requirement for registration or approval of a NASM plan will be based on the quality of the material to be applied. The amendment will require a NASM plan prepared by a certified individual and approved by OMAFRA in order to land apply sewage and pulp and paper biosolids. Farms applying agricultural source material will continue to follow their current nutrient management plan requirements.
  
  - Those applying NASM with an approved NASM plan will be required to notify the local district office of the MOE prior to the land application.
- NASM that exceeds certain pathogen and metal levels in the proposed regulation will require a C of A under the EPA.

- Setbacks from residences and other occupied buildings to reduce the impact of offsite odours are mandated. These setbacks were generally included in the site C of As previously, and little impact will be experienced from this item.

**NASM Categories:** There are three categories of NASM, based on metal and pathogen content. Each category is based on specific quality criteria and sets out requirements for NASM plan approvals and sampling and analysis. Within the three categories, NASM is further sub-categorized based on the concentration of metals, pathogens, and odour for land application and storage.

**Odour Categories:** Odour categories determine the setback requirements to individual dwellings, residential areas, and land with commercial, community, or institutional uses. The odour categories are based on odour detection thresholds measured as odour units per cubic metre (OU/m³):

- OC1: <500 OU/m³
- OC2: ≥500 to <1,500 OU/m³
- OC3: ≥1,500 to <4,500 OU/m³

**Sampling and Analysis:** O. Reg. 267/03 places the responsibility on the farmer, or the person who is required to have a nutrient management plan, to test both the NASM and the soil where the material is to be applied. Under the new regulation, farmers are still responsible for soil testing of the land where the material is to be applied, but, in the case of NASM, the generator of the material is responsible for sampling and analysis in order to determine the NASM quality. That information is to be provided to the farmer for the development of the NASM plan and appropriate agronomic application rates.

**Anaerobic Digestion:** The requirement for the use of off-farm materials as a co-substrate in an on-farm mixed anaerobic digestion facility has been streamlined. The requirement of a C-of-A for farms accepting certain off-farm materials, such as grease trap waste from restaurants for treatment in a mixed anaerobic digester and output from the processing of 25-50 percent off-farm material in an on-farm mixed anaerobic digester, has been eliminated.

**Protocols and Guides:** Protocols for sampling and analysis and nutrient management are incorporated to assist in meeting the requirements of the regulation. An odour guide facilitates the application of odour categories set out in the regulation.

### 3.3.2 Unrestricted Use of Compost and Fertilizer Products

Utilization of biosolids as a soil amendment and/or fertilizer in Canada comes under both federal and provincial jurisdiction. The sale of biosolids and biosolid-based products as fertilizers and soil amendments is regulated under the FFA and *Fertilizers Regulations* administered by the CFIA. Biosolids supplied free of charge is within the provincial jurisdiction (regulated by the NMA).

The FFA regulates the import and sale of fertilizers and soil supplements in Canada, including CFIA-registered biosolids products. The FFA and *Fertilizers Regulations* address
the registration, form, and composition; packaging and labelling; sampling and analysis; and safeguarding of fertilizers and supplements. The CFIA enforces these regulations under the authority of the FFA and *Fertilizers Regulations*. These regulations are outlined further in TM4 (Appendix I).

In compliance with FFA, the CFIA approves the registration of fertilizers and soil supplement products. This approval is required for the unrestricted use of the product. Registered fertilizers and supplements must, however, be sold and can then be utilized for any application, including public access areas, golf courses, flower beds, and vegetable gardens. Any products that are distributed for free are considered a waste product and, therefore, approvals for land application are still required. Registration includes pre-consultation, development of product labelling, and quality assurance/quality control (QA/QC) protocols.

Very few biosolids products in Ontario have successfully registered through the CFIA for unrestricted use. Most recently, the City of Guelph’s Lystek biosolids product received CFIA registration as a fertilizer. As defined above, the Lystek product must be sold in order to take advantage of CFIA registration for unrestricted use.

The Niagara Biosolids Processing facility is owned by the Niagara Biosolids Limited Partnership, which is a joint venture between N-Viro and Walker Industries. The N-Viro product produced at this facility (19,000 tonnes per year) is marketed and distributed by N-Viro to an agricultural co-operative (N-Viro Systems Canada LP, 2009). Similarly, N-Viro products produced at Sarnia and Leamington are marketed and distributed through agricultural co-operatives. The N-Viro product from each of these facilities is a CFIA-registered product and distribution is accordingly regulated under the FFA.

### 3.3.3 Landfill Disposal

Biosolids disposed of in a sanitary landfill, including ash from biosolids incineration, must be a non-hazardous waste, as defined under the EPA. Many landfills require that the biosolids be dewatered to a minimum of 20 percent solids or pass a slump test.

At the end of 2009, the phased-in changes to the Land Disposal Restrictions under O. Reg. 347 came into effect. The restrictions require that, prior to disposal, all hazardous waste be treated in an approved manner. While municipal biosolids are not typically hazardous, there may be incidents where hazardous materials are discharged to sewers, resulting in biosolids non-compliant with land application quality requirements, and potentially hazardous. In this situation, the biosolids generator is responsible for finding an alternative disposal method, which could include incineration or landfiling, potentially with other prior treatment as required under the Land Disposal Restrictions. Municipalities with proactive sewer use by-law enforcement are unlikely to generate hazardous biosolids and trigger these requirements, but contingency planning should include a procedure for such an event, should it occur.

Since landfill disposal of biosolids generates a significant amount of leachate, the landfill must have adequate leachate collection and control systems to prevent groundwater contamination.

The EPA is discussed further in TM4 (Appendix I).
### 3.3.4 Sewer Use By-law

Sewer use by-laws can reduce the loading of contaminants originating from industrial, commercial, and institutional facilities that enter the municipal sewer system, and are therefore related to biosolids quality control.

The current Regional sewer use by-law is *By-law number I-90 of the Regional Municipality of Waterloo* amended in 1992 (Waterloo, 1990).

The Region’s current sewer use by-law is similar to the MOE’s 1988 model sewer use by-law, as it contains requirements for discharges to sanitary, combined, and storm sewers (including discharge limits); and prohibits some types of wastes. The by-law provides for surcharge agreements and compliance programs, and contains a clause referring to biosolids quality.

Biosolids quality can be improved by limiting the input of specific compounds through the enforcement of a sewer use by-law. If certain compounds in WWTP biosolids exceed the quality requirements for the product’s end-use, these compounds could be targeted for more stringent limits in the sewer use by-law.

The Region’s Sewer Use By-law and the by-laws of other Ontario municipalities are discussed in greater detail in TM4 (Appendix I).

### 3.4 Growth in the Region

The plant flow rates and loadings for the year 2041 were outlined in the Wastewater Treatment Master Plan (WWTMP) completed by EarthTech in 2007. A summary of these values are provided in Exhibit 3-8.

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**Exhibit 3-8**

Projected 2041 Influent Plant Flows and Loads as Outlined in the WWTMP

<table>
<thead>
<tr>
<th>Description</th>
<th>Flow (MLD)</th>
<th>cBOD₅</th>
<th>TSS</th>
<th>TKN</th>
<th>TP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayr WWTP</td>
<td>3.8</td>
<td>511</td>
<td>552</td>
<td>149</td>
<td>22</td>
</tr>
<tr>
<td>Elmira WWTP</td>
<td>9.3</td>
<td>1,565</td>
<td>1,839</td>
<td>292</td>
<td>46</td>
</tr>
<tr>
<td>Galt WWTP</td>
<td>54.4</td>
<td>10,944</td>
<td>12,968</td>
<td>1,848</td>
<td>273</td>
</tr>
<tr>
<td>Hespeler WWTP</td>
<td>12.1</td>
<td>1,593</td>
<td>2,008</td>
<td>363</td>
<td>50</td>
</tr>
<tr>
<td>Kitchener WWTP</td>
<td>122.8</td>
<td>21,282</td>
<td>25,277</td>
<td>4,622</td>
<td>634</td>
</tr>
<tr>
<td>New Hamburg WWTP</td>
<td>10.2</td>
<td>1,143</td>
<td>1,240</td>
<td>252</td>
<td>43</td>
</tr>
<tr>
<td>Preston WWTP</td>
<td>17.0</td>
<td>2,860</td>
<td>3,360</td>
<td>533</td>
<td>85</td>
</tr>
<tr>
<td>St. Jacobs WWTP</td>
<td>2.2</td>
<td>464</td>
<td>687</td>
<td>74</td>
<td>17</td>
</tr>
<tr>
<td>Waterloo WWTP</td>
<td>66.7</td>
<td>12,417</td>
<td>14,133</td>
<td>2,219</td>
<td>392</td>
</tr>
<tr>
<td>Wellesley WWTP</td>
<td>1.7</td>
<td>121</td>
<td>176</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>Industrial Roads Service Area (IRSA)</td>
<td>3.5 ³</td>
<td>4,722</td>
<td>4,861</td>
<td>361</td>
<td>39</td>
</tr>
<tr>
<td>East Side Community</td>
<td>15.0</td>
<td>2,520</td>
<td>2,960</td>
<td>470</td>
<td>75</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>318.7</strong></td>
<td><strong>60,142</strong></td>
<td><strong>70,061</strong></td>
<td><strong>11,211</strong></td>
<td><strong>1,682</strong></td>
</tr>
</tbody>
</table>

Sources: 1 – WWTMP, Figure 2.1 2 – WWTMP, Table 2.7 3 – WWTMP, Table 2.4
The Industrial Road Service Area (IRSA) flows will be treated at the Galt WWTP and the East Side Community flows will be treated at the Kitchener WWTP.

These are used as the basis for the future biosolids projections to 2041.

### 3.4.1 Future Wastewater Treatment Needs

TM2 (Appendix H) includes a summary of the equipment capacities and age for each of the Region’s WWTPs. This information was used to develop the opportunities and constraints discussed in TM4 (Appendix I). Equipment nearing the end of its typical service life and areas where capacity may need to be expanded were identified and incorporated into the short-listed alternative strategies later in the study. Exhibit 3-9 summarizes the opportunities and constraints identified for the Region’s WWTPs as a result of this review.

**Exhibit 3-9**

**Summary of WWTPs Opportunities and Constraints for Existing Facilities**

<table>
<thead>
<tr>
<th>WWTP</th>
<th>Opportunities</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayr</td>
<td>Footprint available for expansion</td>
<td>No dewatering currently on site</td>
</tr>
<tr>
<td></td>
<td>Not reliant on other WWTPs for treatment</td>
<td></td>
</tr>
<tr>
<td>Conestogo</td>
<td>Limited capacity for expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not able to stabilize its sludge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No biosolids storage on site</td>
<td></td>
</tr>
<tr>
<td>Elmira</td>
<td>Upgrades in progress</td>
<td>Additional centrifuge(s) may be required for dewatering</td>
</tr>
<tr>
<td></td>
<td>Footprint available for expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not reliant on other WWTPs for treatment</td>
<td></td>
</tr>
<tr>
<td>Galt</td>
<td>Footprint available for expansion</td>
<td>Cogeneration facilities not currently installed</td>
</tr>
<tr>
<td></td>
<td>Not reliant on other WWTPs for treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biogas available for beneficial use; for example, electricity and heat production from cogeneration/CHP</td>
<td></td>
</tr>
<tr>
<td>Heidelberg</td>
<td>Limited capacity for expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not able to stabilize its sludge</td>
<td></td>
</tr>
<tr>
<td>Hespeler</td>
<td>Upgrades in progress</td>
<td>Not able to stabilize its sludge</td>
</tr>
<tr>
<td></td>
<td>Footprint available for expansion</td>
<td>Thickening limited to supernating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited storage in aerated digestion cells</td>
</tr>
<tr>
<td>Kitchener</td>
<td>Footprint available for expansion</td>
<td>Insufficient heating of digester contents, requires upgrades (boilers, heat exchangers and digester mixing equipment to be installed)</td>
</tr>
<tr>
<td></td>
<td>Not reliant on other WWTPs for treatment</td>
<td>Cogeneration facilities not currently installed</td>
</tr>
<tr>
<td></td>
<td>Biogas available for beneficial use; for example, electricity and heat production from cogeneration/CHP</td>
<td></td>
</tr>
</tbody>
</table>
### Exhibit 3-9
Summary of WWTPs Opportunities and Constraints for Existing Facilities

<table>
<thead>
<tr>
<th>WWTP</th>
<th>Opportunities</th>
<th>Constraints</th>
</tr>
</thead>
</table>
| New Hamburg | Footprint available for expansion                  | Concern that receiving large volumes of sludge from other WWTPs negatively impacts plant operation.  
Aerobic digester(s) may need to be constructed  
No dewatering currently on site |
|             | New Hamburg is able to receive solids from other WWTPs |                                                                             |
| Preston     | Upgrades in progress                               | Limited capacity for expansion  
Additional digester capacity may be required (convert secondary digester to a primary digester)  
Improved loading facility may be required with secondary digester conversion. |
|             | Biogas available for beneficial use; for example, boilers |                                                                             |
| St. Jacobs  | Footprint available for expansion                  | Not able to stabilize its sludge  
Limited storage  
Truck loading requires use of contractor pump; removed volume records may be inaccurate |
| Waterloo    | Upgrades in progress                               | Cogeneration facilities not currently installed |  
Footprint available for expansion  
Not reliant on other WWTPs for treatment  
Biogas available for beneficial use; for example, electricity and heat production from cogeneration/CHP |
| Wellesley   | Capacity for expansion                              | Not able to stabilize its sludge  
Limited storage in aerated digestion tank |

### 3.5 Consultation Activities during Phase 1

#### 3.5.1 Notification of Study Commencement

A Notice of Commencement and cover letter were sent to review agencies on February 17, 2010, notifying them of the initiation of the study. A Notice of Commencement, including an invitation for interested members of the public to join the SAC was published in the local newspapers and the Regions website on February 17, 2010. Appendix A provides the agency and project mailing lists, the notices of commencement, and the agency correspondence received in response to the Notice of Commencement.

#### 3.5.2 Public Information Centre #1

The first PICs were held on June 21st, 22nd, and 23rd, 2010 in St. Jacobs, Kitchener, and New Dundee, respectively. A Notice of Invitation was published in local newspapers (The Record, Cambridge Times, Waterloo Chronicle, New Hamburg Independent, Ayr News, Elmira Independent, and the Woolwich Observer) twice (in the weeks of June 7 and
June 14, 2010) and also posted on the Region’s website; and e-mailed to the individuals and organizations on the project mailing list. Appendix E contains the notice and correspondence received in response to the notice.

A display of project information was available during the PICs and interested members of the public were invited to discuss their questions and concerns with members of the PSC in an informal setting. An information brief summarizing the information presented on the display and comment sheet was provided to attendees. A total of four members of the public signed the register for the first PIC (see Appendix E).

The intention of the first round of PICs was to introduce the study and its purpose. The information presented included the problem definition, an overview of the Master Plan and Class EA decision-making process, background information on the Region’s current biosolids management practices, project activities, and the evaluation process. The information presented at this PIC can be seen in Appendix E. Four completed comment sheets were returned following this PIC. Appendix E also summarizes the comments received and the actions taken with respect to the comments.

### 3.5.3 Stakeholder Advisory Committee

The first meeting with the SAC was held on June 7, 2010. The agenda items included introductions, discussion of the role of the SAC, introduction of the project, background on the Region’s biosolids management practices, and an overview of the work plan and schedule. The preliminary technical analysis was discussed, and the screening criteria and long list of alternatives were introduced and discussed with the group.

Appendix D contains the agenda, meeting summary, and materials provided for the first SAC meeting.

### 3.5.4 Project Steering Committee

The PSC met three times during the first phase of the project. The PSC provided insight into the Region’s operations; contributed to the selection of the SAC members; and provided confirmation of the project mission statement, PIC materials, and screening exercises. The PSC also developed and endorsed criteria to evaluate the long list of alternative strategies. Appendix C contains agendas and meeting minutes from the PSC meetings.

### 3.5.5 Project Team

The PT met regularly throughout the first phase of the project and provided valuable insight into the Region’s operations and biosolids management program. The PT developed and endorsed the screening process used to evaluate the long list of alternatives, and endorsed the short list of alternatives. The PT also developed and endorsed the criteria to evaluate the long list of alternative strategies and provided input on the scoring of the long list of alternatives. Appendix B contains agendas and meeting minutes from the PT meetings.

### 3.5.6 Impact of Consultation on the Study

The consultation with the PSC, the public, and the SAC had considerable impact on the study. The PSC helped to identify key issues, as well as options and solutions. All groups provided information regarding farming practices, and the attitude toward the Region’s current biosolids management program in the Region. Input received from the public, and
through the committees, contributed to the selection of the screening criteria and lead to the selection of the alternative biosolids management strategies.
4. Alternative Assessment

4.1 Developing the Master Plan

This BMP was developed in a way consistent with the decision-making process shown in Exhibit 4-1. This process consisted of two phases which follow the requirements of the Municipal EA process.

4.1.1 The Decision Making Process

Phase 1 technical activities included initial data gathering to determine the current biosolids management situation in the Region, and future capacity requirements. This information was used to help define the BMP’s goals and objectives. The key project initiation activities in Phase 1 included publishing a Notice of Master Plan Commencement, notifying key government review agencies and forming the PT, a PSC, and a SAC. Appendix A provides the agency and project mailing lists, as well as materials related to the Notice of Master Plan Commencement.

Phase 2 activities included several component tasks focused on the development of a preferred management strategy. First, a long list of potential biosolids end use alternatives, products, and treatment options was screened to identify those appropriate to develop management strategies. A long list of biosolids management strategies were developed by selecting end use alternatives, the appropriate biosolids products for the end use and developing process trains to produce the product by combining treatment technologies. The long list of management strategies was evaluated to determine a short list of management strategies that was further evaluated to select a preferred management strategy. The steps in selecting the preferred management strategy were as follows:

1. Develop screening criteria and apply these criteria to the long list of end-use, product and processing alternatives. This was a “fatal flaw” analysis in which an end use, product, or alternative treatment technology had to meet all of the fatal flaw criteria to be carried forward to the detailed evaluation.

2. Develop a long list of management strategies – twelve (12) strategies were developed, each strategy incorporated all thirteen WWTPs. Develop evaluation criteria and weightings for the criteria for the detailed evaluation and score criteria for each strategy. The detailed evaluation utilized a multi-criteria decision analysis, which ranked each strategy. Based on the ranking, select management strategies for further evaluation.

3. Develop a short list of biosolids management strategies. Evaluate the strategies for environmental impacts using a life cycle assessment (LCA), risk impact, and financial impacts to select the preferred strategy. The four short listed strategies include:
   - Strategy I: Contracted Disposal and Land Application
   - Strategy II: Multiple Heat Drying Facilities and Land Application
   - Strategy III: Other Stabilization and Land Application
• Strategy IV: Single Heat Drying Facility and Land Application

• All strategies employ the second-generation ATAD process (located at the Ayr WWTP) to treat biosolids from the Hespeler and New Hamburg WWTPs

The results of these evaluations aided in the selection of the preferred recommended biosolids management strategy that was presented and discussed with both the PSC and SAC.

Exhibit 4-1
Decision Making Process

4.2 Developing the Long List of Alternative Strategies

CH2M HILL developed an inventory of the universe of currently available biosolids end uses, products, and processing technologies. The PT and PSC developed screening criteria for the long list, defined by “fatal flaw” analysis. The initial screening activity was conducted using the criteria determined by the PT. Acceptable end-uses, products, and technologies were then organized into 12 alternative strategies. These 12 strategies were ranked using detailed scoring criteria developed by the PT in consultation with SAC and PSC and evaluated the broader categories of “the technical environment”, “social/cultural consideration”, “natural environment”, and “economic environment”. The low-scoring strategies were eliminated from further consideration. The remaining alternative strategies were combined into four short-listed strategies for further consideration.

The screening of the universe of biosolids end-uses, products and processing technologies and the development of the 12 long-listed strategies is discussed in more detail in the following section.
4.2.1 Universe of Biosolids Alternatives

The first task was to develop the inventory of the universe of all end uses, products, and biosolids processing technologies that are available in the North American market. The processing technologies included liquid and post-dewatered stabilization, high temperature oxidation/combustion, and energy from waste. The universe of options is included with *Technical Memorandum 3: Review and Evaluation of Biosolids Management Alternatives* (TM3), which can be found in Appendix J. This universe of options list categorizes the options by end-uses, products, and technologies.

The matrix included in Appendix J describes each technology and its advantages and disadvantages.

4.2.2 Fatal Flaw Screening

The PT developed and endorsed the “must-have” criteria used to screen the universe of alternatives. The universe of alternatives matrix shown in TM3 (Appendix J) was screened with the criteria outlined below using a “fatal flaw” analysis. In a “fatal flaw” analysis, an alternative must pass all of the criteria to be carried through to the next evaluation step.

The must-have criteria for the fatal flaw analysis of the universe of biosolids management options were defined as: able to integrate with the existing facilities, sustainable, and reliable. The parameters used to define whether an option met the criteria for biosolids end uses/disposal and biosolids products were:

- **Integration:**
  - There is opportunity to take advantage of existing infrastructure
  - There are no major obstacles to implementation
  - End-uses are within the Region’s capability to implement (technically, financially, regulatory)

- **Sustainability:**
  - End-uses/products endure over time in an environmentally-safe manner
  - The long-term strategy provides the capacity to manage all the biosolids produced at the WWTPs

- **Reliability:**
  - End-uses/products meet or exceed Ontario’s regulatory requirements and standards
  - The overall biosolids management strategy is reliable and meets public scrutiny

The parameters used to define whether an option met the criteria for biosolids stabilization processes were:

- **Commercially proven:**
  - The processing technology has demonstrated full-scale operations experience for at least three years at similar-sized facilities and can be implemented/integrated into the Region’s facilities.

- **Scalability:**
The processing technology is scalable and can be expanded to meet changing capacity needs

Modularity can provide redundancy

**Adaptability:**

- The processing technology is adaptable to changing Ontario Regulations (for example, adding additional processes or technologies can provide this adaptability).

These criteria are used to evaluate the universe of technologies.

### 4.2.3 Screened List of Alternatives

The “long list screening matrix: biosolids stabilization and treatment processes” presented in TM3 (Appendix J) represents the universe of alternatives evaluated using the must-have criteria. A technology is removed from the list if it does not meet any one of the must-have criteria; the reason the technology does not meet the criteria (indicated by an “x”) is noted in the comment section.

The following were determined to meet all must-have criteria:

- **Biosolids End Uses/Disposal:**
  - Agricultural land
  - Soil Amendment/Compost (assuming the MOE approves their proposed guidelines)
  - Unrestricted Wholesale/Retail (for example, golf courses)
  - Cement-Kiln or Power Plant Fuel
  - Landfill Disposal/Utilization
  - Contingency Landfill Disposal

- **Biosolids Products:**
  - Ash
  - Fuel
  - Fertilizer
  - Compost (assuming the MOE approves their proposed guidelines)
  - Ag-Lime Substitute
  - Dewatered Biosolids
  - Semi-solid Biosolids
  - Liquid (stabilized) biosolids

- **Liquid Stabilization Processes:**
  - Conventional (Mesophilic) Anaerobic Digestion (MAD)
  - Thermophilic Anaerobic Digestion
  - Temperature-Phased Anaerobic Digestion
  - Two-Phase Anaerobic Digestion (Acid/Gas)
  - Conventional Aerobic Digestion
  - Autothermal Thermophilic Aerobic Digestion (ATAD)
  - Aerobic Thermophilic Pre-Treatment
  - Dual Digestion
  - Pre-Pasteurization/MAD
ALTERNATIVE ASSESSMENT

- WAS Pre-treatment/MAD
- Thermal Hydrolysis/MAD (Cambi)
- Anaerobic Co-Digestion

- Post-Dewatering Stabilization Processes:
  - Alkaline Stabilization
  - Advanced Alkaline Stabilization with Assisted Drying (AASAD) (N-Viro)
  - EnVessel Pasteurization (RDP)
  - Schwing Bioset
  - Lystek
  - Direct Thermal Drying (Belt)
  - Fluidized Bed Drying
  - Solar Dryer
  - Flash Dryer
  - Vertical Tray Dryers
  - Indirect Thermal Drying (Paddle, Auger, Disc)
  - Direct Thermal Drying (Drum)
  - Composting-Aerated Static Pile
  - Co-Composting with MSW
  - Composting-Enclosed/In-vessel
  - Composting-Windrow

- High Temperature Combustion/Oxidation/Energy from Waste Processes:
  - Fluidized Bed Reactor Incineration

The remaining six (of 12) end uses, eight (of nine) biosolids products, 12 (of 21) liquid stabilization processes, sixteen (of 21) post-dewatering stabilization processes, and one (of seven) high temperature combustion/oxidation, energy from waste processes will be used in the next stage of the evaluation to develop the long list of alternative biosolids management strategies.

4.2.4 Long List of Biosolids Management Strategies

The purpose of developing each strategy was to enable the team to compare alternatives (relative to each other) that could meet the Region’s needs to 2041. The strategies each focused on a specific processing technology and end use, allowing the team to identify the advantages and disadvantages of each technology and end use within each WWTP, and for the Region as a whole. Following the evaluation of these strategies, a short list of strategies was developed for detailed evaluation. The short-listed strategies may reflect one of the long-list strategies in whole, or may use the best components from a number of strategies to develop a new strategy.

In the following descriptions of the 12 strategies selected for evaluation, the following key, shown in Exhibit 4-2, was used:
Strategy Evaluation Key

**Strategy 1: Land Application**

Under this strategy, the biosolids produced at the Region’s WWTPs would all be destined for land application, with the exclusion (due to quality concerns) of those biosolids generated at the Elmira WWTP due to the heavily industrial nature of that plant’s influent wastewater. Equipment sizing at the Preston WWTP has not allowed for firm digester capacity (that is sufficient capacity at the design peak month flow rate with one unit out of service), because onsite spatial constraints would likely not allow an additional digester to be constructed, and therefore it is assumed that the contingency for this strategy would be to landfill the biosolids produced.

To maximize the use of existing infrastructure, utilization of the existing storage lagoons at Ayr and New Hamburg would continue under this strategy, and existing centrifuge dewatering facilities would be used at the large WWTPs. It has been assumed that the land application contractor(s) would provide the dewatered biosolids cake storage under their contract requirements. Exhibit 4-3 shows a schematic of this strategy.
**Strategy 2: Landfill**

Under this strategy, all the biosolids produced in the Region’s WWTPs would be landfilled by a contractor.

It was assumed that the landfill would require the biosolids to be stabilized, and digestion capacity at each applicable WWTP had been expanded, where appropriate, to meet this requirement. Additional digesters for firm capacity were assumed not to be required as the stabilization requirement for a landfill is not as stringent as that consistently required by a land application program.

All of the Region’s biosolids would require dewatering to pass the slump test required by the receiving landfill and its governing regulations for waste disposal. The only storage for the dewatered cake would be in the cake bins at each dewatering facility. This would allow
approximately 4 days cake-storage capacity. Haulage and disposal of cake by a contractor would be continual. Exhibit 4-4 shows a schematic of this strategy.

**Exhibit 4-4**
Strategy 2 Schematic – Landfill
**Strategy 3: Waste Minimization**

Under this strategy, all of the biosolids produced in the Region’s WWTPs would be destined for land application, with the exclusion (due to quality concerns) of those biosolids generated at the Elmira WWTP because of the heavily industrial nature of that plant’s influent wastewater.

This strategy would include volume reduction technologies where appropriate. The Cannibal process was used in this analysis for waste minimization. Cannibal is a proprietary process sold in North America by Siemens Water Technologies (Siemens). Additional information on this technology is provided in TM3 (Appendix J).

Through vendor discussions, the New Hamburg and Hespeler WWTPs were selected for this process.

Additionally, dewatering was assumed for all biosolids, excluding those produced at the Ayr WWTP, where continued use of the existing storage lagoon and a liquid-to-land program maximizes the existing infrastructure investment. It has been assumed that the land application contractor(s) would provide the dewatered biosolids cake storage under their contract requirements. Exhibit 4-5 shows a schematic of this strategy.
Strategy 4: Compost

Under this strategy, the majority of the biosolids produced in the Region’s WWTPs would be destined for a regional composting facility that uses aerated static pile processing. The process would be fully enclosed and include odour control. The facility would provide storage of composted material. It was assumed that the compost would be land applied and that there would be no product revenue, as there is currently no established market. To maximize the use of existing infrastructure, the existing centrifuge dewatering facilities would be used at the large WWTPs.

The biosolids generated by and managed through the Ayr and New Hamburg WWTPs would continue to be stored in the existing lagoons and liquid land applied seasonally, in order to maximize the use of the existing infrastructure. The biosolids generated at the Elmira WWTP would continue to be landfilled because of quality concerns due to the heavily industrial nature of that plant’s influent wastewater.

WWTPs utilizing the new regional composting facility are not required to provide firm digestion capacity, as additional stabilization would be provided through that process.

The proposed biosolids compost quality requirements have not yet been adopted by the MOE; however, in future, the Region may be able to develop a market for composted biosolids, if they can be approved for other end uses, such as distribution as unrestricted compost. This strategy could be compatible with co-composting with other organic wastes, such as “green bin” household organics and leaf and yard waste, although sale of the product would be permitted only if the MOE adopts the proposed biosolids compost quality requirements. It should be noted that, under the proposed guidelines, organic wastes other than biosolids would be classified Category AA – unrestricted. A co-compost with organic waste and biosolids would be classified Category A, requiring labelling and other restrictions. Exhibit 4-6 shows a schematic of this strategy.
Strategy 5: Alkaline Stabilization

Strategy 5: Alkaline Stabilization would be similar to Strategy 4: Composting, with the exception of the actual biosolids processing technology at the centralized facility. The regional facility would house an AASAD process, similar to that sold by N-Viro International Corporation (N-Viro), and would generate an alkaline soil amendment product. TM3 contains further information on the N-Viro process.
It was assumed that the alkaline-stabilized biosolids would be land applied and there would be no product revenue. Facilities that currently use the N-Viro process do sell their product to agricultural co-operatives, but there is no net revenue from the sale. Because the product could be CFIA-registered for unrestricted use, and likely marketed through an agricultural co-operative, only 40 days of onsite storage was included in the analysis. Exhibit 4-7 shows a schematic of this strategy.

Exhibit 4-7
Strategy 5 Schematic – Alkaline Stabilization

Strategy 6: Heat Drying
Strategy 6: Heat Drying would be similar to Strategies 4 and 5 (Composting and Alkaline Stabilization), with the exception of the actual biosolids processing technology at the centralized facility. The regional facility would house a rotary drum drying process and
generate a pelletized product. A number of equipment vendors are available for this technology, and TM3 contains further information on drum dryers by Andritz, one of these vendors.

It was assumed that the pelletized biosolids would be land applied and there would be no product revenue. Alternative markets, such as for fuel at an energy-from-waste facility, may also be developed for the pellets, but net revenues are not typical.

Exhibit 4-8 shows a schematic of this strategy.

Exhibit 4-8
Strategy 6 Schematic – Heat Drying
Strategy 7: Incineration

Under this strategy, all of the biosolids produced in the Region’s WWTPs would be dewatered and incinerated at a centralized facility. The process would recover excess energy. The facility would provide short-term storage of the ash, which would subsequently be trucked to landfill. There may be potential to use the ash beneficially to offset raw inputs in cement manufacturing or other similar industries, if available in the area.

The WWTPs utilizing the new centralized incineration facility are not required to provide firm digestion capacity.

The industry-accepted BAT for biosolids incineration uses fluidized bed incinerators (FBI) and a comprehensive air pollution control (APC) train. Waste heat is used to heat the incoming air and, except for the start-up period, the process normally does not require additional energy input. The remaining waste heat can be used to generate power, which can be sold to the grid. Numerous FBI vendors exist, and the information from Infilco Degremont included in TM3 provides one example of a vendor’s equipment.

Exhibit 4-9 shows a schematic of this strategy.
Exhibit 4-9
Strategy 7 Schematic – Incineration

Potential synergies with co-processing with energy from waste. Dewatered solids would be transported to processing facility.
Strategy 8: Heat Drying (Onsite)

Strategy 8: Heat Drying (on site) would be similar to Strategy 6: Heat Drying, with the exception that the heat drying biosolids processing technology would be installed at each of the three largest WWTPs (Waterloo, Kitchener (at the Manitou Drive Dewatering Facility), and Galt). These facilities would each house a rotary drum drying process and generate a pelletized product. A number of equipment vendors are available for this technology, and TM3 contains further information on drum dryers by Andritz, one of these vendors.

It was assumed that the pelletized biosolids would be land applied and that there would be no product revenue. Alternative markets, such as for fuel at an energy-from-waste facility, may also be developed for the pellets, but net revenues are not typical. Exhibit 4-10 shows a schematic of this strategy.

Exhibit 4-10
Strategy 8 Schematic – Heat Drying (Onsite)
**Strategy 9: Contracted Disposal**

Under this strategy, the onsite processing would continue at each existing WWTP, with the addition of thickening at Hespeler and dewatering at New Hamburg. Digested sludge from Ayr would be trucked to Kitchener (Manitou Drive Dewatering Facility) for dewatering.

All dewatered solids would be disposed of by contracted services. It was assumed that the budget quotation provided by Liberty Energy would be the basis for the cost analysis. Liberty Energy is an energy-from-waste thermal oxidation facility proposed to be constructed in Hamilton, Ontario. All trucking of biosolids to the facility is included in the budget quotation and would be completed under the disposal contract. Under Liberty Energy’s pricing options, it was assumed for this project that no capital investment would be made and all capacity risk would be assumed by Liberty Energy.

Exhibit 4-11 shows a schematic of this strategy.
Exhibit 4-11
Strategy 9 Schematic – Contracted Disposal
**Strategy 10: Thermal Hydrolysis**

This strategy is similar to Strategy 1: Land Application, in that all the biosolids produced in the Region’s WWTPs would be destined for land application, with the exception of those generated from the Elmira WWTP.

Under this strategy, thermal hydrolysis would be introduced at the Kitchener WWTP, including dewatering as a preparatory step. CAMBI is a recognized vendor of this technology, and TM3 (Appendix J) provides vendor information on the process. The lifecycle cost of this scenario can most easily be compared to the lifecycle cost of Scenario 1; the difference is the CAMBI process at the Kitchener WWTP.

CAMBI’s Thermal Hydrolysis Process (THP) is a high-pressure steam pre-treatment for anaerobic digestion of biosolids and other biological wastes. CAMBI reports that applying their THP technology results in doubled digester loading, increased biogas production, and a pathogen-free and stabilized biosolids product with increased cake dewaterability. Exhibit 4-12 shows a schematic of this strategy.

**Exhibit 4-12**

*Strategy 10 Schematic – Thermal Hydrolysis*
Strategy 11: Second Generation Autothermal Thermophilic Aerobic Digestion

This strategy is similar to Strategy 1: Land Application, in that all of the biosolids produced in the Region’s WWTPs would be destined for land application, with the exception of those generated at the Elmira WWTP.

Under this strategy, second generation autothermal thermophilic aerobic digestion (ATAD) or Advanced Autothermal Thermophilic Aerobic Digestion (AATAD) would be introduced at the Ayr and New Hamburg WWTPs. A recognized vendor is Thermal Process Systems with their patented ThermAer process. They are represented by WCI Environmental Solutions Inc. TM3 (Appendix J) provides vendor information.

Second generation ATAD is commonly referred to as “liquid composting” because it operates at thermophilic temperatures comparable to conventional composting (50°C to 70°C). The process is described as autothermal because, once it has reached operating temperature it requires no heat source (other than mixing energy) to maintain thermophilic temperatures. The heat released by organic decomposition during digestion typically sustains the thermophilic operating temperatures. Increased operating temperatures produce a more rapid digestion process compared to conventional aerobic digestion. The increased digestion rate results in a decreased digester volume. Results from operating facilities show that the system, which is relatively simple, has low operation, maintenance, instrumentation, and energy requirements.

Compared to conventional aerobic digestion, second generation ATAD is a more effective digestion and pathogen and vector attraction reduction process. The second generation ATAD process typically destroys 50 to 70 percent of the volatile solids in the biosolids. Volume reduction saves hauling costs.

To effectively operate the second generation ATAD process, the feed material must be thickened to a minimum 40,000 mg/L (4 percent solids) and meet the minimum target chemical oxygen demand (COD). Some second generation ATAD facilities with lower energy WAS feed require a minimum of 5 to 6 percent solids concentration. Exhibit 4-13 shows a schematic of this strategy.
Strategy 12: Other Stabilization

This strategy is similar to Strategy 1: Land Application, in that all of the biosolids produced in the Region’s WWTPs would be destined for land application, with the exception of those generated from the Elmira WWTP.

Under this strategy, additional stabilization would be added to the Kitchener, Galt, and Waterloo WWTPs, to further reduce pathogens and improve the biosolids’ physical characteristics to allow for liquid storage and land application at a reduced volume. A proprietary system by Lystek International Inc. was selected as a proven technology for this strategy. The Lystek technology is an energy-efficient process involving a combination of heat, alkali, and high-shear mixing to produce a high-solids, pathogen-free, high-nutrient fertilizer value, liquid biosolids product from dewatered biosolids. The City of Guelph, Ontario has successfully registered the Lystek product with the CFIA. TM3 provides vendor information.
Exhibit 4-14 shows a schematic of this strategy.

**Exhibit 4-14**
Strategy 12 Schematic – Other Stabilization

### 4.3 Evaluation of Biosolids Management Long List of Alternative Strategies

This section outlines the evaluation conducted on the long list of alternative strategies. This evaluation is used in the development of the short-listed strategies.

#### 4.3.1 Long-List Evaluation Process

The long-listed strategies are ranked using the CH2M HILL BMP Tool, using a multi-criteria decision analysis (MCDA). MCDA is a structured approach to analyzing and ranking a multitude of criteria with multiple alternatives. The PT and PSC developed screening criteria in four main objective categories:
1. Technical environment
2. Social/cultural environment
3. Natural environment
4. Economic environment

The long-listed strategies were scored for each of the criteria. GHG emissions modelling and cost modelling were used to develop the scores for the relevant criteria.

These scores were input into the BMP tool, which ranked the alternative strategies.

### 4.3.2 Strategy Evaluation

#### Screening criteria

Exhibit 4-15 presents the criteria used to evaluate the 12 alternative biosolids management strategies presented in the previous section. The PT developed and endorsed these evaluation criteria in PT meeting 6 (July 6, 2010). During the criteria development in the workshop, special consideration was given to ensure that the Region’s guiding principles for sustainability put forth in their Environmental Sustainability Strategy were followed, and that the criteria met the sustainability strategy goal statements for the five priority areas of:

1. Air and energy
2. Water
3. Waste and material resources
4. Rural and urban land
5. Sustainability culture

Using the Performance Scales, three scores were available for each criterion: 10, 5, and 0. The scores related to a specific measure, as shown in Exhibit 4-15.

### Exhibit 4-15
Evaluation Objectives, Criteria, and Measures

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Evaluation Criteria</th>
<th>Criteria Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Environment</td>
<td><strong>Technical Performance</strong> – The ability of an alternative to perform its intended functions satisfactorily (treatment, utilization method, disposal options)</td>
<td>The alternative is reliable, and consistently meets or exceeds performance and product quality criteria – 10</td>
</tr>
<tr>
<td></td>
<td>The alternative is reliable, and meets performance and product quality criteria with regular operations and maintenance (O&amp;M) – 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative is reliable but requires redundancy and higher levels of O&amp;M to meet performance and product quality criteria – 0</td>
<td></td>
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<tr>
<td></td>
<td><strong>Energy Requirements</strong> – The energy requirements for the product produced by the alternative are comparable to the existing treatment system and other alternatives.</td>
<td>The alternative requires less energy than the existing system – 10</td>
</tr>
<tr>
<td></td>
<td>The alternative requires similar energy to the existing system – 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative uses more energy than the existing system – 0</td>
<td></td>
</tr>
</tbody>
</table>
### Exhibit 4-15
Evaluation Objectives, Criteria, and Measures

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Evaluation Criteria</th>
<th>Criteria Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Renewable Energy</strong> – The degree to which the alternative replaces fossil-fuel energy sources with renewable energy sources</td>
<td>The alternative generates more renewable energy than the existing system – 10</td>
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<tr>
<td></td>
<td>The alternative generates a similar amount of renewable energy to the existing system – 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative generates no renewable energy – 0</td>
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<tr>
<td><strong>Waste to Landfill</strong> – The degree to which the alternative requires waste disposal to landfill</td>
<td>The alternative generates ≥ 20% less waste to landfill than the existing system – 10</td>
<td></td>
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<tr>
<td></td>
<td>The alternative generates the same amount of waste to landfill as the existing system, ± 20% – 5</td>
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<tr>
<td></td>
<td>The alternative generates ≥ 20% more waste to landfill than the existing system – 0</td>
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<tr>
<td><strong>Chemical Consumption</strong> – The degree to which the alternative requires use of chemicals</td>
<td>The alternative uses less chemicals than the existing system, by at least 20% – 10</td>
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<tr>
<td></td>
<td>The alternative uses the same amount of chemicals as the existing system, ± 20% – 5</td>
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</tr>
<tr>
<td></td>
<td>The alternative uses more chemicals than the existing system, by 20% or more – 0</td>
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<tr>
<td><strong>Long-term Adaptability</strong> – The ability of an alternative (treatment, utilization/disposal) to adapt to changing conditions (technologies, regulations, market factors)</td>
<td>The alternative can be easily adapted to changing conditions to meet long term needs – 10</td>
<td></td>
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<tr>
<td></td>
<td>The alternative is somewhat flexible to meet long term needs (some constraints) – 5</td>
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<tr>
<td></td>
<td>The alternative is not very flexible; it could prove difficult to meet long term needs – 0</td>
<td></td>
</tr>
<tr>
<td><strong>Ease of Implementation</strong> – The alternative can be easily implemented on a technical, regulatory, and practical basis (land availability, operational aspects, administrative requirements, etc.)</td>
<td>The alternative is very easy to implement with respect to approvals, construction, and operations – 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative is somewhat easy to implement (some constraints) – 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative has many difficulties with respect to its implementation – 0</td>
<td></td>
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<tr>
<td><strong>Operational Compatibility</strong> – The alternative is compatible with current processing units and can be installed and integrated into the current plant operations with minimal impact to current operations</td>
<td>The alternative is very compatible and compliments current processing units. It can be integrated into current plant operations with minimal impact – 10</td>
<td></td>
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<tr>
<td></td>
<td>The alternative is somewhat compatible and complimentary to current processing units; it can be integrated, but will have some impact – 5</td>
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<tr>
<td></td>
<td>The alternative is not compatible or complimentary to current processing units and integration may be difficult – 0</td>
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<tr>
<td><strong>Complexity</strong> – The alternative does not add complexity to current operations and can be operated and maintained by current level of licensed operators with appropriate training</td>
<td>The alternative is not complicated; it can be operated and maintained with current staff competencies – 10</td>
<td></td>
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<tr>
<td></td>
<td>The alternative is somewhat complicated; it can be operated and maintained with minimal staff training – 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The alternative is complicated; significant staff training and development would be necessary for O&amp;M – 0</td>
<td></td>
</tr>
</tbody>
</table>
### Exhibit 4-15
**Evaluation Objectives, Criteria, and Measures**

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Evaluation Criteria</th>
<th>Criteria Measure</th>
</tr>
</thead>
</table>
| **Regulatory Acceptance/Approvals** – Regulatory approvals are readily obtainable. Both processing and product utilization/disposal are approvable | The alternative is an accepted regulatory practice and obtaining approvals is not expected to be difficult – 10  
The alternative is unique; some effort is expected to receive regulatory acceptance and approval – 5  
The alternative is very unique and regulatory acceptance and approval may take significant effort – 0 |
| **Social/Cultural Consideration** | Odour – The potential for the occurrence of odour events  

- The alternative has little or no potential to produce odour – 10  
- The alternative has moderate potential to produce odour; odour control measures may be needed to prevent migration offsite – 5  
- The alternative has a high potential to produce odour; significant mitigation would be needed to control migration offsite – 0 |
| **Agricultural Practices** – The potential for the alternative to be compatible with current and developing agricultural practices over the long term | The alternative provides added value to current practices and developing practices – 10  
The alternative is compatible with current and developing practices – 5  
The alternative is not compatible with existing and developing practices; modifications may be required to achieve compatibility – 0 |
| **Visual Character** – The potential for the alternative to maintain the visual character of an area | The alternative improves the visual character of an area – 10  
The alternative has similar visual character to existing system – 5  
The alternative will degrade the visual character of an area – 0 |
| **Transportation** – The potential for the alternative to avoid increased demands on the transportation systems (patterns, volumes, and infrastructure requirements) | The alternative will reduce demands on the transportation system – 10  
The alternative will place similar demands on the transportation system – 5  
The alternative will increase demands on the transportation system – 0 |
| **Noise** – The potential for the occurrence of noise events | The alternative has little or no potential to produce noise – 10  
The alternative has moderate potential to produce noise; noise control measures may be needed to prevent noise migration offsite – 5  
The alternative has high potential to produce noise; significant mitigation would be needed to control noise migration offsite – 0 |
| **Occupational Health & Safety (In-Plant)** – Potential risk or liability to staff health and safety from exposure to:  
  - Explosions  
  - Processing chemicals  
  - Gaseous emissions  
  - Toxic organics | The alternative will reduce potential risks to staff health and safety compared to current treatment – 10  
The alternative will result in a similar potential risk to staff health and safety compared to current treatment – 5  
The alternative will result in an increase in potential risk to staff health and safety compared to current treatment (without substantial mitigation) – 0 |
<table>
<thead>
<tr>
<th>Objectives Evaluation Criteria</th>
<th>Criteria Measure</th>
</tr>
</thead>
</table>
| **Occupational Health & Safety (Offsite)** – Potential risk or liability to community health and safety from exposure to: | The alternative reduces the potential risk to community health and safety – 10  
The alternative will result in similar potential risk to community health and safety – 5  
The alternative will result in an increase in potential risk to community health and safety (without substantial mitigation) – 0 |
| - Traffic accidents  
- Gaseous emissions  
- Toxic organics  
- Heavy metals |                                                                                                                                                  |
| **Public Acceptability** – The potential of the alternative to receive public support and acceptance based on: | The alternative has the potential to receive a high level of support and endorsement from the public – 10  
The alternative has the potential to receive a moderate level of support and endorsement from the public – 5  
The alternative has the potential to receive little to no support and endorsement from the public – 0 |
| - Projects of a similar nature in other Ontario communities  
- Community history with the WWTP |                                                                                                                                                  |
| **Natural Environment** |                                                                                                                                            |
| **Water Quality** – The potential of the alternative to improve water quality and aquatic habitats and support the Region’s Source Protection Planning | The alternative will result in improvements to water quality and aquatic habitats – 10  
The alternative will result in similar water quality and aquatic habitats as due to current practices – 5  
The alternative results in degradation to water quality – 0 |
| **Terrestrial Systems** – The potential of the alternative to improve terrestrial habitats/systems (including mammals, reptiles, birds) and terrestrial features/functions | The alternative results in an improvement of terrestrial systems and habitats – 10  
The alternative would result in similar terrestrial habitat quality of the existing terrestrial systems and habitats – 5  
The alternative would result in a degradation of terrestrial systems and habitats – 0 |
| **Soil Quality** – The potential impact of an alternative on soil quality and productivity | The alternative has the potential to improve the quality and/or productivity of the soil – 10  
The alternative provides for similar quality or productivity of the soil – 5  
The alternative has the potential to reduce the quality and/or productivity of the soil – 0 |
| **Groundwater Quality and Flow** – The potential of the alternative to impact groundwater resources | The alternative enhances groundwater resources by providing recharge and/or improving water quality – 10  
The alternative provides for similar impacts to groundwater resources as the existing system – 5  
The alternative degrades groundwater resources – 0 |
| **Greenhouse Gas (GHG) Emissions** – The potential for an alternative to reduce GHG emissions. | A natural scale between 0 and 10 based on the relative difference in GHG emissions of each strategy across the total range of GHG emissions |
| **Economic Environment** |                                                                                                                                            |
| **Strategy Life Cycle Cost** – The relative net present value (NPV) of the strategy compared to the others | A natural scale between 0 and 10 based on the relative difference in NPV of each strategy across the total range of NPVs |
| **Strategy Capital Cost** – The relative capital cost of the strategy compared to the others | A natural scale between 0 and 10 based on the relative difference in the capital cost of each strategy across the total range of capital costs |
Exhibit 4-15
Evaluation Objectives, Criteria, and Measures

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Evaluation Criteria</th>
<th>Criteria Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy O&amp;M Cost – The relative O&amp;M costs of the strategy compared to the others</td>
<td>A natural scale between 0 and 10 based on the relative difference in O&amp;M costs of each strategy across the total range of O&amp;M costs</td>
<td></td>
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</tbody>
</table>

Non-Financial Evaluation of Long List of Alternative Strategies

Members from the PT and the PSC attended a workshop on July 13, 2010. At the workshop, the members of the PT and the PSC were briefed on the scoring approach. Then the group scored one criterion from each of the technical environment, social and cultural considerations, and natural environment objective groups together to standardize the approach taken by each individual. Following the workshop, some members (seven in total) of the workshop scored each of the 12 strategies using the remaining criteria in Exhibit 4-16 (except for the economic environment criteria). TM3 contains the workshop member scores. These scores were averaged and input into CH2M HILL’s BMP Tool, which ranks the 12 strategies by total score (a lower overall score results in a lower ranking). TM3 outlines the scoring results by criterion objective for each strategy as input into the tool.

GHG emissions were calculated using BEAM (Biosolids Emissions Assessment Model) modelling. TM3 summarizes the BEAM modelling. The results were translated to a natural log score where 10 was the lowest GHG emission, and 0 was the highest.

Economic Environment

The scoring workshop members did not score the economic environment. Rather, a natural scale was used to score each strategy for the economic environment objective. The natural scale was developed using financial information for each of the 12 long-listed strategies. The strategies were scored relative to each other with the strategy with the highest NPV scoring “0”, and the strategy with the lowest NPV strategy scoring “10”, and all the other strategies scoring relatively between, based on their cost. The scores input into the BMP tool can be seen in TM3.

Screening Evaluation Results

The BMP Tool analyzes a number of alternatives using weighted criteria, providing a uniform method of objectively ranking a range of alternatives. Each criterion outlined in the previous sections is input to the tool and given an assigned weight. Each strategy is scored by the members of the workshop, and the scores are averaged and input into the tool. The tool uses the criterion weightings and averaged scores to rank the strategies.

The averaged scores for each criterion (as outlined in TM3) were input into the BMP Tool. The BMP Tool used the scores and the assigned weighting for each objective to rank the 12 strategies. Exhibit 4-16 displays the results.
4.4 Developing the Short-List of Biosolids Management Strategies

Based on the rankings from the BMP Tool, the highest ranked strategies were incorporated into four short-listed strategies, which were refined for a detailed evaluation including LCA, risk impact, and refined cost analysis. A process flow diagram and a description of each of these strategies are provided below.

**Strategy I: Contract Disposal and Land Application**

Under this strategy, the biosolids produced at the Region’s largest WWTPs (Kitchener, Galt, and Waterloo) and at the Elmira, Preston, St. Jacobs, Wellesley, Heidelberg and Conestogo WWTPs would be disposed of by contracted services. Biosolids generated at the Preston WWTP would be trucked to Galt for dewatering, while biosolids generated at the other, smaller plants (excluding Elmira) would be trucked to Waterloo for dewatering. Onsite dewatering would continue at Galt, Waterloo, Kitchener and Elmira. The Liberty facility proposed to be constructed in Hamilton was selected for review in this project, although the Region implementation of “contract disposal” may result in an alternative process being selected.

Based on a financial comparison of the top five strategies, it was determined that it was more economically beneficial to dispose of biosolids at the New Hamburg, Hespeler, and
Ayr WWTPs using second generation ATAD and land application, rather than contract disposal. Also, further analysis showed that it was financially beneficial to install second generation ATAD only at the Ayr WWTP and truck sludge from the New Hamburg and Hespeler WWTPs to Ayr for treatment, rather than to install second generation ATAD at the New Hamburg WWTP and/or Hespeler WWTP. This is common to all of the short-listed strategies.

Exhibit 4-17 shows a schematic of this strategy.

**Exhibit 4-17**
Strategy I Schematic – Contract Disposal and Land Application
Strategy II: Multiple Heat Drying Facilities and Land Application

Under this strategy, the Region’s largest WWTPs (Kitchener [or Manitou Drive Facility], Galt, and Waterloo) would each house a belt-drying process and generate a dried product. Biosolids generated at the Elmira WWTP would be disposed of by landfilling (due to quality concerns because of the heavily industrial nature of that plant’s influent wastewater). Biosolids from Preston would be trucked to Galt while St. Jacobs, Wellesley, Heidelberg, and Conestogo biosolids would be trucked to Waterloo.

As in Strategy I, second generation ATAD would be installed at the Ayr WWTP and receive sludge from the New Hamburg and Hespeler WWTPs. The product from the second generation ATAD would be liquid land applied, and the existing onsite storage would be used. Exhibit 4-18 shows a schematic of this strategy.
Exhibit 4-18
Strategy II Schematic – Onsite heat drying and land application

* Potential synergies with co-processing with energy from waste. Dewatered solids or heat-dried solids would be transported to processing facility.
Strategy III: Other Stabilization and Land Application

Under this strategy, additional stabilization (Lystek) would be added to the Kitchener (at the Manitou Drive Dewatering facility), Galt, and Waterloo WWTPs in order to further reduce pathogens and improve the biosolids’ physical characteristics to allow for liquid storage and land application at a reduced volume. Sludge from Preston would be trucked to Galt while St. Jacobs, Wellesley, Heidelberg, and Conestogo would be trucked to Waterloo.

As in Strategy II, biosolids generated at the Elmira WWTP would be disposed of by landfiling (due to quality concerns because of the heavily industrial nature of that plant’s influent wastewater) and a second generation ATAD would be installed at the Ayr WWTP and receive sludge from the New Hamburg and Hespeler WWTPs. The products would be liquid land applied, and the existing onsite storage would be used. Exhibit 4-19 shows a schematic of this strategy.
**Exhibit 4-19**

**Strategy III Schematic – Other Stabilization and Land Application**

Under this strategy, a common belt-drum drying process would generate a dried product from the Kitchener, Galt, Preston, Waterloo, Conestogo, St. Jacobs, Wellesley, and Heidelberg WWTPs’ dewatered biosolids.

Biosolids generated at the Elmira WWTP would be disposed of by landfilling (due to quality concerns because of the heavily industrial nature of that plant’s influent wastewater).

---

**Strategy IV: Single Heat Drying Facility and Land Application**

Under this strategy, a common belt-drum drying process would generate a dried product from the Kitchener, Galt, Preston, Waterloo, Conestogo, St. Jacobs, Wellesley, and Heidelberg WWTPs’ dewatered biosolids.

Biosolids generated at the Elmira WWTP would be disposed of by landfilling (due to quality concerns because of the heavily industrial nature of that plant’s influent wastewater).
As in Strategy I, a second generation ATAD would be installed at the Ayr WWTP and receive sludge from the New Hamburg and Hespeler WWTPs. The products would be liquid land applied, and the existing onsite storage would be used. Exhibit 4-20 shows a schematic of this strategy.

Exhibit 4-20
Strategy IV Schematic – Regional Heat Drying facility and Land Application
4.5 Evaluation of Short-listed Biosolids Management Strategies

This section outlines the evaluations conducted on the long list of alternative strategies. This evaluation is used in the development of the short-listed strategies.

4.5.1 Evaluation Process

The short-listed strategies were evaluated for environmental impact, risk, and cost. The environmental impact was evaluated by conducting LCA for each of the strategies. To evaluate risk, a risk inventory was compiled and the short-listed strategies were scored for the likelihood and severity of each risk identified in the inventory. The cost information collected during the long-list evaluation was refined and input into CH2M HILL’s proprietary Technomic model to generate improved cost estimates for each strategy.

This evaluation process is documented in Technical Memorandum 5: Evaluation of Short-Listed Alternatives (TM5) which can be found in Appendix K.

4.5.2 Strategy Evaluation

Life Cycle Assessment

The LCA was performed to compare the potential environmental impacts associated with each of the short-listed strategies. The following environmental components were evaluated for each of the short-listed strategies:

- GHG Emissions (carbon dioxide [CO₂] equivalent [CO₂e] emissions to the atmosphere): This component estimates a strategy’s contribution to global climate change.
- Acidification (hydrogen ion [H+] equivalent emission to the atmosphere): This component estimates the extent to which a strategy contributes to the acidification of the atmosphere and, by extension, rainfall which affects the oceans, fresh water bodies, and soils.
- Eutrophication (nitrogen [N] equivalent emission to the atmosphere and water): This component estimates the nutrient emissions for a strategy; nutrient emissions affect the dissolved oxygen levels in water bodies resulting in the death of fish and other organisms.
- Abiotic Depletion of Resources (depletion in the availability of non-living, natural resources, such as minerals): This component estimates the non-living natural resources required in the life cycle of a strategy.
- Water Consumption (mass of water consumed by process, measured in kg): This estimates the water consumption of a strategy and also accounts for water contributions.

The short-listed strategies were analyzed using GaBi4 Software, an LCA model produced by PE Americas. The analysis includes the life-cycle stages of sludge anaerobic digestion, dewatering, processing, and disposal of biosolids products. The life-cycle stages prior to the sludge digestion were not included because they are similar for all of the short-listed strategies and including them would not contribute to differentiating between the strategies.
Although the relative differences in the stages evaluated will have a greater impact by excluding these similar process stages, it was determined that this approach would provide a more accurate analysis. To provide a comparison between the environmental endpoints associated with the processing and utilization/disposal of biosolids products, process-specific data was input to the model when available. The LCA is a cradle–to-grave analysis. TM5 contains additional information on the LCA process and assumptions (Appendix K).

**Risk Impacts**

Risk is inherent in any biosolids management program. Managing risk identifies potential hazardous events, assesses the likelihood of an event occurrence, assesses the severity of an event, and develops an appropriate strategy to manage risk based on these factors and their financial impact. In general, the lower the likelihood and/or severity of a potential event, the lower the effort required to manage that risk. A BMP that considers risk management is far more robust and reliable than a plan that does not.

The first step in managing risk is to prepare a risk profile. In developing this profile, CH2M HILL identified specific risk issues, and evaluated the likelihood of an event occurring and the severity of the event’s outcome, both on a scale of 1 to 5. The scores were totalled and actions needed to reduce or minimize risk issues, based on the scores, were identified for each risk identified.

Following is a description of the evaluation scores used:

**Likelihood Score**

1. **Rare** – The event may occur in exceptional circumstances, and has not occurred in the past. Equipment is new (within the warranty period).
2. **Unlikely** – The event could occur at some time. Historically, it has occurred less than once every 5 to 10 years. Equipment is refurbished or rebuilt.
3. **Possible** – The event has occurred or may occur once or more per year. Equipment is approaching end of its life cycle.
4. **Likely** – The event has occurred or may occur on a monthly to quarterly basis.
5. **Very Likely** – There are one or more occurrences of the event on a monthly or more frequent basis. Equipment has exceeded its life cycle.

**Severity Score**

1. **Insignificant** – The event causes no injuries, and has no environmental impact. Minor investment is required.
2. **Minor** – The event has the potential to cause injuries, and has minor environmental impact. Unplanned investment is covered by the current budget. There is no loss of the Region’s reputation. There may be an increase in annual operating costs up to 5 percent.
3. **Moderate** – The event may cause minor injuries, and has easily reversible environmental impact. It may require a one-time unplanned investment of $25,000 to $100,000. The Region may be non-compliant, or there may be an increase in annual operating costs of 5 to 10 percent.
4. **Major** – The event has the potential to cause severe injury, and have significant environmental impact. A one-time unplanned investment of $100,000 to $250,000 may be required. The event may lead to basement flooding or an increase in annual operating costs of 10 to 25 percent.

5. **Catastrophic** – The event is likely to cause death or serious injury, and severe and irreversible contamination. A large population is likely to be affected for an extended period of time. The event may require significant unplanned investment greater than $250,000, or an increase to the annual operating cost of over 25 percent.

The Risk Management Matrix evaluation completed for the short-listed strategies can be found in TM5 (Appendix K).

**Economic Evaluation**

A financial analysis of the strategies was performed using CH2M HILL’s proprietary Technomic model. This model evaluates life-cycle costs of wastewater solids treatment systems, from digestion onwards, by combining the calculated capital and operational costs of the technical process requirements for each scenario. The model calculates mass balances for each solids-handling process using volumes and loads entered by the user to determine equipment sizes and resulting capital, operating, and present-worth costs. All upgrades and/or expansions to solids treatment processes currently under construction or detailed design were assumed to be completed, and the cost of these projects was not included in the Technomic models. The models were updated to reflect any conceptual design changes to each of the plants within each strategy and any new quotations provided by vendors.

A detailed description of the Technomic model can be found in TM3 (Appendix J). The refinements made to the model for the long-list evaluation can be found in TM5 (Appendix K).

**4.5.3 Evaluation Results**

**Life Cycle Assessment**

The detailed results of the LCA can be found in TM5 (Appendix K). The LCA provided insight into the environmental impacts of the four short-listed strategies. The main considerations from the LCA included:

- Strategies I, II, and IV (Option 1) would have similar environmental impacts, with greater climate change, acidification, and eutrophication impacts than Strategies III and IV (Option 2).
- Strategies III and IV (Option 2) generally resulted in lower impacts for the environmental categories evaluated.

Strategy IV Option 1 evaluates a central heat drying facility using natural gas to supply the heat, Option 2 evaluates a central heat drying facility using landfill gas and/or heat recovery to supply heat to the dryer.

**Risk Impacts**

The Region can mitigate all risks identified for the risk inventory through planning and use of best management practices. The four short-listed strategies had similar risk profiles and
no high risks were identified. Therefore, the risk analysis did not result in any significant differences between the four short-listed strategies.

**Economic Evaluation**

The detailed cost estimates for each of the four short-listed strategies can be found in TM5 (Appendix K).

The financial assessment of the final four strategies had the following results:

- Costs for Strategies I, III, and IV are not significantly different.
- Strategies II and IV have the highest capital cost, but the lowest annual O&M costs.
- Strategies I and III have the lowest capital cost, but the highest annual O&M costs.
- Strategy II has the highest cost per dry tonne.
- Strategy I has the lowest cost per dry tonne unless landfill gas could be used to run heat-drying facility in Strategy IV. If landfill gas or heat recovery is used, Strategy IV would be the least-expensive per dry tonne.

### 4.6 Consultation Activities during Phase 2

#### 4.6.1 Project Team

The PT met regularly throughout the second phase of the project and provided valuable insight into the Region's operations and biosolids management program. Appendix B contains agendas, meeting minutes, and materials from the PT meetings.

#### 4.6.2 Stakeholder Advisory Committee

Two meetings were held with the SAC during the second phase of the project (the first meeting was held in the first phase of the project). The second meeting was held on November 24, 2010 and the third meeting was held on April 28th, 2011. The committee provided valuable feedback that has been incorporated into the final preferred strategy discussed in the next section. Appendix D contains the meeting summaries, agenda, and materials.

#### 4.6.3 Project Steering Committee

The PSC met twice during the second phase of the project and provided valuable information to the PT regarding the Region’s operations and how the biosolids management program may affect other Regional departments. Appendix C contains the meeting summaries, agendas, and materials.

#### 4.6.4 Public Information Centre No. 2

The second set of PICs was held on May 4th, 5th, and 10th, 2011 in Baden, Cambridge, and Waterloo, respectively. A Notice of Invitation was published in local newspapers (The Record, Cambridge Times, Waterloo Chronicle, New Hamburg Independent, Ayr News, Elmira Independent, and the Woolwich Observer) twice (in the weeks of April 18 and April 25, 2011) and was also posted on the Region’s website; and e-mailed to individuals on the
project mailing list, key stakeholder groups, and review agencies. See Appendix E for the notice and correspondence received in response to the notice.

A display of project information was available during the PICs, and the public was invited to discuss their questions and concerns with members of the PT in an informal setting. The attendees were provided with an information brief summarizing the information presented on the display, and a comment sheet. A total of 20 members of the public signed the registers for the second PIC (see Appendix E).

The purpose of the second set of PICs was to provide an update and summary of the work completed since PIC 1. The information presented included the process of moving from the long list to the short list, biosolids management strategy development, the detailed evaluation, and the strategy recommendations and implementation plan.

The information presented at the second set of PICs can be seen in Appendix E. Four comment sheets were returned following this PIC. Appendix E summarizes the comments and correspondence received and actions taken with respect to the comments.

4.6.5  Notice of Study Completion

A Notice of Completion and cover letter were sent to review agencies on August 26, 2011, notifying them of the study’s completion and the commencement of the 30-day review period starting August 29, 2011. A Notice of Completion was published in the local newspapers (The Record, Waterloo Chronicle, New Hamburg Independent, Woolwich Observer, Cambridge Times, Ayr News, and The Independent-Elmira) and on the Region’s website to provide comment on the Master Plan Report for a 30-day review, which ends on September 27, 2011. The Master Plan Report was available for review at the Region’s Clerk Office, in Kitchener, and at townhalls throughout the Region (Waterloo, Cambridge, North Dumfries, Wellesley, Wilmot, and Woolwich). Appendix F contains the Notice of Completion and the agency and public correspondence received in response to the Notice of Completion and review of the Master Plan Report.

4.6.6  Impact of Consultation of the Study

The consultation between the PT, PSC, the public, and the SAC had considerable impact on Phase 2 of the study. The development of the alternative strategies and recommended preferred alternative have been influenced by the public consultation conducted as part of the study. This includes comments provided by the two PICs conducted, the PSC, and SAC. All groups provided information regarding current practices and the feasibility of the recommended biosolids management program in the Region.
5. **Recommended Biosolids Management Strategy**

### 5.1 Recommended Strategy

Based on the evaluation of biosolids management strategy options, the recommended strategy includes the following components:

- Processing of the Region’s biosolids into Class A products
- Installation of second-generation ATAD at the Ayr WWTP to process solids from the Ayr, New Hamburg, and Hespeler WWTPs into a Class A biosolids product that can be land applied or marketed as a fertilizer.
- Installation of a centralized heat drying facility to process dewatered biosolids from the Kitchener, Galt, and Waterloo WWTPs. This facility will be located on Regional property such that it can recover waste heat from local industry or cogeneration facilities. This process will produce a Class A heat dried product that can be land applied, marketed as a fertilizer, or used as a fuel in cement kilns.
- Employment of CHP/cogeneration at the Kitchener, Galt, and Waterloo WWTPs.

TM5 (Appendix K) discusses the development of this strategy and its implementation is described in detail in *Technical Memorandum 6: Implementation of the Recommended Preferred Strategy* (TM6), which can be found in Appendix L.

### 5.2 Strategy Overview

The preferred strategy uses heat drying to further process the dewatered cake from the Kitchener, Galt, and Waterloo WWTPs into a Class A product. The dried, Class A product can receive a letter of no objection from the CFIA and be sold as a fertilizer product. This product can be land applied by the Region or its contractor, or marketed and sold as a fertilizer product. It can also be sold and used as fuel in cement kilns. There are also opportunities to co-manage the dried product with other waste streams within the Region’s departments (for example, MSW).

The biosolids from the Region’s smaller WWTPs (Ayr, New Hamburg, and Hespeler) will be processed using the second-generation ATAD process. This process results in a liquid product which is highly stabilized, has been reduced in volume, and is less odourous than digested solids. It is considered a Class A product, allowing a diversity of end-uses including land application as a liquid or dewatered cake, and registration with the CFIA, allowing it to be sold as a fertilizer product.

The preferred strategy employs two key technologies: heat drying, and the second-generation ATAD process. The technologies are described in greater detail below, as well as in TM6 (Appendix L).
Under the recommended preferred strategy, a single heat drying facility will be constructed at a central location within the Region. This facility will generate a dried biosolids product from the Kitchener, Galt, Preston, Waterloo, Conestogo, St. Jacobs, Wellesley, and Heidelberg WWTPs’ dewatered biosolids. An analysis was performed assuming biogas or waste heat produced at existing cogeneration facilities located at the Waterloo landfill or from a local industry located adjacent to the Cambridge landfill could be used at the heat drying facility; natural gas would be used to augment the heating requirements as needed. The biosolids generated at the Elmira WWTP will continue to be landfilled because of quality concerns due to the heavily industrial nature of that plant’s influent wastewater.

A second-generation ATAD process will be installed at the Ayr WWTP. The Ayr WWTP will receive and treat sludge from the New Hamburg and Hespeler WWTPs. The second-generation ATAD product will be land applied as a liquid. The existing storage lagoons at the Ayr WWTP will be used, as required, for seasonal storage. If additional storage is required, the second-generation ATAD product will be stored in the biosolids storage lagoon or in the existing aerobic digestion lagoons located at the New Hamburg WWTP. When the New Hamburg lagoons are not being used to store the second-generation ATAD product, the solids produced at the New Hamburg WWTP can be thickened in the lagoons prior to being transported to Ayr for additional processing.

This strategy also recommends that CHP/cogeneration be installed at the Region’s three largest plants: the Kitchener, Waterloo, and Galt WWTPs.

TM6 (Appendix L) describes the impact of the recommended strategy on each of the Region’s WWTPs.

### 5.3 Implementation Plan

#### 5.3.1 Combined Heat Power/Cogeneration

It is recommended that CHP/cogeneration facilities be installed at the Kitchener, Waterloo, and Galt WWTPs. It is further recommended that these upgrades occur within the first 10 years of the implementation of the biosolids management strategy. It is also recommended that the CHP/cogeneration facilities employ waste heat recovery to provide digester and/or building heat. TM2 (Appendix H) identified that the digester heating and mixing equipment at the Kitchener WWTP is nearing its end of life. The necessary upgrades to the Kitchener WWTP digesters should be prioritized and coordinated with the installation of cogeneration. This allows the Region to take advantage of the gas generated by the digester, which would otherwise be flared off.

CHP/Cogeneration facilities at Kitchener, Waterloo, and Galt can be designed, built and operated by a private company, within a public-private partnership similar to the one the Region has established with Toromont Energy Ltd. for the co-generation facility located at the Waterloo landfill.

#### 5.3.2 Second Generation ATAD

It is recommended that the second-generation ATAD process and thickening be implemented at the Ayr WWTP within the first 5 to 8 years of the implementation of the preferred strategy. This allows the Region to begin producing a Class A product early in the
implementation of the biosolids management strategy. To reduce the cost of transporting
the solids from the Hespeler WWTP to the Ayr WWTP, it is recommended that WAS
thickening be installed at the Hespeler WWTP.

The ATAD and thickening process could be constructed under a design-build-finance­
operate-maintain model through a public-private partnership. This would allow capital
savings to the Region and earlier implementation. TM6 (Appendix L) discusses alternative
project delivery methods.

5.3.3 Heat Drying

The construction of a new, centralized heat drying facility employing belt drying technology
is recommended to be complete within the first 15 years of the implementation of the
biosolids management strategy. This timeline accounts for the WWTP upgrades currently
planned by the Region, and assumes that the Region will be completing the work.

It is recommended that the belt heat drying facility be located at a site where it can utilize
biogas and waste heat recovery from cogeneration engine exhausts, or from local industry to
offset the natural gas requirements of the dryer. Belt heat dryers operate at a lower
temperature and have reduced dust generation resulting in a drying operation that
mitigates many of the risks associated with thermal drying processes. The heat dried
product is considered a Class A product. This builds on the recommendations of the 2003
BMP, which recommended that the Region dewater its biosolids. The Region is in the
process of implementing this recommendation by constructing dewatering at the Kitchener
WWTP Manitou Drive Biosolids Management Facility. Dewatering upgrades have been
completed at the Galt WWTP and are scheduled for the Waterloo WWTP.

The use of the central heat drying facility may be implemented earlier if an alternative
project delivery method is used. It is recommended, that the Region consider the
construction of the heat-drying facility under a design-build-finance-operate-maintain
model through a public-private partnership. As with CHP/Cogeneration and ATAD
facilities, the Region could potentially realize significant capital savings through a public­
private partnership as compared to the traditional TM6 (Appendix L) discusses alternative
project delivery methods.

5.3.4 Interim Biosolids Management

In the interim (before the implementation of second-generation ATAD and heat drying) it is
recommended that the Region continue using contract disposal with land application. The
Region’s biosolids management would be contracted to a third party for land application.
Onsite dewatering at the Kitchener, Waterloo, Galt, and Elmira WWTPs would continue,
and the Region would contract out the hauling and disposal of both the dewatered and
liquid biosolids. The Region may consider a disposal method other than land application in
the new contract (e.g. composting, lime stabilization, incineration, etc.), allowing the Region
more diversity and flexibility. It is recommended that the storage of biosolids also be the
responsibility of the contractor. The landfilling of dewatered biosolids would be used as a
contingency practice only.
5.3.5 Biosolids Management Plan Updates
It is recommended that the Region continue to update their biosolids master plan on a regular basis (approximately every 5 years). This allows the Region to stay current, respond to regulatory changes, and incorporate advances in technology.

5.3.6 Implementation Schedule
Exhibit 5-1 illustrates the implementation schedule for the recommended biosolids management strategy.

5.4 Permits and Approvals Requirements
Implementation of the BMP components will require various types and levels of approvals. These requirements are summarized below.

5.4.1 Class Environmental Assessment Approvals (Environmental Assessment Act)
The Waterloo BMP completes Phase 1 and a substantial portion of Phase 2 of the Class EA process. Component activities identified in the BMP may require additional Class EA approval prior to their implementation. In all cases, the Waterloo BMP will provide the required project rationale and background data, and must be clearly referenced in site-specific Class EA studies and reports.

Operational process improvements and upgrades to existing WWTPs, up to the existing rated capacity, will fall under Schedule A or Schedule B. With the completion of this BMP, all Schedule A activities may proceed to the implementation phase, without the need for additional assessment. Schedule B activities may require additional assessment, depending on the specific undertaking, and consultation with stakeholders local to the project. A project file must be maintained for Schedule B activities and a 30-day review period must also be completed prior to project implementation.
### Exhibit 5-1
Implementation Schedule

<table>
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<tr>
<th>Year into Implementation Plan</th>
<th>2011</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
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<td>Engineering &amp; Approvals</td>
<td>Construction</td>
<td>Operation</td>
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</table>

**Key**: EA Period, Engineering & Approvals, Construction, Operation

**Biosolids Management Plan Recommendations**

- Elmira WWTP
  - Current Dewatering Upgrades
  - Addition of 2nd Centrifuge
- Kitchener WWTP
  - Heating & Mixing Upgrades
  - Cogeneration
- Galt WWTP
  - Cogeneration
- Waterloo WWTP
  - Cogeneration
- Ayr WWTP
  - Addition of Thickening
  - ATAD
- Hespeler WWTP
  - Addition of Thickening
- Region Property (Landfill)
  - Heat Drying
  - Update BMP
  - Update BMP
  - Update BMP
  - Update BMP
Where proposed activities require capacity increases beyond rated, including biosolids storage capacity and new transfer stations, the Region will be required to complete the activities for a Schedule C Class EA, including the completion of an ESR.

Regional facilities that are owned and operated by the private sector do not fall under the Class EA process. The EA schedule required for each of the implementation projects is outlined in TM 6 (Appendix L).

5.4.2 Certificates of Approval – Sewage (Ontario Water Resources Act)

Upgrades at the Region’s WWTPs will require amendments to the existing C of As for each plant. If the Region were to construct a facility at a new location, a new C of A would be required. Regional facilities that are owned and operated by the private sector do not fall under OWRA, and do not need a C of A.

5.4.3 Certificates of Approval – Air (Environmental Protection Act)

Upgrades at the Region’s WWTPs may require amendments to existing C of As, or new C of As, which would cover emissions of contaminants, including odour and noise. For example, installation of a cogeneration system will require an amendment to a plant’s C of As for its boilers. Regional facilities owned and operated by the private sector will require a C of A. C of As are designated Class I instruments under the Environmental Bill of Rights (EBR) and are advertised on the EBR Registry during a 30-day public comment period.

5.4.4 Certificates of Approval – System (Environmental Protection Act)

Biosolids land application contractors require an Organic Waste Management System C of A to transport waste material to the application site, or between plants. C of As are designated Class I instruments under the EBR and are advertised on the EBR Registry during a 30-day public comment period.

5.4.5 Certificates of Approval – Sites (Environmental Protection Act)

Previously, each land application site required an Organic Soil Conditioning Site C of A. However, under the proposed changes to the NMA, site C of As are going to be phased out and will no longer be required as outlined in TM4 (Appendix I). Individual farmers will be required to have a nutrient management plan for their farm.

5.4.6 Local Government Permits

Upgrades at the Region’s WWTPs may require building permits. New facilities at other locations will require building permits, and may require planning approval.
The BMP study has identified the following key capital recommendations:

- Continue updating the BMP on a regular basis (approximately every 5 years) to stay up-to-date on new research on health and environmental impacts of the alternative management methods, technological advances, and regulatory changes.

- Install CHP/cogeneration units at the Kitchener, Galt, and Waterloo WWTPs. These CHP/cogeneration facilities should use heat recovery to provide building and/or digester heating.

- Implement the second-generation ATAD process and WAS thickening at the Ayr WWTP.

- Implement the transfer of solids from the New Hamburg WWTP and thickened solids from the Hespeler WWTP to the Ayr WWTP for treatment through the second-generation ATAD process.

- Implement the heat drying of biosolids by employing belt-drying technology. This facility should be located at a site where heat recovery from local industry or cogeneration facility can be used to heat the biosolids drying process.

- It is recommended that the Region work to educate the public with regard to the heat dried product and work to develop a market for the heat dried product.

- It is recommended that the Region develop a formal contingency plan for the management of biosolids for times when the heat drying facility is offline and for the production “off-spec” material as part of a wide biosolids management contingency plan.

- The Region should consider alternative delivery methods (such as design-build-finance-operate-maintain) modeled through public private partnerships for the implementation of the CHP/cogeneration, advanced ATAD, and heat drying facilities.

Consider implementation of the above facilities through an alternative project delivery method (e.g. design-build-finance-operate-maintain) modeled through a public-private partnership.
7. **References**


**Acts and Regulations**


