Upper York Sewage Solutions
Environmental Assessment

Assessment of the Proposed Reclaimed Water Program

Prepared for:
The Regional Municipality of York

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Executive Summary

York Region confirmed the Innovative Wastewater Treatment Technologies (Lake Simcoe Water Reclamation Centre) alternative with York Durham Sewage System (YDSS) Modifications as the Preferred Alternative for accommodating the growth forecasted to occur in the Upper York Sewage Solutions (UYSS) Environmental Assessment (EA) service area to 2031. This forecast is in accordance with both the provincial growth management policies outlined in the Growth Plan for the Greater Golden Horseshoe pursuant to the Places to Grow Act, 2005 and applicable environmental legislation including, but not limited to, the Lake Simcoe Protection Act, 2008, the Oak Ridges Moraine Conservation Act, 2001, the Greenbelt Act, 2005, and the Ontario Water Resources Act, 1990.

The UYSS service area consists of the growth portions of the Towns of Aurora, Newmarket, and portions of East Gwillimbury, including Queensville, Holland Landing, and Sharon. The wastewater servicing capacity required to accommodate only the growth forecasted to occur in the UYSS service area to the year 2031 is 47.2 megalitres per day (MLD) annual average day flow. However, including residences currently serviced by existing private on-site septic systems and residences currently serviced by the Holland Landing Water Pollution Control Plant (WPCP) (Lagoons) in East Gwillimbury, capacity for the UYSS service area of 53 MLD (52.8 MLD) is required.

The Preferred Alternative (Innovative Wastewater Treatment Technologies) consists of the following components:

- A new Lake Simcoe Water Reclamation Centre (Water Reclamation Centre) that would produce 40 MLD annual average day flow of clean treated water suitable both for discharge to Lake Simcoe via the East Holland River and reclaimed water applications;
- A proposed project-specific phosphorus off-setting program to maintain the total phosphorus load to the East Holland River within the current allocation for the Holland Landing WPCP (Lagoons). These lagoons would be replaced by the proposed Water Reclamation Centre and would be decommissioned, and;
- Modifications to the existing York Durham Sewage System to provide additional system reliability during high flow conditions to accommodate sewage flow from approved growth from the Towns of Aurora and Newmarket.

It is intended that this "Assessment of the Proposed Reclaimed Water Program" be in support of the Preliminary Design Report for the Water Reclamation Centre providing additional information on the reclaimed water system.

York Region is moving ahead in its efforts to increase public awareness on the value of water to achieve sustainable program delivery as evidenced through the implementation of Water for Tomorrow. The use of reclaimed water in York Region is consistent with both the spirit and concepts embraced in the "Water for Tomorrow" program. Furthermore, in 2011 York Region Council endorsed a long-term water conservation strategy which included a suite of program components including an enhancement of York Region’s commitment to innovative water conservation initiatives, water resource protection and management, energy conservation and
greenhouse gas reduction. The Water Reclamation Centre would become a centre of excellence for education, innovation, and technology focussed on the value and importance of sustainably managing York Region’s water resources while protecting Lake Simcoe.

Reclaimed water generated from the Water Reclamation Centre is a highly treated new water resource already recognized in British Columbia, Alberta, Atlantic Canada, throughout the United States and around the world. The Water Reclamation Centre provides an opportunity to demonstrate the value of this resource to Ontarians which can be used beneficially to enhance the natural environment by displacing potable water demands and reducing stresses on environmentally sensitive water resources. It is intended that initially the reclaimed water will be used for irrigation of sod farms, tree farms, golf courses, and potential industrial uses within the vicinity of the proposed Water Reclamation Centre. Reclaimed water used for irrigation will be applied to lands at agronomic rates resulting in infiltration into the plant root zone while protecting against runoff from the irrigation site.

This report includes a "Proposed Water Reclamation and Reuse Framework for Non-potable Applications" which is a set of technical and operating criteria proposed for use in governing the production, distribution, application, and management of reclaimed water (i.e., the overarching program as captured from global water reuse experience). This Framework will form the basis for developing the Project-Specific Reclaimed Water Guidelines in consultation with the MOE. The Project-Specific Reclaimed Water Guidelines will be developed post-EA approval and prior to commissioning of the Water Reclamation Centre.

It is anticipated that the reclaimed water system will grow over time in response to both the volume of wastewater received at the Water Reclamation Centre and customer demand – a flexible system designed to match the reclaimed water quantity and quality demands of the customers.

One "Class A" or standard of reclaimed water will be produced at the Water Reclamation Centre that will be required to meet stringent quality standards established in this document and summarized in Table ES.1.
Table ES.1: Proposed Reclaimed Water Treatment Requirements for York Region

<table>
<thead>
<tr>
<th>Unit Operation</th>
<th>Limit¹</th>
</tr>
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<tbody>
<tr>
<td><strong>Filtration Method</strong></td>
<td></td>
</tr>
<tr>
<td>Cloth Disk filter at 35 L/min/m²</td>
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<tr>
<td><strong>Effluent Limits</strong></td>
<td></td>
</tr>
<tr>
<td>Average turbidity of 2 NTU within 24-hour period</td>
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</tr>
<tr>
<td>Not to exceed 5 NTU more than 5 percent of time within a 24-hour period, and</td>
<td></td>
</tr>
<tr>
<td>Not to exceed 10 NTU at any time</td>
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</tr>
<tr>
<td>Microfiltration</td>
<td>Not to exceed 0.2 NTU more than 5 percent of time within a 24-hour period, and</td>
</tr>
<tr>
<td></td>
<td>Not to exceed 0.5 NTU at any time</td>
</tr>
<tr>
<td><strong>Primary Disinfection</strong></td>
<td><strong>Disinfection Limit</strong></td>
</tr>
<tr>
<td><strong>UV</strong></td>
<td></td>
</tr>
<tr>
<td>For non-membrane filtration:</td>
<td></td>
</tr>
<tr>
<td>▪ Design dose of 100 mJ/cm² at maximum day flow</td>
<td></td>
</tr>
<tr>
<td>▪ UV transmittance &gt; 55 percent at 254 nm</td>
<td></td>
</tr>
<tr>
<td>For microfiltration:</td>
<td></td>
</tr>
<tr>
<td>▪ Design dose of 80 mJ/cm² at maximum day flow</td>
<td></td>
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<tr>
<td>▪ UV transmittance &gt; 65 percent at 254 nm</td>
<td></td>
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<tr>
<td>For reverse osmosis:</td>
<td></td>
</tr>
<tr>
<td>▪ Design dose of 50 mJ/cm² at maximum day flow</td>
<td></td>
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<tr>
<td>▪ UV transmittance &gt; 90 percent at 254 nm</td>
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<tr>
<td><strong>Chlorine</strong></td>
<td></td>
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<tr>
<td>▪ CT ≥ 300 milligram-minutes per litre with a modal contact time of at least 30 minutes based on peak dry weather flow; or,</td>
<td></td>
</tr>
<tr>
<td>▪ When combined with filtration, inactivates/removes 5-log₁₀ of plaque-forming units of F-specific bacteriophage MS2</td>
<td></td>
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<tr>
<td><strong>Secondary Disinfection</strong></td>
<td><strong>Disinfection Limit</strong></td>
</tr>
<tr>
<td><strong>Chlorine</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Chlorine residual at end user connection of 0.5 mg/L</td>
<td></td>
</tr>
<tr>
<td><strong>All Disinfected Reclaimed Water</strong></td>
<td><strong>Effluent Limits</strong></td>
</tr>
<tr>
<td><strong>Fecal Coliform</strong></td>
<td></td>
</tr>
<tr>
<td>▪ Median concentration non-detectable per 100 mL over 7 days sampling</td>
<td></td>
</tr>
<tr>
<td>▪ No sample &gt; 14 per 100 mL</td>
<td></td>
</tr>
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¹ Definition of units provided in List of Abbreviations and acronyms provided in Glossary.
² Meeting the above water quality limits will result in achieving a cBOD₅ limit lower than 10 mg/L.

In addition to the proposed reclaimed water quality requirements listed in the above table, this report sets out use requirements such as: application rate ranges (see Table 3.5); setback distances from adjacent land uses, landforms or features; separation distances between reclaimed water pipelines and potable water lines; signage and public notification of reclaimed water use; and cross connection controls.

Appropriate infrastructure will be provided to transfer reclaimed water from the Water Reclamation Centre to the various customers. Although initially the plant is only anticipated to receive 10 MLD of wastewater, a concept analysis of customer demand through potential user interviews indicated an upper value of 28.5 MLD of potential reclaimed water demand in the vicinity of the Water Reclamation Centre during the warm weather months.
System operating strategies including operation under average and wet weather conditions for reclaimed water have been established. These conditions factor into the distribution system infrastructure design and operation. To supply reclaimed water to customers the system will be progressively developed in response to reclaimed water demand and wastewater inflows to the Water Reclamation Centre. For the first irrigation season following start-up of the Water Reclamation Centre it is expected that customers in the vicinity of the plant could be supplied.

This report lays out management models that describe the important elements for an effective strategy to operate and manage a reclaimed water program, as well as how this could be integrated within York Region’s existing management structure. York Region will be required to establish an agreement template and reclaimed water rates for the anticipated customer base. This report also lays out a strategy for developing a fair reclaimed water rate that can be charged to a variety of future customers.

The technical elements for the generation of reuse water as a new water resource would be included in the CA for the Water Reclamation Centre. The mechanism for regulation of the End User/Customer of reclaimed water will be a stepped process approved through the EA which anticipates future development of regulatory framework for the End User while working collaboratively with the MOE or other provincial agencies and starting with a demonstration scale project using project-specific guidelines. This demonstration-scale project would see one End User using an ECA facilitated through the project. The specific End User approval requirements would be developed post-EA approval in consultation with a Regulatory Agency which may be the Ontario Ministry of the Environment (MOE), the Ontario Ministry of Agriculture and Food, or both.
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**Upper York Sewage Solutions EA**

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List of Abbreviations

ASM  Available Soil Moisture
AWWA  American Water Works Association
BOD$_5$  5- Day Biochemical Oxygen Demand
cBOD$_5$  5- Day Carbonaceous Biochemical Oxygen Demand
CCME  Canadian Council of Ministers of the Environment
EA  Environmental Assessment
$E_c$  Crop Evapotranspiration
ECA  Environmental Compliance Approval
EPA  United States Environmental Protection Agency
ET  Evapotranspiration Values
LSRCA  Lake Simcoe Region Conservation Authority
MF  Microfiltration
mg/L  Milligrams per litre
mJ  Millijoule
mL  Millilitres
MLD  Megalitres per day
mm  Millimetres
MOE  (Ontario) Ministry of the Environment
nm  Nanometre
NTU  Nephelometric Turbidity Units
NWQMS  National Water Quality Management Strategy
OMAFRA  Ontario Ministry of Agriculture, Food and Rural Affairs
OWRA  Ontario Water Resources Act
PTTW  Permit to Take Water
RO  Reverse Osmosis
SCADA  Supervisory Control and Data Acquisition
SMD  Soil Moisture Deficit
ToR  Terms of Reference (for the Environmental Assessment)
TP  Total Phosphorus
TSS  Total Suspended Solids
UF  Ultrafiltration
USGA  United States Golf Association
UV  Ultra Violet Radiation
UYSS  Upper York Sewage Solutions
WPCP  Water Pollution Control Plant
YDSS  York Durham Sewage System
Section 1.0
Introduction

This report documents the reclaimed water program of the Lake Simcoe Water Reclamation Centre (Water Reclamation Centre) as part of the Upper York Sewage Solutions Environmental Assessment (UYSS EA)\(^1\). As a result of a detailed assessment of potential servicing alternatives and participant input received through various and extensive consultation activities, the proposed Innovative Wastewater Treatment Technologies (Lake Simcoe Water Reclamation Centre Alternative with York Durham Sewage System (YDSS) Modifications) was confirmed as the Preferred Alternative for accommodating the growth forecasted to occur in the UYSS EA service area to 2031\(^2\).

As part of the Lake Simcoe Water Reclamation Centre Preferred Alternative, using environmentally sustainable wastewater purification and water recycling technologies, wastewater from growth in the Town of East Gwillimbury and a portion of the Town of Newmarket would be conveyed to the Water Reclamation Centre for treatment; the clean treated water would be discharged within the Lake Simcoe watershed.

The Water Reclamation Centre would include infrastructure to convey wastewater from the local municipal sewer systems, treat the wastewater at the Water Reclamation Centre, and then convey the clean treated water that complies with Ministry of the Environment (MOE) treatment standards for surface water discharge to the East Holland River. As documented in the Screening Assessment of the Alternatives To the Undertaking, the Innovative Wastewater Treatment Technologies (i.e., the Preferred Alternative To) would consist of a Water Reclamation Centre with an ultimate capacity of 40 megalitres per day (MLD) annual average day flow.

As part of their commitment to water conservation, The Regional Municipality of York (York Region) initiated “Water for Tomorrow”, and in 1998 launched a comprehensive water efficiency and conservation program that promotes innovative water conservation. Following through on this commitment, the Water Reclamation Centre will also be designed to produce reclaimed water, a new water resource that is highly treated and safe for unrestricted access. Reclaimed water is already recognized in British Columbia, Alberta, Atlantic Canada, throughout the United States and around the world as a valuable water resource. The Water Reclamation Centre represents an opportunity to demonstrate the value of this resource to Ontarians for its ability to reduce freshwater use.

Initially the reclaimed water will be used for irrigation (sod farms, golf courses, commercial tree farms, etc.) during the growing season and for industrial uses.

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\(^1\) The alternative method(s) described herein are considered as proposed until the Undertaking identified through the UYSS EA is approved by the Minister of the Environment.

\(^2\) See the Screening Assessment of the Alternatives To the Undertaking Report (CRA et al., 2011).
To enable the production of both virtually phosphorus-free surface water discharge for the East Holland River and the production of reclaimed water for beneficial reuse, the Water Reclamation Centre will be designed to operate in two modes:

- 100 percent of the influent wastewater treated for surface water discharge to the East Holland River (Lake Simcoe subwatershed), or
- Up to 75 percent of the influent wastewater (three of the four parallel treatment trains) treated for production and use as reclaimed water, with the remainder treated for surface water discharge to the East Holland River.
  - Low nutrient reclaimed water will be produced by withdrawing water downstream of the microfiltration units included as part of the surface water discharge train.
  - In the future, should customer demand create a business case for nutrient-rich reclaimed water for irrigation, Water Reclamation Centre processes can be operated to retain more of the valuable nutrients. It should be noted that while the Water Reclamation Centre is designed to produce both low nutrient and nutrient-rich reclaimed water, this EA is not seeking approval for the use of nutrient-rich reclaimed water.

It is intended that this document be in support of the documents outlined in the approved as amended Terms of Reference, specifically the Technical Work Plan (Appendix H) and Financial Work Plan (Appendix I) that will be produced during the UYSS EA.

This report includes a "Proposed Water Reclamation and Reuse Framework for Non-potable Applications" which is a set of technical and operating criteria proposed for use in governing the production, distribution, application, and management of reclaimed water (i.e., the overarching program as captured from global water reuse experience). This Framework will form the basis for developing the Project-Specific Reclaimed Water Guidelines in consultation with the MOE. The Project-Specific Reclaimed Water Guidelines will be developed post-EA approval and prior to commissioning of the Water Reclamation Centre.

The first step in detailing the reclaimed water program of the Water Reclamation Centre was the identification of the drivers for reclaimed water in York Region (Section 2.0). The second step included assessment of potential markets for reclaimed water, which involved identification of potential customers and reclaimed water quality and quantity requirements (Section 3.0). The use of reclaimed water as part of this project also required the establishment of a proposed water reclamation and reuse framework for non-potable applications, which were prepared following consultation with the Ministry of the Environment (Section 4.0).

Following definition of the potential markets and demands, and the establishment of a framework for project-specific guidelines, infrastructure requirements at the Water Reclamation Centre and for the distribution system are detailed (Section 5.0). Management models for administering the reclaimed water system are also described (Section 6.0).
Section 2.0
Drivers for Reclaimed Water

2.1 Introduction

Reclaimed water is a new water resource and opportunities for marketing reclaimed water in York Region must be evaluated based on the factors that drive reclaimed water use including: quantity demand, quality requirements, environmental issues, compliance limits and infrastructure requirements. These factors will vary by reuse type and by local conditions. The following sections discuss these drivers relative to the implementation of reclaimed water use in York Region.

2.2 York Region Short- and Long-Term Vision for Reclaimed Water Use

2.2.1 Reclaimed Water Defined

Reclaimed water is wastewater that has gone through various treatment processes to meet specific water quality criteria with the intent of being used in a non-potable beneficial manner (e.g., irrigation and industrial uses) that will displace demands for freshwater.

The ultimate scope of the reclaimed water program will be determined by the customer base and demand that will be established post-EA approval. The Water Reclamation Centre will be capable of providing low nutrient reclaimed water by redirecting water following microfiltration, disinfection and discharging to the reclaimed water distribution system. Alternatively, nutrient-rich reclaimed water could be produced retaining a higher phosphorus and/or nitrogen concentration through operating the biological treatment process with a low solids retention time followed by cloth disk filtration and disinfection.

It is envisaged that only low nutrient reclaimed water will be produced during the initial years of operation of the Water Reclamation Centre. As the treatment processes at the plant become established and public awareness and acceptance of this new water resource grows York Region will review the economics of producing nutrient-rich reclaimed water through dedicated treatment.

2.2.2 Marketing/Communication Outreach

York Region is moving ahead in its efforts to increase public awareness of the value of water to achieve sustainable program delivery as evidenced through the implementation of Water for Tomorrow. Furthermore, in 2011 York Region Council endorsed a long-term water conservation strategy which included a suite of program components including an enhancement of York Region’s commitment to innovative water conservation initiatives, water resource protection and management, energy conservation and greenhouse gas reduction.
The use of reclaimed water in York Region is consistent with both the spirit and concepts embraced in the Water for Tomorrow program. The Water Reclamation Centre will become a centre of excellence for education, innovation, and technology with one focus on the value and importance of reclaimed water as a water resource. Marketing and communication for reclaimed water use will be an integral component of the Water Reclamation Centre.

Initial outreach to the community and potential customers will be a key factor in establishing a successful reclaimed water program. In addition, feedback on areas of interest / concern over reclaimed water use received from interviews with potential initial customers (Section 3.0) can be addressed through an appropriate Outreach Program.

York Region will want to ensure factual and up-to-date information about reclaimed water quality and benefits is provided to dispel any misinformation that might arise, which is the primary reason for developing and implementing an active communication and outreach program. This information can be disseminated through fact sheets, presented at community meetings, and published on the existing York Region website.

A long-term external communication plan and key messages on reclaimed water should be developed, primarily targeted at potential customers. Information should continue to be presented as appropriate in community meetings and posted on the website for the greater community to hear and read about. This is a critical step to ensuring misinformation is not promulgated and the reclaimed water program is perceived as being transparent and accessible to all.

The long-term communication plan might include a reclaimed water fact sheet (FAQs for Customers), Water Reclamation Centre facility tours, a dedicated website and a key message card for staff that provides quick facts and other information about the reclaimed water program, its initial proposed uses, safety of the treatment process, and related responses.

2.3 Quality Requirements

Water quality requirements for reclaimed water are driven by compliance limits and customer needs.

As this is a new water resource, water quality requirements that focus on protecting public health and the natural environment must be developed. The recommended framework presented in Section 4.0 of this report includes reclaimed water quality requirements for various end uses. Potential users of reclaimed water include agricultural (irrigation of sod farms, golf courses, commercial tree farms etc.) and commercial/industrial sectors in York Region. Customer requirements can include specific constituent limits to meet end user needs – essentially custom or boutique water.

Factors that affect reclaimed water quality include the quality of the influent wastewater, the wastewater treatment processes and operations, and the design and operation of the reclaimed water storage and distribution systems. Thus, it is important to gain an understanding of the
water quality requirements of the potential customers during the planning phase of the reclaimed water initiative.

As will be presented in more detail in Section 3.0, the UYSS water reuse strategy focuses first on beneficial reuse through irrigation of non-food crops such as sod farms and golf courses. In the future there may be the opportunity for the use of reclaimed water for additional agricultural uses (e.g., commercial tree farms, nurseries), commercial and industrial users.

### 2.4 Considerations for Reclaimed Water Use

#### 2.4.1 Public Perception

A study by Ogilvie, Ogilvie & Company in 2010, Stakeholder/Public Attitudes towards Reuse of Treated Wastewater, was conducted to gauge stakeholder and public attitudes towards the concept of reclaiming treated wastewater. The study covered two towns in York Region; the Town of Georgina and the Town of East Gwillimbury, as well as the Source Protection Committee for the South Georgian Bay Lake Simcoe Source Protection Region and the PROPEL Committee and Original Stakeholder Advisory Committee for the Lake Simcoe Protection Plan.

The findings of the study indicate a general lack of familiarity with reuse. However, the study also identified that the general perception is that there is a need for water reuse and that it is a good idea for providing non-potable water.

Global experience has shown that public engagement in active and meaningful participation in, and "ownership" of the project decision making process, as well as building and maintaining trust with the community, are essential parts of a successful reclaimed water project (Ogilvie et al., 2010). Outreach programs to promote community engagement and educate the public on reclaimed water are a cornerstone of successful reclaimed water program implementation, which York Region is familiar with and will use as a basis for constructive community engagement. Key components of such a program should include openness, effectively communicating the value of reclaimed water, reclaimed water quality/quantity, information on opportunities for reuse (including examples of uses that are allowed and not allowed) and delivering early and consistent messages on the reclaimed water program.

#### 2.4.2 Environmental Protection

Reclaimed water is a water resource that can displace some potable water demands and reduce stresses on environmentally sensitive water sources. It is used throughout the United States, in several Canadian provinces, and around the world for this purpose.

Use of reclaimed water for irrigation must be carried out responsibly and at agronomic loading rates to promote infiltration into the soils for uptake by plants. To this end, there are a variety of potential environmental considerations which must be addressed when developing a reclaimed...
water program. Some will be addressed in the form of compliance limits and others are related specifically to the particular end use of reclaimed water.

Part of the design of a reclaimed water distribution scheme must, therefore, include consideration of pathways through which the reclaimed water may enter into and travel through the environment, such as through surface runoff, drift from irrigation spray, leaching to soils and groundwater and via migration through groundwater supplies. In Section 4.0, further discussion regarding the framework for project-specific water reuse guidelines to control the discharge of reclaimed water into the pathways is provided. This framework forms the basis for detailed project-specific guidelines to be developed post-EA approval and prior to the generation of reclaimed water for end users.

### 2.4.2.1 Application at Agronomic Rates

The fertility of lands irrigated with reclaimed water can be increased through the nutrients contained in the water, particularly nitrogen, phosphorus, and potassium. The Atlantic Canada Wastewater Guidelines Manual (Environment Canada, 2006) notes that "Nutrient loading rates, while significant, are seldom at levels that would present a concern when using municipal treated effluent for irrigation. Most nutrient levels are well within the range that can be assimilated by plants if the treated effluent is applied at a rate and frequency that conforms to active crop growth".

Most plants require more nitrogen than any other nutrient and it can easily be assimilated by the plant and soil system which will contain it or convert it to nitrogen gas (Environment Canada, 2006). **Nitrogen** is typically found in reclaimed water as organic nitrogen, ammonium, and nitrate. Organic nitrogen provides soil fertility while ammonium and nitrate contribute to plant nutrition (National Water Quality Management Strategy (NWQMS), 2006). Microorganisms in the soil can convert organic nitrogen and ammonia to nitrate, which is poorly bound to soil and therefore the most mobile form of nitrogen in the soil (NWQMS, 2006). If applied in excessive quantities, nitrogen contained in reclaimed water has the potential to spread to water bodies via runoff, direct discharge, or leaching to groundwater.

**Phosphorus** in the reclaimed water adsors to soil and is effectively immobilized making it readily available to plants. Proper irrigation controls will result in very little phosphorus leaching to the groundwater through soils and prevents surface runoff to nearby water bodies.

**Potassium** contained in reclaimed water is typically assimilated by crops and is not considered an environmental risk (Environment Canada, 2006).

Over fertilization could lead to nutrient imbalances, eutrophication, and nitrate contamination of groundwater. Note that such conditions are highly unlikely and controlled through user agreements and compliance limits (see Section 4.0 and Section 6.0).

By applying reclaimed water at agronomic rates, nitrogen and phosphorus will be supplied at beneficial levels and prevent the formation of a nutrient imbalance in the soils.
Surface Water Protection

There are a wide variety of Best Management Practices to protect surface water bodies from receiving excessive amounts of nutrients. Nutrients predominantly reach water bodies through direct discharge, surface runoff, or leaching to groundwater (which then travels to surface water bodies) and can lead to algae and weed growth. The growth of algae and weeds can then deplete oxygen levels, nutrient supplies, and light penetration to other aquatic species and in the case of algae may release toxins to the water body. Eutrophication can occur if lands or water bodies receive an excess amount of nutrients that cause excessive plant growth. On land, eutrophication can occur when an excessive amount of nutrients is applied and can result in loss of crop. As the customer base is defined, appropriate Best Management Practices for the end user will be identified.

Groundwater Protection

Through the application of reclaimed water at agronomic rates, ground water will be protected from receiving nutrients present in the reclaimed water. This is important for protection of groundwater resources particularly where they are used as a drinking water source.

2.4.2.2 Soil Productivity Protection

Monitoring salts is a common practice in any type of irrigation. Salts are a natural component of soils and are a source of nutrients for plants. Salts typically found in reclaimed water are sodium, chloride, potassium, calcium, magnesium, sulphate, and bicarbonate. Salinity is a measure of the total dissolved salts of the water. Per the Atlantic Canada Wastewater Guidelines Manual (Environment Canada, 2006) "while most turf species used on golf courses are reasonably salt tolerant, ground covers, ornamental plants, trees and shrubs may be affected if salt concentrations are too high".

Both sodium and chloride salts can be toxic to plants at high concentrations and can enter the plant via the roots or the leaves from spray irrigation. The occurrence of excess sodium in relation to calcium and magnesium can destroy soil structure and may be toxic to some crops (Environment Canada, 2006). A sodium adsorption ratio (SAR) is used as an indicator of sodium hazard in water. Further, it is recognized that over time the salinity of the soils can increase as water is evaporated or taken up by the plants and the salts remain in the soil. If the salt level in the soil rises too high the ability of the plant to uptake water will be affected due to the osmotic effects caused by the salinity (NWQMS, 2006). The reduced water uptake leads to reduced plant growth.

While the concentrations of sodium, magnesium, and calcium should be verified at full scale, for the reclaimed water anticipated to be produced by the Water Reclamation Centre, excess salts are not expected to be a problem.
2.4.2.3 Metals in Reclaimed Water

Metal contamination of the reclaimed water is unlikely. The long-range projections for growth in the area served by the Water Reclamation Centre do not indicate extensive development of industries which would create metal wastes.

The following metals can be toxic to plants and are included in Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Agriculture: aluminum, arsenic, beryllium, boron, cadmium, chromium (trivalent and hexavalent), copper, fluoride, iron, lead, lithium, manganese, molybdenum, nickel, selenium, tin, titanium, tungsten, uranium, vanadium and zinc (CCME, 2013).

While heavy metals can be toxic to plants at sufficient concentrations, the Atlantic Canada Wastewater Guidelines Manual (Environment Canada, 2006) advises that "Uptake of harmful amounts of toxic heavy metals by plants is not considered a potential risk in the use of municipal treated effluent. Most metals are removed from the wastewater in the primary treatment process".

2.4.2.4 Hydraulic Loading

Over-supply of water to or changing the water supply of an area can alter the water balance and lead to shifts in the vegetation or ecosystem characteristics. Flora and fauna can then adapt to, and become dependent on, the changed water balance (United States Environmental Protection Agency (EPA), 2012).

*The adverse effects of over watering are avoided with application of reclaimed water at agronomic rates; however, understanding of the issue and the mechanism is important.*

If base flows to the groundwater increase through leaching of reclaimed water through the soils, the water table can rise and soils become saturated. Saturated, or waterlogged soils, can cause salts in the soils to mobilise and increase soil salinity, affect ecosystems that rely on deeper soil water levels and affect wetlands or marshes where the water table is naturally high. Plants in waterlogged areas can suffer from hypoxia due to the lack of oxygen available to roots, which can cause decreased plant growth rates and increase plant susceptibility to disease (NWQMS, 2006).

Raised water tables and/or irrigation at a rate greater than evaporation plus downward demand can result in waterlogging at the surface or runoff. Stream flows can then increase during wet periods as a result of the reduced soil moisture capacity and greater runoff. The conditions that arise would be quite similar to those conditions described in Section 2.4.2.1 above for eutrophication where excessive growth of competitive species blocks the growth of less competitive species.
2.4.2.5 Stormwater Management

Well established stormwater management techniques are used to avoid adverse impacts of stormwater on lands irrigated with reclaimed water. Stormwater Best Management Practices, physical buffers (offset distances, bunds\(^3\) and drains) and biological buffers (vegetation strips) can be used to avoid migration of nutrients off-site and channel water at the site boundaries (NWQMS, 2006).

In some cases, changes in land use, such as commercial, industrial, or other developments are made possible by access to a reclaimed water supply and the changes are accompanied by larger building footprint and paved areas. Increased areas of impervious surfaces can reduce the area in which stormwater would naturally infiltrate and lead to higher surface runoff volumes which should be directed away from lands under irrigation with reclaimed water.

2.4.2.6 Impacts to Commercial and Industrial Users

There are several potential issues which must be addressed if reclaimed water is used for industrial or commercial purposes.

Corrosion and Scaling

Corrosion and scaling are not problems with reclaimed water used for irrigation. However if used for certain industrial applications, the presence of dissolved solids and minerals in the reclaimed water can lead to build up of these substances in industrial facilities equipment/systems such as cooling towers (most common) and stack gas scrubbers. Industrial end users may require additional water treatment processes/procedures to protect their systems, such as periodic discharging a portion of the used water from the system and replacing with fresh water.

Scaling can occur in industrial and commercial equipment if calcium, magnesium, sulphate, alkalinity, phosphate, silica, or fluoride is present in the reclaimed water. Scaling can be minimised by pre-treatment of the reclaimed water with water softeners, demineralizers, or reverse osmosis. Once scale has formed it must be periodically removed through chemical or mechanical means.

Biological Growth

Microbiological organisms present in the reclaimed water can form deposits in process equipment which can cause blockages or contribute to microbially-induced corrosion (EPA, 2012). Any nutrients in the reclaimed water may contribute to microbial growth. A biological control program may be required within processes experiencing biological growth. For example, use of biocides is typical for cooling towers regardless of the source water.

\(^3\) constructed retaining wall designed to prevent inundation or breaches from a known source or a secondary containment system commonly used to protect environments from spills
Section 3.0
Assessment of Potential Markets

3.1 Introduction

Reclaimed water is a new water resource for York Region that can serve as a non-potable water supply for many applications within the agricultural, commercial, industrial, and domestic sectors. During the initial years of Water Reclamation Centre operations, reuse applications that are expected to have a customer demand are irrigation of sod farms and golf courses. Other potential uses exist within York Region, and as such the customer base will likely expand in the future.

This section of the report reviews a broad range of potential uses for reclaimed water and identifies specific initial potential customers (sod farms, golf courses, and commercial tree farms) for reclaimed water from the Water Reclamation Centre. Furthermore, this section presents results of investigations of the typical reclaimed water quality and quantity that would be required by these initial users. A literature review of irrigation rates and nutrient demands was conducted to estimate the potential reclaimed water usage at sod farms, golf courses, and commercial tree farms in the vicinity of the Water Reclamation Centre. Interviews were then conducted with potential reclaimed water users to better understand present water consumption patterns and identify trends in usage that may affect future consumption.

3.2 Review of Previous Studies

Two studies have been recently conducted concerning reclaimed water use in the Lake Simcoe watershed. Table 3.1 lists the studies that have been reviewed.

Table 3.1: Previous Reclaimed Water Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Author</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Reuse Concept Analysis</td>
<td>AECOM for Lake Simcoe Region Conservation Authority</td>
<td>December 2010</td>
</tr>
<tr>
<td>Stakeholder/Public Attitudes towards Reuse of Treated Wastewater</td>
<td>Ogilvie, Ogilvie &amp; Company for Lake Simcoe Region Conservation Authority</td>
<td>March 2010</td>
</tr>
</tbody>
</table>

Water Reuse Concept Analysis

This study was conducted to look at the technical feasibility of water reuse, and explore available supply, demand and the cost benefit for various reuse options within the Lake Simcoe watershed. The driver for the study was the Lake Simcoe Protection Plan which describes the watershed as experiencing environmental pressures, particularly in relation to the quantities of phosphorus entering the lake.
The main purpose of this study was a preliminary screening of the feasibility of diverting phosphorus loadings from Lake Simcoe through implementing water reuse initiatives using reclaimed water from Water Pollution Control Plants (WPCP).

Three water reuse scenarios were investigated to develop a conceptual-level assessment of the cost effectiveness of reclaimed water applications to reduce phosphorus loadings to Lake Simcoe. The scenarios were:

1. Production of reclaimed water at Keswick WPCP for sod farm irrigation
2. Production of reclaimed water at Barrie Water Pollution Control Centre for reuse in new urban developments
3. Production of reclaimed water for irrigation at Uxbridge Brook WPCP ‘to represent a dedicated municipal land application/disposal practice’

The investigation concluded that the Keswick WPCP sod farm irrigation scenario had the most favourable cost-effectiveness for phosphorus removal of the three scenarios. Furthermore, implementation of sod farm irrigation could offer an attractive alternative to attain the required phosphorus loading levels for the Keswick WPCP, or for a different treatment plant, through a water quality trading off-set program.

The study also found that, in the context of the above opportunities, an urban reuse system can be quite beneficial and cost-effective for municipal water and wastewater management.

Recommendations for future efforts to further develop the potential benefits of reclaimed water use made in the study are as follows:

- Conduct a detailed feasibility study of sod farm irrigation from the Keswick WPCP
- Identify additional irrigation opportunities
- Evaluate the feasibility of urban reuse in further detail
- Integrate water reuse opportunities into regional and municipal water management strategies
- Develop a schedule of reuse opportunities suitable for water quality off-set trading

**Stakeholder/Public Attitudes towards Reuse of Treated Wastewater**

This study was run in parallel with the Water Reuse Concept Analysis study and provides a summary of findings from interviews of local stakeholder and public attitudes towards the concept of reclaiming treated wastewater.

The following stakeholder groups were interviewed:

- Town of Georgina (53 interviewees)
- Town of West Gwillimbury (Bradford; 21 interviewees)
- City of Barrie (17 interviewees)
Source Protection Committee for the South Georgian Bay Lake Simcoe Source Protection Region (10 interviewees)
PROPEL Committee and Original Stakeholder Advisory Committee for the Lake Simcoe Protection Plan (7 interviewees).

The interview was structured to gauge stakeholder and public acceptance of potential reuse applications and included such issues as:

- Levels of stakeholder awareness of the concept of reusing purified water from sewage treatment plants
- Stakeholder attitudes and opinions towards concept of reusing purified water
- Identification of acceptable and unacceptable uses of purified water
- Stakeholder rankings of the reasons for reusing purified water
- Types of information stakeholders need about reusing purified water and who do they trust to provide this information
- Method of engaging stakeholders in an on-going dialogue about reusing purified water from sewage treatment plants

Findings from the interviews provided the following information on reclaimed water use:

- General lack of familiarity with water reuse
- General perception that there is a need for water reuse
- General perception that water reuse is a good idea for providing non-potable water
- High familiarity with common water and wastewater terms
- Most acceptable uses of reclaimed water were where there was little or no risk of human ingestion
- Least acceptable uses of reclaimed water were where there was risk of human ingestion
- Interview results were consistent with American studies of acceptability of different types of water reuse
- The primary reasons for supporting water reuse were environmental
- The major concerns about water reuse were dominated by potential health effects
- Major barriers to public acceptance listed by respondents were:
  - Concerns about protection of public health
  - Lack of confidence in management of public utilities/authorities
  - Lack of public understanding about water reuse
  - Cost of treatment and distribution
- Terminology for water reuse favoured "reusing purified water" and "reclaiming water for beneficial uses"
- Levels of trust were low and mirrored American experiences
- Some willingness to pay a surcharge for reclaimed water
- The majority of respondents were willing to pay $100-$200 per year for reclaimed water
- Only limited concerns if the reclaimed water use was limited to commercial and industrial uses and paid for by them
- Most prevalent water conservation measures by respondents were technology replacements, not behaviour changes
- Majority of respondents were interested in continued involvement with reclaimed water use
- Public Information Meetings and websites were the preferred communication channels.

3.3 Potential Reclaimed Water Market

In order to complete a full and detailed evaluation for the potential use of reclaimed water, a range of potential reclaimed water application opportunities and demands in York Region were identified and studied including irrigation of agricultural areas (sod farms, container nurseries, greenhouses, commercial tree farms, hay fields and pastures), recreational areas (golf courses, and sports fields), highway corridors and regional roads, and other applications such as use of reclaimed water in new developments, industrial applications and baseflow augmentation of watercourses.

3.3.1 Irrigation of Agricultural Areas

The use of reclaimed water for irrigation of agricultural areas is among the most common and widely accepted applications of reclaimed water worldwide. The use of reclaimed water for irrigation not only offers a new water resource that is an alternative to the increasingly limited availability of surface and groundwater resources for the purpose of irrigation at the scale of sod farms, golf courses and commercial tree farms, but also provides a source of nitrogen and phosphorus, thereby reducing fertilizer requirements and costs while sustainably recycling these critical nutrients.

The successful application of reclaimed water for irrigation of agricultural areas throughout the United States, Australia, and elsewhere inform the proposal for non-food crop agricultural reuse in York Region.

3.3.1.1 Sod Farms

Proper irrigation management and control is an important factor in increasing sod production and ensuring quality in a competitive market. Irrigation may occur from May to October and there is a demand for sod (one interviewee said they would water more if they had more water available). Most irrigation takes place in the drier months of July and August. Sod production is dependent on sufficient water. During dry periods, growers currently rely on local water courses, private wells and storage, and a Permit To Take Water to maintain production and
delivery of sod to the market. Use of reclaimed water to maintain and encourage growth of sod product is a more sustainable practice.

### 3.3.1.2 Greenhouses

York Region has about 26.5 hectares (ha) of greenhouses (Planscape Inc. and Regional Analytics, 2009). In the Holland Marsh, greenhouses account for about 4.25 ha that allow growers to plant crops early in the season, and produce multiple crops which increases productivity. Further analysis would be required in the future to identify non-food crop greenhouses, should this application be considered in the future.

### 3.3.1.3 Commercial Tree Farms and Container Nurseries

Tree farms usually consist of field production nurseries that grow landscape trees and Christmas trees. Tree farms are highly competitive markets in Southern Ontario and use irrigation to increase yield and ensure the quality of their products. Tree production growers in Ontario currently irrigate in order to accelerate the tree growth.

Another application of tree farms is the management of those tree farms for the purpose of carbon sequestration and oxygen generation while using reclaimed water as a source of water and nutrients. Maples and poplars are ideal trees for carbon sequestration, as they use a large amount of water and can tolerate wet soil conditions. Maple is commonly used for furniture and other wood products. Poplar use for feedstock for oriented strand board and pulp mills is increasing. Both maple and poplar are grown in Southern Ontario.

Container nurseries are nurseries where non-food crop plants are grown in a pot. The demand of nursery products typically increases as new residential and commercial development takes place.

### 3.3.1.4 Hay Fields and Pastures

Tame hay (hay cut from cultivated grasses) and fodder crops (sometimes used as animal feed), considered in the same crop category, are one of the top five crops in East Gwillimbury (2006 Census of Agriculture, Statistics Canada). However, it is not common practice in Ontario to irrigate hay and fodder crops (Verhallen, 2010).

### 3.3.2 Irrigation of Recreational Areas

The use of reclaimed water for irrigation of recreational areas such as golf courses, sports fields, and other manicured areas are common applications of reclaimed water particularly in more urban areas.
3.3.2.1 Golf Courses

In the East Holland, Maskinonge, and Black River subwatersheds in York Region the pumping of groundwater for golf course irrigation poses a strain on regional water resources. Currently about 68 percent of the available groundwater resources in the East Holland River subwatershed are in use (East Holland River Subwatershed, 2010). Depleting groundwater supplies reduces groundwater discharges (baseflow) to head water streams in the Oak Ridges Moraine and as a result has negative impacts on cold water fisheries and other aquatic habitats.

Existing Reclaimed Water Use for Golf Course Irrigation in Ontario

The Ballantrae Golf and Country Club in Stouffville, Ontario, located west of Highway 48 and north of Aurora Road has a Permit To Take Water that provides for the use of treated wastewater for golf course irrigation since 1998. Water is pumped to two ponds on site, mixed with treated sewage effluent from a 900-unit condominium development and irrigated using an overhead spray irrigation system on the 18-hole golf course (Environmental Registry, 2010).

*The Ballantrae Golf and Country Club received signature status by the environmental education organization Audubon International for its water reuse activities and preservation of green space.*

3.3.2.2 Manicured Open Spaces

In general, manicured open spaces include sports fields and parks. There are several sports fields located within York Region that may provide an opportunity for irrigation with reclaimed water.

3.3.3 Irrigation of Urban Areas

Boulevards around Regional corridor centres are a source of civic pride and offer green trees, flowering shrubs, and a pleasing aesthetic on main roadways in an urban setting. These areas would continue to flourish with access to plentiful reclaimed water supplied by tanker trucks, thereby reducing stress on potable water supply particularly during seasonal water bans.

Highway corridors are usually composed of a variety of grasses, some native shrubs and sometimes trees; and they can include grassed swales, constructed wetlands, and stormwater management facilities. However, these areas a generally designed/planned with drought resistant grasses and shrubs.

Increasing use of reclaimed water in urban areas elsewhere has led to the development of many large dual water systems that distribute both potable water and reclaimed water to the same service area. As the UYSS service area will be an area of future development, a
dedicated reclaimed water distribution system for landscape irrigation and fire protection could be installed to service the residents of this area.

3.3.4 Reclaimed Water Use in Industrial Applications

Use of reclaimed water in industry is widespread with most common use as cooling water and boiler make-up water. Other industrial uses include ash/dust suppression in flue gas scrubbers and at construction sites. Use of reclaimed water for feed water to high purity water systems is an emerging trend in industrial applications in water scarce regions.

3.3.5 Baseflow Augmentation of Watercourses

The intent of stream augmentation is typically to improve the existing stream water quality and quantity to sustain or enhance aquatic life particularly during summer, low flow months. The East Holland River, a tributary to Lake Simcoe, is under considerable stress partly as a result of the high level of impervious surfaces in the growing urban areas resulting in decreased infiltration of precipitation which in turn can result in low groundwater levels and reduced baseflow in watercourses. The cumulative effects of these activities have caused the East Holland River to become one of the most stressed subwatersheds in the Lake Simcoe watershed, and one of the largest contributors to Lake Simcoe’s phosphorus loads (MOE, 2010). Discharge of the high-quality, phosphorus-reduced, clean treated water from the Water Reclamation Centre to the East Holland River as proposed by the UYSS EA would improve both the quality and quantity of water in the river which flows into Lake Simcoe.

3.4 Water Reclamation Centre Initial Reclaimed Water Opportunities

3.4.1 Initial Reclaimed Water Uses

Potential reclaimed water application opportunities and demands in York Region will be assessed based on their distance from the Water Reclamation Centre, with a preference placed on closer demands/locations which can more easily be provided with reclaimed water. Potential applications located within five kilometres of the Water Reclamation Centre are considered to be the most feasible users, followed by those located within a ten-kilometre radius. Of the potential reclaimed water application opportunities and demands in York Region identified in Section 3.3, only sod farms and golf courses are expected to have an initial significant demand for this new water resource. These are the customers to be permitted for reclaimed water use by a Regulatory Agency during the initial years following the Water Reclamation Centre start-up. The water quality requirements for these applications are provided in Section 4.0.
Potential opportunities will also be assessed by their proximity to other potential opportunities, such that customer cluster areas can be identified. This will allow reclaimed water to be provided to these areas by a common transfer main and may extend the range of the reclaimed water supply beyond ten kilometres from the Water Reclamation Centre. Assessment of the potential reclaimed water opportunities and identification of opportunities that would be considered initially are covered in Section 3.4.2.

### 3.4.2 Initial Reclaimed Water Customers

Sod farms and golf course opportunities that have been identified as potential reclaimed water users in the initial years following the Water Reclamation Centre start-up are listed in Table 3.2. For reference, potential customers beyond a ten-kilometre radius have also been included.
Table 3.2: Identified Potential Reclaimed Water Opportunities

<table>
<thead>
<tr>
<th>Use Type</th>
<th>Stakeholder</th>
<th>Location</th>
<th>Distance from Water Reclamation Centre (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sod farm</td>
<td>Queensville Sod Farm</td>
<td>21468A Leslie St, Queensville</td>
<td>0 – 5 km</td>
</tr>
<tr>
<td>Sod farm</td>
<td>Brouwer Sod Farm</td>
<td>23965 Warden Ave, Keswick</td>
<td>5 – 10 km</td>
</tr>
<tr>
<td>Sod farm</td>
<td>J. Lipani and Sons Sod Farms</td>
<td>2374 Holborn Rd, Queensville</td>
<td>0 – 5 km</td>
</tr>
<tr>
<td>Sod farm</td>
<td>Carruthers Sod Limited</td>
<td>3441 Queensville Side Rd E, Queensville</td>
<td>5 – 10 km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Silver Lakes Golf and Country Club</td>
<td>21114 Yonge Street, Newmarket</td>
<td>0 – 5 km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Shawneeki Golf Club</td>
<td>18543 Woodbine Ave, Sharon</td>
<td>5 – 10 km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Pheasant Run Golf Club</td>
<td>18033 Warden Ave, Sharon</td>
<td>5 – 10 km</td>
</tr>
<tr>
<td>Additional Reclaimed Water Opportunities (10 – 15+ km distance from Water Reclamation Centre - for reference only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golf Course</td>
<td>Cardinal Golf Club</td>
<td>2740 Davis Drive West, King</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>St Andrews Valley Golf Club</td>
<td>4 Pinnacle Trail, Aurora</td>
<td>10 – 15 km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>King Valley Golf Club</td>
<td>15675 Dufferin St, King City</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Magna Golf Club</td>
<td>14780 Leslie St, Aurora</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Westview Golf Club</td>
<td>1563 Vandorf Rd, Aurora</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Highland Gate Golf Club</td>
<td>21 Golf Links Dr, Aurora</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Beacon Hall Golf Course</td>
<td>400 Beacon Hall Dr, Aurora</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Kings Riding Golf Club</td>
<td>400 Bathurst St. King City</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Emerald Hills Golf and Country Club</td>
<td>14001 Concession #5, Stouffville</td>
<td>15+ km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Orchard Beach Golf and Country Club</td>
<td>273 Metro Rd N, Keswick</td>
<td>10 – 15 km</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Lyndhurst Park Golf Club</td>
<td>24198 Highway 48, Baldwin</td>
<td>15+ km</td>
</tr>
</tbody>
</table>

† Constraints in terms of distance and urban interference would have to be reviewed on a case-by-case basis.

Two sod farms and one golf course are located within the five kilometre radius of the Water Reclamation Centre and were identified as primary potential opportunities. Two additional sod farms and two golf courses located between five and ten kilometres from the plant were identified as secondary potential opportunities. To complete the list, a cluster of two golf courses and a sod farm located ten kilometres north of the Water Reclamation Centre and a cluster of ten golf courses located approximately fifteen kilometres south of the Water Reclamation Centre were also identified as potential opportunities.

As mentioned in the Introduction, the Water Reclamation Centre will be capable of providing both low nutrient and nutrient-rich reclaimed water. To create UYSS-specific reclaimed water
infrastructure, Project-Specific Guidelines, management models and a marketing/communication strategy, details of the potential reclaimed water customer’s current and future predicted water consumption volumes are needed.

Independent of the water consumption requirements, nutrients (nitrogen and phosphorus) present in the nutrient-rich reclaimed water can be beneficially reused by end users to decrease the amount of fertilizer that must be purchased. The value of having nitrogen and phosphorus provided with the reclaimed water will be further evaluated as part of the economic analysis for future customers as the program is developed.

3.5 Water Reclamation Centre Initial Reclaimed Water Demand Projections Based on Published Data

A literature review of agricultural practices and water reuse guidelines specific to Canada or York Region, or industry practices or standards in the absence of such guidelines, was conducted to develop irrigation demands for each reclaimed water end user type (sod farms and golf courses).

This evaluation is based on all the potential users identified in Table 3.2. The potential land areas for application of reclaimed water used in the evaluation are summarized in Table 3.3.

<table>
<thead>
<tr>
<th>Use Type</th>
<th>Potential Irrigated Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sod farms</td>
<td>1,148</td>
</tr>
<tr>
<td>Golf Courses</td>
<td>769</td>
</tr>
</tbody>
</table>

3.5.1 Sod Farm and Golf Course Irrigation

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Turfgrass Management Recommendations – Publication 384 (M384) (OMAFRA, 2009) was the primary source of guidelines for determination of sod farm and golf course irrigation and nutrient demands. The Water Budget method was used to estimate average monthly irrigation (water quantity) demands.

3.5.1.1 Precipitation Analysis

Understanding precipitation trends is integral to estimating irrigation needs. In the absence of a precipitation data set of sufficient duration in the direct vicinity of the Water Reclamation Centre proposed location it was necessary to identify the best available data set relevant to York Region. Daily precipitation data from Baldwin and Richmond Hill were identified as potential data sets based on their proximity to the Water Reclamation Centre and their period of record.
Daily data for Baldwin, Ontario (January 1, 2005 to November 28, 2012) and a summary of historical data for Richmond Hill, Ontario (January 1, 1971 to December 31, 2000) were acquired from the National Climate Data and Information Archive and compared.

**Figure 3.1** presents a comparison of the two data sets, focusing on the average monthly precipitation and the average days per month with precipitation events greater than 5 or 10 millimetres (mm). The comparison suggests that while the average precipitation varies, there is no discernible trend that would make one data set better than the other for this application. Further, the number of days per month with rain events exceeding 5 or 10 mm is very similar for both locations. Given the relative similarity between the two data sets, the location of the stations was used as the determining factor. The Baldwin data was chosen despite being a smaller data set, because Richmond Hill is located on the other side of the Oak Ridges Moraine (different watershed) from the Water Reclamation Centre in Queensville and the UYSS service area and likely experiences different weather patterns. Thus, daily data precipitation data for Baldwin, Ontario for the period January 1, 2005 to November 28, 2012 and the Water Budget Method were used to estimate daily and average monthly irrigation needs over the period of record.

**Figure 3.1: Comparison of Baldwin and Richmond Hill Precipitation Data**

The significance of the frequency of 5-and 10-mm rain events is related more to the need for storage if operating in nutrient-rich reclaimed water mode. The biological processes to deliver nutrient-rich water require a number of days to stop and restart - i.e., cannot be turned on and off as is the case for low nutrient treated water. If there are multiple rain events in a row and/or consecutive days of rain, the reclaimed water users may not need the reclaimed water. When this
happens production of the reclaimed water must stop (low nutrient operating mode) or it needs to be stored (nutrient-rich operating mode) for beneficial reuse after the wet weather event.

**Figure 3.2** shows that based on historical data it can be expected that 90 percent of the time there will be no more than two rain events of greater than or equal to 5 mm/day on consecutive days in any given month. Thus, 90 percent of the time it may not be possible to irrigate once or twice a month.

**Figure 3.2: Consecutive Rain Events Analysis**

![Consecutive Rain Events Analysis](image)

3.5.1.2  **Water Budget Method**

The Water Budget Method is recommended by OMAFRA to estimate daily irrigation requirements and is based on a calculated daily Soil Moisture Deficit (SMD). The SMD is a function of the moisture storage capacity of the soil (field capacity) and the Available Soil Moisture (ASM), which is based on the previous day ASM, precipitation, the previous day irrigation, and crop evapotranspiration ($E_c$). Irrigation equal to the SMD is recommended when the SMD exceeds 50 percent of the field capacity. A detailed discussion of the method can be found in OMAFRA M384.

Inputs for the analysis include the field capacity, daily precipitation data, and crop evapotranspiration. Field capacity is a function of soil type and is defined for various soil types in M384. For this analysis, the soil type was assumed to be sandy loam and the soil was assumed to be saturated at the start of the analysis, i.e., ASM initial was assumed to be 100 percent of the field capacity or 30 mm for a sandy loam at the start of the analysis. Daily precipitation data for the period January 1, 2005 to November 28, 2012 at Baldwin, Ontario.
Crop evapotranspiration rates for turf vary as a function of weather conditions, therefore a range of $E_c$ values were considered to evaluate the potential range and sensitivity of calculated irrigation rates. OMAFRA M384 provides observed average maximum daily evapotranspiration values (ET) for the months of May through September for various areas throughout Ontario (OMAFRA, 2009). While not specific to turf, it was assumed that these provide a valid estimate of $E_c$ for turf. Values for October through April were estimated based on this data. The United States Golf Association (USGA) reports a range of $E_c$ of 4 mm/day to 10 mm/day for cool season grasses (Beard and McKenna, 2008). For this analysis the OMAFRA ET values for Ottawa, Ontario (same climatic zone as vicinity of Water Reclamation Centre) were used in the irrigation calculations and compared to results derived using 4 mm/day (USGA low) and 10 mm/day (USGA high) values.

The results of the Water Budget irrigation evaluation are summarized in Table 3.4. Comparison of the results for the various $E_c$ values suggests that the OMAFRA ET and USGA low $E_c$ derived irrigation rates are of similar magnitude, while the USGA high $E_c$ derived rates are notably higher. Further consideration of the data reveals that the irrigation rates derived using the OMAFRA ETs more closely mimic anticipated irrigation practices, with noticeably lower irrigation rates in the cooler months, while the USGA low $E_c$ derived rates vary only slightly over the course of the growing season with no apparent correlation to seasonal variation in weather conditions. While it appears 4 mm/day is a valid estimate of the average evapotranspiration over the growing season as compared to the OMAFRA ET values, it does not provide the sensitivity to local weather conditions that the OMAFRA values provide. For this reason, the OMAFRA ET based irrigation rates were used for estimating sod irrigation demand potential for the sod farms and golf courses.
### Table 3.4: Estimated Evapotranspiration Rates and Calculated Irrigation Rates

<table>
<thead>
<tr>
<th>Month</th>
<th>Avg. Mon. Precipitation (mm/d)</th>
<th>Evapotranspiration (mm/d)</th>
<th>Avg. Mon. Irrigation (mm/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OMAFRA ET^2</td>
<td>USGA Low Ec^3</td>
</tr>
<tr>
<td>January</td>
<td>1.8</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>February</td>
<td>2.2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>March</td>
<td>1.3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>April</td>
<td>2.3</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>May</td>
<td>2.3</td>
<td>3.6</td>
<td>4</td>
</tr>
<tr>
<td>June</td>
<td>2.8</td>
<td>4.6</td>
<td>4</td>
</tr>
<tr>
<td>July</td>
<td>3.5</td>
<td>4.7</td>
<td>4</td>
</tr>
<tr>
<td>August</td>
<td>2.8</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>September</td>
<td>3.0</td>
<td>2.3</td>
<td>4</td>
</tr>
<tr>
<td>October</td>
<td>2.6</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>November</td>
<td>2.4</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>December</td>
<td>2.1</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

1. Based on daily precipitation data for the period January 1, 2005 to November 28, 2012 at Baldwin, Ontario acquired from the National Climate Data and Information Archive.
2. Monthly average based on OMAFRA M384 observed average maximum daily evapotranspiration for select days May through September for Ottawa ON (M384 Table 8-1). Values for October through April estimated based on this data.
3. USGA recommends a range of Ec of 4 mm/day to 10 mm/day for cool season grasses.

### 3.5.1.3 Sod Farm and Golf Course Irrigation Demands

As stated above, the OMAFRA Water Budget method was used to estimate average monthly irrigation rates for the growing season, April through November. It is assumed that no irrigation will occur during the winter months.

These calculated irrigation rates were used to estimate reclaimed water demands for sod farms and golf courses listed in Table 3.2. Figure 3.3 and Figure 3.4 present an estimate of total monthly irrigation demands for the potential sod farms and golf courses, respectively.
Figure 3.3: Sod Farm Irrigation Demands

![Sod Farm Irrigation Demands Graph]

Figure 3.4: Golf Course Irrigation Demands

![Golf Course Irrigation Demands Graph]

3.6 Water Reclamation Centre Initial Reclaimed Water Demand Projections Based on Potential Customer Interviews

Although implementation of the Water Reclamation Centre reclaimed water program is almost a decade into the future and demands are now only rough projections, it is nonetheless important to approach future end users to determine level of interest and knowledge of reclaimed water. To increase understanding of actual water quantity and nutrient requirements, potential
customers were invited to participate in an interview focused on better understanding their irrigation and fertilization practices.

An interview questionnaire was developed to focus on irrigation of non-food crops only and was set up with general, open-ended questions relating to the project and detailed questions on the irrigation and fertilization practices of the interviewees. By contacting several potential customers, more information and better understanding of water use at each property type (e.g., golf course or sod farm) was gained.

Interviews were conducted in early 2013 by the UYSS Project Team with the following potential end users:

- Queensville Sod Farm
- Brouwer Sod Farm
- Silver Lakes Golf and Country Club
- Beacon Hall Golf Course
- Emerald Hills Golf and Country Club
- Orchard Beach Golf and Country Club
- Pheasant Run Golf Club
- Shawnee Golf Club
- Water and sewage manager for Emerald Hills Golf and Country Club, King Valley Golf Club, Highland Gate Golf Club, and Kings Riding Golf Club

Findings of the interviews on water quantity are presented in Section 3.6.1 and findings on nutrient usage are presented in Section 3.6.2. A copy of the questionnaire and summary of responses to all questions is provided in Appendix A.

3.6.1 Water Quantity

For users currently taking more than 50,000 litres/day of water from ground or surface water sources, a Permit To Take Water (PTTW) is required under Section 34 of the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation (O. Reg. 387/04). Currently the golf courses and sod farms interviewed obtain water from both groundwater and surface water sources and all had a PTTW issued by the MOE. These permits allowed the user to take water during a limited time period each year, typically for five to six months during the warmer months (May to October). The withdrawal of water is typically limited to a maximum flowrate within a 24-hour period. Flow rates outlined in the permits are maximum permissible flowrates and are likely determined by peak irrigation demands during the dry summer months.

The PTTWs are mostly issued for a five- or ten-year period and the permits for almost all of those interviewed expire in 2018. Both ground and surface water sources in the area are facing increased pressure as a result of greater demand from a growing population and as greater irregularities in weather patterns are experienced. Several participants mentioned in the
interview that they expect permit requirements to become more stringent in the future as tighter control is placed on the use of water resources. Availability of reclaimed water can help provide a secure water source to these facilities and alleviate demands on the ground and surface water systems in the area.

The start of the irrigation period is dependent on the weather but generally starts in May or June, rarely in July, and finishes around October. Almost all irrigation takes place in the evening, overnight or early morning to reduce evaporation loses. During particularly rainy years, several facilities noted they may use very little irrigation water and then maybe only for a one or two month period.

In addition to monitoring weather conditions, irrigation is prompted by visual inspections of the sod/turf and the use of moisture meters or soil probes on some properties.

All of the interview respondents store water in onsite ponds from which the irrigation water is pumped when required. The volume of the ponds was known by less than half of those interviewed and but generally seems to be less than 1 megalitre (ML) except for one property with a 57 ML reservoir.

Golf Courses

At the golf courses, the frequency of irrigation varies with the weather and can be as often as every night during dry periods to less than two nights per week. For the golf courses interviewed, the minimum, average, and maximum irrigation rates during the irrigation period were on average 0.3 MLD, 0.6 MLD, and 1 MLD, respectively per golf course. The average area irrigated at a golf course is 28 ha.

Two golf courses already use reclaimed water generated and treated at an associated housing development. Representatives of both of these facilities indicated that owners, staff, and patrons are comfortable with water reuse and that water security has increased with reclaimed water use.

Sod Farms

The irrigation rates at the two sod farms interviewed were found to be different due to the specific conditions at the farms such as the "age" of the sod (when planted), the soil types, the type of turf being grown and were also highly dependent on the weather. The irrigation rates reported were equivalent to 30 m³/ha/d minimum 54 m³/ha/d average, and 110 m³/ha/d maximum during the irrigation period. The average area of sod under irrigation is 182 ha.

Golf Course and Sod Farm Irrigation Rates

Based on the information collected during the interviews, irrigation rates considered representative of the flows that might be utilized by any individual golf course or sod farm are presented in Table 3.5.
Table 3.5: Current Irrigation Demand Projections

<table>
<thead>
<tr>
<th>Location</th>
<th>Flow (MLD)</th>
<th>Hectares per property (ha)</th>
<th>Irrigation Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>m³/ha/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mm/ha/day</td>
</tr>
<tr>
<td>Golf Course</td>
<td>0.3 (low)</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>0.6 (average)</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>1 (maximum)</td>
<td>28</td>
<td>39</td>
</tr>
<tr>
<td>Sod Farm</td>
<td>5 (low)</td>
<td>182</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>10 (average)</td>
<td>182</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>20 (maximum)</td>
<td>182</td>
<td>110</td>
</tr>
</tbody>
</table>

The low condition described above would generally occur during periods of above average rainfall. The average values were based on the use of irrigation based on the assumption of typical summer weather conditions in York Region. The maximum irrigation rates noted would be infrequently applied during extreme dry periods and at agronomic rates. The calculated values noted in the table are based on current use information collected during the interviews (volume/ha per night), assumptions on weather (wet to dry) and the subsequent frequency of irrigation. These data are based on actual conditions noted at sod farms and golf courses in York Region.

3.6.2 Current Nutrient Application Practice

Nitrogen is applied to the sod/turf at all of the facilities that participated in the interviews. Both soluble and slow release forms of nitrogen are used and one property uses biosolids from wastewater treatment plants as a nutrient source (biosolids not from a York Region facility). The application of nitrogen coincides with the irrigation season and was found to vary depending on turf type, as follows:

- Sod: 230-240 kilograms nitrogen per hectare (kg N/ha) annual total; 4 – 6 applications
- Golf course greens: 4-5 kg N/ha annual total; applied every 1 – 2 weeks
- Golf course tees: 4-5 kg N/ha annual total; applied every 1 – 2 weeks
- Golf course fairways: 3 kg N/ha annual total; 1 - 4 applications
- Golf course roughs: generally not fertilized

Phosphorus application is not as widespread as nitrogen. It is not typically applied at golf courses unless it is an incidental component of a fertilizer blend. At sod farms, phosphorus is applied during seeding of the sod once per year at an average rate of 180 kg P/ha.

Fertilization frequency at both the golf courses and sod farms is determined through visual inspections of the sod/turf, past experience, fertilizer supplier recommendations, weather patterns, annual soil tests, and/or growth measured from grass clippings.

Most of those interviewed indicated that provision of nitrogen and phosphorus in the reclaimed water could be beneficial and make the reclaimed water more valuable. Quality concerns were
voiced by some participants over the potential in the reclaimed water for heavy metals, pharmaceuticals, salts, sodium, bicarbonate, and pH levels.

### 3.7 Summary and Implications of the Market Assessment for the Water Reclamation Centre

Of particular import for the Water Reclamation Centre are the projections for the volume of irrigation water demand. Based on the water quantity information gathered from literature and during the interviews, minimum, average, and maximum irrigation demands were compared for the golf courses and sod farms. Sod farm and golf course demands provided during the interviews are more conservative (lower) than the demands estimated based on literature values and therefore have been used to estimate the current reclaimed water potential presented in Table 3.6. For facilities that did not participate in an interview, the average of the demands and the average irrigated areas for all interviewees were applied. Two of the sod farms initially identified were not able to participate in the interview process and insufficient information was available to estimate irrigation or fertilization demands, therefore they are not included in the initial demands for the Water Reclamation Centre presented in Table 3.5.

<table>
<thead>
<tr>
<th>Potential Reclaimed Water User</th>
<th>Average Daily Irrigation Rate (MLD)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Sod Farms</td>
<td>10.8</td>
</tr>
<tr>
<td>Golf Courses</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td>15.2</td>
</tr>
</tbody>
</table>

\(^1\) Irrigation rate during mid-May to mid-September irrigation period only. Total rate for all facilities.

From the findings of the literature review and the interviews, there is a greater demand for water (15 MLD minimum) amongst the potential initial reclaimed water customers than the Water Reclamation Centre would produce at start-up (5 MLD reclaimed water) but not more than would be produced at ultimate capacity (30 MLD reclaimed water). As these potential customers are all irrigation demands, the irrigation rates are highly dependent on the season and weather conditions. It is expected that a reclaimed water demand for irrigation purposes will be for mid-May to mid-September only, and that the actual start and finish irrigation months will change annually as a response to the weather patterns. If a particularly rainy year occurs, water demand may be very low, although this was not able to be quantified from the information gathered in the interviews.

The frequency of irrigation will also change in response to rainfall and will affect the volume of water that a facility could apply as irrigation. Under the contract a minimal volume of reclaimed water will be established. In the event of an unusually prolonged wet season surplus reclaimed
water will be redirected through the reverse osmosis surface water treatment train for discharge to the East Holland River.

Section 4.0
Framework for Project-Specific Water Reuse Guidelines

4.1 Introduction

This section of the report provides the proposed technical elements to be incorporated into the Environmental Compliance Approvals (ECAs) for the production and use of reclaimed water from the Water Reclamation Centre. It is anticipated that all of the technical elements for the generation of reuse water as a new water resource would be included in the ECA for the Water Reclamation Centre. The mechanism for regulation of the customer/end user of reclaimed water will be developed in consultation with a Regulatory Agency which may be the MOE, the Ontario Ministry of Agriculture and Food, or both.

Section 4.2 of the report reviews the reclaimed water regulations in other provinces of Canada as a backdrop for the development of water reuse criteria for the Water Reclamation Centre in York Region. Section 4.3 provides an overview of the technical elements of a framework which would govern reclaimed water use and which is described in detail in Appendix B. Reclaimed water definitions are provided in Appendix C. Section 4.4 describes recommended project-specific reclaimed water quality while Section 4.5 summarizes the end user requirements.

4.2 Reclaimed Water Regulations and Guidelines in Canada

Regulations and guidelines regarding the reuse of treated wastewater effluent have been developed by the federal body Health Canada as well as the Provinces of Ontario, British Columbia and Alberta, and the Atlantic Canada provinces. Water reuse is permitted in other provinces on a small-scale, case-by-case basis.

*These regulations and guidelines consider reclaimed water as a water product in its own right.*

In 2002, the Canadian Council of Ministers of the Environment (CCME) identified the following reuse applications in Canada:

- Agricultural cropland irrigation in British Columbia, Alberta, Saskatchewan, and Manitoba
- Golf course and landscape irrigation in British Columbia and Alberta. The feasibility of reuse applications for golf course and landscape irrigation was studied in Prince Edward Island
- Experimental housing in Ontario, Nova Scotia, and British Columbia
• Reuse of wastewater at isolated facilities such as isolated resorts and truck stops in British Columbia and Ontario

Federal

Health Canada published the Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing in 2010. This document provides guideline values for reclaimed water quality and discusses management frameworks for implementing reclaimed water systems for toilet and urinal flushing applications. The reclaimed water quality guideline values are presented in Appendix D.

Ontario

In February of 2011, the MOE published the Water and Energy Conservation Guidance Manual for Sewage Works, which provides a general discussion on reclaimed water use. The publication notes that "there are currently no provincial policies or regulations governing water reclamation and reuse in Ontario".

The 2008 MOE Design Guidelines for Sewage Works contain guidelines for land application of treated effluent as a method of disposing secondary treated effluent. Treatment and storage requirements are detailed for irrigation of crops (not for direct human consumption), recreational lands such as golf courses, forests, and bush land. A summary of these requirements is included in Appendix D; however, **it should be noted that the proposed reclaimed water resource is of a much higher quality than the secondary effluent disposal contemplated by the Guidelines.**

British Columbia

The *Municipal Sewage Regulation under the Environmental Management Act*, requires local governments and private wastewater dischargers to protect public health and the environment. The Act was amended in 2006, 2007, 2009, and 2010. The regulation provides authorization (with minimum standards and requirements) for the treatment, reuse, and discharge of domestic wastewater or municipal waste. Regulatory standards for reclaimed water in British Columbia are summarized in Appendix D.

Alberta

The Alberta Wastewater and Storm Drainage Regulation allows the Alberta Ministry of Environment and Water to issue site-specific approvals for systems that reuse treated municipal wastewater effluent for irrigation on agricultural lands and other large facilities such as golf courses. The *Environmental Protection and Enhancement Act* (2000) authorized general regulation of water reuse for irrigation, and Guidelines for Municipal Wastewater Irrigation (Alberta Environment, 2000) were established to ensure that municipal wastewater is used for irrigation only when environmentally acceptable and agriculturally beneficial. Wastewater irrigation applications in Alberta are restricted to the period between May 1 and September 30, and adequate storage for the remaining seven months of the year is required. Reclaimed water guidelines for Alberta are summarized in Appendix D.
Atlantic Canada

The Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal was published in 2006 and covers the provinces of Nova Scotia, New Brunswick, Newfoundland and Labrador, and Prince Edward Island. This document provides guidelines for land application of reclaimed water by irrigation and infiltration methods. Reclaimed water guidelines for reclaimed water in Atlantic Canada are summarized in Appendix D.

4.3 Proposed UYSS Project-Specific Water Reuse Guidelines for York Region

Appendix B provides a recommended Water Reclamation and Reuse Framework including criteria for non-potable applications, design elements and reporting requirements. The Framework is divided into seven components or articles as follows:

Article I. Definitions
This section includes the definition of reclaimed water (Class A4) as well as a variety of terms used in the specified reuse criteria.

Article II. Uses of Reclaimed Water
This section lists the use of reclaimed water for irrigation uses at sod farms and golf courses.

Article III. Use Area and Management Requirements
This section describes the general requirements for the use of reclaimed water. It also covers such subjects as the management of tanker trucks used to distribute reclaimed water on areas not served by the distribution system, setback distances, separation distances, and cross connection control.

Article IV. Other Methods of Treatment
Treatment methods other than those included in these requirements and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the Regulatory Agency that the treatment methods and reliability features will assure an equal degree of treatment and reliability.

Article V. Sampling and Analysis
This section describes the necessary sampling and analysis required to demonstrate compliance with the suggested guidelines.

4 Class A reclaimed water is for unrestricted access use and requires tertiary treatment plus disinfection and must meet stringent quality requirements.
Article VI. Engineering Report and Operational Requirements
This section specifies that no person or entity shall produce or supply reclaimed water for direct use unless they file an engineering report with the Regulatory Agency. The remainder of this section covers personnel, maintenance operating records and other factors related to operation and maintenance of the Water Reclamation Centre.

Article VII. General Design Requirements
This section covers design issues, alarms and power supply for the reclaimed water system.

4.4 Proposed Water Quality Criteria and Treatment Requirements

Uses of reclaimed water fall into two major categories – reclaimed water for irrigation purposes, described in Table 4.1, and other uses of reclaimed water described in Table 4.2. The proposed framework for project-specific guidelines for reclaimed water as a new water resource establishes recommended standards for one class of reclaimed water: Class A.

Table 4.1: Summary of Proposed Permitted Uses of Reclaimed Water for Irrigation Uses for Reclaimed Water Produced at Water Reclamation Centre

<table>
<thead>
<tr>
<th>Permitted Uses For Irrigation Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted access golf courses</td>
</tr>
<tr>
<td>Sod Farms</td>
</tr>
<tr>
<td>Commercial Tree Farms</td>
</tr>
</tbody>
</table>

Table 4.2: Summary of Proposed Permitted Uses of Reclaimed Water for Other Uses of Reclaimed Water Produced at Water Reclamation Centre

<table>
<thead>
<tr>
<th>Other Permitted Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Water - Reclaimed water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates aerosols or mist</td>
</tr>
<tr>
<td>Firefighting - Reclaimed water used for fire protection of structures as follows:</td>
</tr>
<tr>
<td>▪ In hydrants or in sprinkler systems located in commercial or industrial facilities or buildings, hotels, or motels</td>
</tr>
</tbody>
</table>

1 For information only. Not intended as a component of the Reclaimed Water approval.

This reclaimed water is a new water resource for York Region and requires the development of reclaimed water quality criteria for the Water Reclamation Centre. These criteria were based on exhaustive research into existing regulations and guidelines throughout the world with a focus
on North American standards for the United States and Canada. Extensive water reuse has been practiced in the United States for decades and the standards that have been developed for each of the states served as a basis for the development of the suggested standards in this document. Interestingly, the standards among the states vary nearly as much as the standards among the provinces in Canada as noted in Appendix D. Although the United States Environmental Protection Agency (2012) has published suggested guidelines for water reuse, neither the United States nor Canada has any federal standards, and the standards written for the various states and provinces reflect local conditions and/or other factors.

The proposed reuse criteria that have been developed for York Region reflect the best-of-the-best criteria that have been developed based on United States and Canadian standards and are a reflection of the intent of York Region to provide the very best quality of reclaimed water to a broad variety of customers. The criteria also reflect a basic understanding of the possible requirements that the MOE will likely deem appropriate for such reuse criteria.

Table 4.3 summarizes the proposed reclaimed water quality criteria for the Water Reclamation Centre and the reclaimed water distribution system. The fundamental concept upon which the criteria are developed requires that the median concentration of fecal coliform bacteria measured in the disinfected effluent is non-detectable per 100 millilitres (mL) using the bacteriological results of the last seven days for which analyses have been completed. It is anticipated that the Environmental Compliance Approval for the Water Reclamation Centre would include a monitoring requirement for E. coli in the effluent for discharge to the East Holland River. However, basing this requirement on fecal coliform for water reuse (rather than E. coli) establishes a more robust standard. While this may seem a stringent requirement for Class A reclaimed water, given the proposed treatment systems at the Water Reclamation Centre, there should be no trouble in achieving this criterion on a consistent basis.
### Table 4.3: Summary of Proposed Reclaimed Water Treatment Requirements for Reclaimed Water Produced at Water Reclamation Centre

<table>
<thead>
<tr>
<th>Unit Operation</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Filtration Method</strong></td>
<td><strong>Effluent Limits</strong></td>
</tr>
<tr>
<td>Mono, dual or mixed media gravity, up flow or pressure at 54 L/min/m²</td>
<td>• Average turbidity of 2 nephelometric turbidity units (NTU) within 24-hour period &lt;br&gt; • Not to exceed 5 NTU more than 5 percent of time within a 24-hour period, and &lt;br&gt; • Not to exceed 10 NTU at any time</td>
</tr>
<tr>
<td>Traveling bridge at 21.5 L/min/m²</td>
<td>• Average turbidity of 2 NTU within 24-hour period &lt;br&gt; • Not to exceed 5 NTU more than 5 percent of time within a 24-hour period, and &lt;br&gt; • Not to exceed 10 NTU at any time</td>
</tr>
<tr>
<td>Cloth Disk filter at 35 L/min/m²</td>
<td>• Average turbidity of 2 NTU within 24-hour period &lt;br&gt; • Not to exceed 5 NTU more than 5 percent of time within a 24-hour period, and &lt;br&gt; • Not to exceed 10 NTU at any time</td>
</tr>
<tr>
<td>Microfiltration</td>
<td>• Not to exceed 0.2 NTU more than 5 percent of time within a 24-hour period, and &lt;br&gt; • Not to exceed 0.5 NTU at any time</td>
</tr>
<tr>
<td><strong>Primary Disinfection</strong></td>
<td><strong>Disinfection Limit</strong></td>
</tr>
<tr>
<td>UV</td>
<td>For non-membrane filtration: &lt;br&gt; • Design dose of 100 millijoules per square centimetre (mJ/cm²) at maximum daily flow &lt;br&gt; • UV transmittance &gt;55 percent at 254 nm &lt;br&gt; For microfiltration: &lt;br&gt; • Design dose of 80 mJ/cm² at maximum daily flow &lt;br&gt; • UV transmittance &gt;65 percent at 254 nm &lt;br&gt; For Reverse Osmosis: &lt;br&gt; • Design dose of 50 mJ/cm² at maximum daily flow &lt;br&gt; • UV transmittance &gt;90 percent at 254 nm</td>
</tr>
<tr>
<td>Chlorine</td>
<td>• CT ≥ 300 milligram-minutes per litre with a modal contact time of at least 30 minutes based on peak dry weather flow, or &lt;br&gt; • When combined with filtration, inactivates / removes 5-log₁₀ of plaque-forming units of F-specific bacteriophage MS2</td>
</tr>
<tr>
<td><strong>Secondary Disinfection</strong></td>
<td><strong>Disinfection Limit</strong></td>
</tr>
<tr>
<td>Chlorine</td>
<td>• Chlorine residual at end user connection of 0.5 mg/L</td>
</tr>
<tr>
<td><strong>All Disinfected Reclaimed Water</strong></td>
<td><strong>Effluent Limits</strong></td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>• Median concentration non-detectable per 100 mL over 7 days sampling &lt;br&gt; • No sample &gt; 14 per 100 mL</td>
</tr>
</tbody>
</table>

1 Meeting the above water quality limits will result in achieving a cBOD₅ limit lower than 10 mg/L.

### 4.5 Proposed End User Requirements for Water Reuse

A variety of end user requirements are included in the framework provided in Appendix B. The end user is defined as a customer who contracts with York Region to use reclaimed water for one of the intended uses as defined in Table 4.1 and Table 4.2. The contract would stipulate the requirements under which the reclaimed water could be used.
Article III in Appendix B describes a series of stipulations for use area management. There are 16 general user requirements ranging from notification that reclaimed water is being used (CAUTION: RECLAIMED WATER – DO NOT DRINK) to reclaimed water pipe colour-coding. Table 4.4 describes some of these stipulations.

A section devoted to tanker trucks that may be utilized to distribute reclaimed water includes stipulations with respect to signage, transport, and inspection.

Another section stipulates setback distances from residences, potable water supply wells and other such features. Required separation distances from potable water lines and cross connect control requirements are also defined.

Table 4.4: Summary of Use Area Requirement for Reclaimed Water Produced at Water Reclamation Centre

<table>
<thead>
<tr>
<th>Use Area Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Public notification of the use of reclaimed water at all use areas</td>
</tr>
<tr>
<td>- Adequate measures to prevent unplanned ponding of reclaimed water</td>
</tr>
<tr>
<td>- Precautions to assure that reclaimed water will not be applied to unacceptable or unapproved applications</td>
</tr>
<tr>
<td>- Potable water facilities will be protected against contact with reclaimed water spray, mist or runoff</td>
</tr>
<tr>
<td>- Public areas where reclaimed water is used must post signs stating &quot;CAUTION: RECLAIMED WATER – DO NOT DRINK&quot;</td>
</tr>
<tr>
<td>- Reclaimed water piping systems in areas to which the general public may have access will have no hose bibs usable by the public</td>
</tr>
<tr>
<td>- It is industry standard that all reclaimed water appurtenances will be colour-coded purple</td>
</tr>
<tr>
<td>- Purple pipe or tape is not required for pipes used for reclaimed water at agricultural uses and at municipal or industrial facilities that have an established labeling or marking system for reclaimed water on their premises</td>
</tr>
<tr>
<td>- Reclaimed water impoundments will not result in contamination of groundwater that may be used for domestic purposes</td>
</tr>
<tr>
<td>- A groundwater monitoring program may be required by MOE</td>
</tr>
<tr>
<td>- Application setback distances from adjacent land uses or landforms, features must be established</td>
</tr>
<tr>
<td>- Separation distances between reclaimed water pipelines and potable water lines must be maintained</td>
</tr>
<tr>
<td>- Cross connection controls must be established and inspected by a cross-connection specialist at the point of use</td>
</tr>
<tr>
<td>- See additional comments/criteria in Article III of the water reclamation criteria in Appendix B</td>
</tr>
</tbody>
</table>
4.6 End User Approval Requirements

A demonstration project would demonstrate successful application of the stringent standards proposed in this EA which will build regulatory and public confidence in the use of this "new" water resource and ultimately enable a streamlined regulatory process which will promote new reclaimed water customers.

The demonstration project will be based on introducing reclaimed water during the Water Reclamation Centre's initial years of operation and York Region will enter into an agreement to deliver reclaimed water to one End User for two seasons or years. Beyond the demonstration program, End Users should obtain approvals using an established provincial ECA process that directly relates to the End User's operations and the Region should not be responsible to the activities of end users under the Water Reclamation Centre's ECA.

As noted above, the mechanism for regulating end users will be developed by the MOE post-EA approval. York Region is willing to run a demonstration project with one End User during the initial two years or seasons of operation, during which responsibility for end user permitting for the demonstration study will rest with York Region.

Section 5.0
Reclaimed Water Infrastructure

5.1 Introduction

Reclaimed water infrastructure will need to be designed to transfer minimum, average and peak system flows from the Water Reclamation Centre to customers. Potential customer demands were identified in Section 3.0 of this report and form the basis of reclaimed water requirements for the proposed system design.

Certain design/operating considerations may also affect the design of the distribution system and customer requirements. For example, the reclaimed water distribution system could be designed to deliver reclaimed water to each customer under pressure with direct connection to irrigation systems, or it could be designed to be delivered under pressure (pumped) and discharged to the atmosphere (i.e., a pond or some other such containment structure). All reclaimed water customer connections will include appropriate backflow prevention. Experience with the design of other systems with no control placed on the customer for when reclaimed water might be drawn by that customer can result in high peak design factors for pipes and pumps. These peak factors could range up to six times the average flow and require a larger diameter pipeline.

An alternative design using the fully pressurized system would guarantee each customer a certain amount of reclaimed water during different periods of the day (e.g., customer 1 from 8:00 a.m. to 10:00 a.m., customer 2 from 10:00 a.m. to 12:00 noon, etc.). This would allow the sequencing of the withdrawal of reclaimed water from the system by a number of different
customers. Experience indicates that this can often cut the peak demand by nearly 50 percent, allowing the pipeline diameter to be a reasonable size.

The final option is simply to require that each customer have a pond or other containment vessel into which the reclaimed water can be discharged. The customer then can re-pump the reclaimed water for use. Such a design would minimize the peaking factors in the system and optimize the pipeline diameter.

The ultimate design of the reclaimed water distribution system must be evaluated once additional contact with potential customers has been made and contracts are executed. The system design covered in this section is based on the assumption that York Region can establish contracts with the customer base.

5.2 Reclaimed Water Flow

Minimum, average, and maximum reclaimed water flow projections were calculated in Section 3.7 based on irrigation information gathered from literature and potential user questionnaires. When the Water Reclamation Centre commences initial operation it is estimated that there will be potential for an upper limit of 28.5 MLD (average) reclaimed water demand. However, it is anticipated that the Water Reclamation Centre will only receive 10 MLD of raw wastewater, of which 5 MLD could be treated for use as reclaimed water. The remaining 5 MLD would be treated for discharge to the East Holland River.

At ultimate capacity of the Water Reclamation Centre (40 MLD annual average influent raw wastewater) an average reclaimed water production of 30 MLD could be provided to customers for beneficial reuse.

5.3 Reclaimed Water Quality

The Water Reclamation Centre will be able to operate two parallel treatment trains to produce highly treated water that meets the water quality requirements for discharge to Lake Simcoe (using reverse osmosis membranes) and water that is suitable for irrigation of agricultural lands (tertiary or microfiltration water) and other uses of reclaimed water.

For surface water discharge to Lake Simcoe, the stringent effluent limit for phosphorus will require a highly advanced quaternary level of treatment, involving reverse osmosis treatment technology, which is an energy-intensive process that removes nutrients, chemical constituents, viruses, and bacteria from the wastewater. The Water Reclamation Centre will also be designed to produce new water products: low nutrient reclaimed water using the surface water discharge treatment train and, in the future with a supporting business case, nutrient-rich reclaimed water using a parallel treatment train. The reclaimed water will be used for irrigation during the growing season.
The Water Reclamation Centre will be designed to operate in two modes:

- 100 percent of the influent wastewater treated for surface water discharge to the East Holland River (Lake Simcoe catchment), or
- Up to 75 percent of the influent wastewater treated to high quality reclaimed water for local land application, with the remainder treated for surface water discharge to the East Holland River.

The Water Reclamation Centre would be designed to process the water through tertiary treatment using a cloth disk filtration process if there is sufficient demand for nutrient-rich reclaimed water, or alternatively low nutrient reclaimed water would be taken from immediately downstream of the microfiltration tertiary treatment process included as part of the surface water discharge treatment train. The ultimate design of the reclaimed water program will be determined by the customer base and demand, however only low nutrient water approval is being requested under this EA. All reclaimed water would be disinfected prior to distribution.

The nutrient-rich reclaimed water treatment train, in contrast to the surface water discharge treatment train, will be able to operate in several modes dictated by the reclaimed water quality required. Reclaimed water rich in ammonia-nitrogen would be filtered by a cloth disk filtration process if nutrient-rich reclaimed water is in demand. This application will be further examined in the future should there be an economically feasible demand for nutrient-rich reclaimed water.

### 5.4 System Operation Strategies

The Water Reclamation Centre and distribution network operation will be fully integrated to ensure reclaimed water produced is beneficially reused within York Region. Operating strategies to manage the range of operating conditions expected have been devised and are outlined below.

#### 5.4.1 Average Conditions

Under average conditions, Water Reclamation Centre reclaimed water production will meet reclaimed water user demand. Reclaimed water will be transferred to customer storage systems from where it will be used as required for irrigation.

#### 5.4.2 Wet Weather Conditions

During wet weather events, agricultural reclaimed water users will not have a significant demand for reclaimed water and when their storage systems fill, will not be able to accept additional reclaimed water. It is likely that demand will continue for industrial or commercial customers through a wet weather event. Should the customer demand for reuse water decline or stop, water will be fully treated through the Water Reclamation Centre reverse osmosis process for discharge to the East Holland River. As discussed in Section 3.5.1.1, historical
precipitation data for York Region indicates that for 90 percent of the time there will be no more than two rain events of greater than or equal to 5 mm/day on consecutive days in any given month.

In the future, if the market supports production and sale of nutrient-rich reclaimed water, wet weather management of this water could be achieved through several methods including distribution to a tree farm operation that can use the water for irrigation during wet weather conditions or additional storage owned by York Region will be required to accommodate the volume of water which cannot be further process for use. Since the demand for nutrient-rich reclaimed water is not fully known at this time and the potential exists for significant capital investment for storage, York Region is not seeking approval for nutrient-rich water under this EA.

**5.4.3 Dry Conditions**

Reclaimed water customers will be contracted to purchase a minimum amount of reclaimed water. However, during dry periods their demand for reclaimed water may be greater than the volume they are contracted to purchase. Under these conditions the customers will be able to access additional reclaimed water on a take-and-pay basis for those volumes beyond the contracted minimum.

During long, dry summers, the reclaimed water produced at the Water Reclamation Centre through the reclaimed water production train can be increased to meet the additional demand until the capacity of the treatment train is met. All of these demands are subject to the production of clean treated water for surface discharge to the East Holland River as established in [Section 1.0](#) and reiterated below:

- 100 percent of the influent wastewater treated for surface water discharge to the East Holland River (Lake Simcoe subwatershed), or
- Up to 75 percent of the influent wastewater (three of the four parallel treatment trains) treated for production of low nutrient or (in the future) nutrient-rich reclaimed water for local land application, with the remainder treated for surface water discharge to the East Holland River.

**5.4.4 Seasonal Start Up and Shut Down**

Since the start and end of the irrigation season varies each year in response to weather patterns, a communication protocol will be established with the reclaimed water users to trigger start up and shutdown operation of the reclaimed water treatment and distribution system at the Water Reclamation Centre.
5.5 Distribution System Infrastructure

A pumping station will be located at the Water Reclamation Centre for distribution of the reclaimed water to customers. Adjacent to the reclaimed water pumping station will be a reclaimed water bulk loading station which will enable water tankers to be filled with reclaimed water for transfer and use offsite.

The reclaimed water distribution network will consist of pipes, valves, and fittings and will be located in existing utility easements and existing road right-of-ways. The distribution system components will be sized in accordance with the reclaimed water demand for transfer to customers.

Secondary disinfection of reclaimed water, through addition of chlorine residual, will take place at the Water Reclamation Centre to prevent microbial regrowth in the distribution system. Chlorine will be dosed in the reclaimed water to ensure a minimum concentration of 0.5 mg/L chlorine residual is maintained throughout the distribution system.

Distribution pipelines will terminate at customer storage systems and all customers will be required to have storage on site. All reclaimed water discharges to customer storage will be metered and controlled by SCADA. An air gap will be maintained between the distribution pipeline and the storage pond to prevent any backflow of water from the storage system to the distribution network.

As the reclaimed water is a new, highly treated water source, it is anticipated the distribution system would be permitted through a Schedule A Class EA with an ECA, similar to a watermain permit. The exact regulatory mechanism will be determined in consultation with the MOE when the customer base and demand have been confirmed.

5.6 System Summary

To produce low nutrient reclaimed water, water will be directed from the surface water discharge treatment train immediately downstream of the microfiltration treatment units and disinfected.

Approximately 28.5 MLD of potential reclaimed water demand has been identified for use at golf courses and sod farms in the vicinity of the Water Reclamation Centre. If realized, this demand would exceed the reclaimed water production at the Water Reclamation Centre at start-up because of limited incoming wastewater flows. To progressively supply reclaimed water to customers the reclaimed water system will be developed in phases – 10 MLD wastewater influent at start-up, of which 5 MLD could be distributed to reclaimed water users in the immediate vicinity of the plant.

In 2031 or when the Water Reclamation Centre is receiving 40 MLD of wastewater from the UYSS service area the Water Reclamation Centre could produce 30 MLD of reclaimed water.
Section 6.0
Management Models

6.1 Introduction

This section describes the important elements of an effective strategy for the operation and management of a reclaimed water program. Models are described for the components of a reclaimed water program covering three key areas:

1. Administration
2. Contracts with the Customers
3. Financial Management

A variety of elements relevant to the establishment of a sound reclaimed water program include a strategy for administration of the elements of the program, a model for how to establish reclaimed water rates, and the potential for offset of costs for system customers. These elements are discussed in this section. Also described is a framework for further clarification of suggested strategies as the design of the Water Reclamation Centre advances and better information about potential customers becomes available.

Fundamental to the discussion in this section are some basic definitions that apply to the development, operation, and management of a typical reclaimed water system. These definitions are based on pending American Water Works Association (AWWA) standards and can be found in Appendix C.

6.2 Reclaimed Water Administration

6.2.1 Water Administration within York Region

The reclaimed water system will become a part of York Region’s sustainability and conservation program. It is recommended for York Region to incorporate the administration of the reclaimed water system into the daily operations and business of the water and wastewater service delivery branches of the Environmental Services Department as suggested on Figure 6.1.
Figure 6.1: Integration of the Reclaimed Water Program into the Environmental Services Department

A reclaimed water management program typically has established performance goals developed before the reuse program begins operation. Such goals could include:

- Water Reclamation Centre plant efficiency;
- Reclaimed water quality; and
- Distribution system performance

Integral to that process is the need to develop and conduct monitoring to determine conformance with the goals, and take appropriate action if goals are not achieved.

The reclaimed water program will be founded on a clear, concise definition of operation and management objectives based on the types of reclaimed water customers, the types of reclaimed water use, and public attitudes towards reclaimed water use, protecting public health, and other factors. During the planning process for the reclaimed water system, appropriate treatment options and processes for water reuse applications have been selected in the treatment process to be provided at the Water Reclamation Centre.
The administrative structure for a reclaimed water system should address a number of functions:

- Marketing and Public Education
- Integrated Resource Planning
- Reclaimed Water Distribution Management
- Operator Certification / Licensing
- Documentation and Compliance Monitoring

### 6.2.2 Marketing and Public Education

Marketing of the reclaimed water as a new water resource could begin during the design and construction of the Water Reclamation Centre. York Region will market reclaimed water as a new water resource through the education component of the Water Reclamation Centre, both to the community and potential customers, conveying the value of reclaimed water. The survey conducted under this EA identified sod farms and golf courses as potential customers. Other potential customers were also identified who could be contacted as the program develops (see Section 3.0).

Public information and education programs are critical to the success of any reclaimed water program. Key components of such a program should include openness, effectively communicating the value of reclaimed water, reclaimed water quality/quantity, information on opportunities for reuse (including examples of uses that are allowed and not allowed) and delivering early and consistent messages on the reclaimed water program.

### 6.2.3 Integrated Resource Planning

In proposing a water reuse program as part of the UYSS EA Preferred Alternative, York Region has recognized the potential value of reclaimed water as a new, alternative source for identified customers to reduce demand on groundwater and surface water supplies in the region. By embracing the concept of water reclamation, reclaimed water becomes a new water resource that is part of the regional water supply portfolio when conducting supply and demand forecasting. As reclaimed water capacity comes online, continuing evaluation of water demand based on available customer use records, irrigated acreage, or other factors associated with a particular type of reuse will be completed. The study of such demands will take into consideration quantity, quality, seasonal demands, and customer seasonal storage needs.

Matching the demands of the customers with the capacity of the Water Reclamation Centre to provide reclaimed water on demand presents a variety of operating challenges. Currently, the identified customers noted in Section 3.0 are able to draw their irrigation water from wells and local streams. Over the past decade, there have been several summers where there have been identified problems with the wells and streams drying up, thus impacting the users’ irrigation schedules. In the future, as water withdrawal permits come up for renewal, it is anticipated that
such renewals may be limited. In fact, several of the potential identified customers indicated that the availability of reclaimed water would provide them with a more dependable supply. The availability of the reclaimed water will thus enhance the water supply portfolio available, and reduce the stress on local/regional aquifers and stream flows. As reclaimed water use becomes established in York Region, it will become a recognized water resource and be incorporated as such into future Master Plans.

6.2.4 Reclaimed Water Distribution Management

The infrastructure requirement for the conveyance system for the reclaimed water was described in Section 5.0. There are a variety of management considerations related to the reclaimed water distribution system that are important, in particular managing service connections, and environmental aspects of distribution.

Reclaimed Water quality monitoring in the distribution system is necessary to ensure a minimum concentration of 0.5 mg/L chlorine residual is maintained throughout the distribution system to prevent microbial regrowth. A program for controlling and monitoring the chlorine residual will be established.

A good leak detection program should be developed and maintained. Such a program would include an annual water audit based on established program goals and assessment measures. Such an audit would provide substantive information regarding potential undocumented reclaimed water losses.

A cross connection control program should be developed and documented. The program should include isolation and containment strategies to protect any adjacent potable water supplies. Testing of devices should be done at least annually and documented.

Environmental considerations in the delivery of the reclaimed water are an important distribution system management consideration. Strategies for the management of environmental incidents are described in the recommended water quality and end use requirements for reclaimed water in Section 4.0.

6.2.5 Operator Certification/Licencing

Operators performing work affecting treatment and delivery of reclaimed water must meet a provincially-regulated level of competency based on the appropriate education, training, skills, certification, and experience. Any program to certify operators for the reclaimed operations at the Water Reclamation Centre and for those associated with operating and maintaining the reclaimed water distribution system must be consistent with other practices currently employed by York Region. Reclaimed water staff should meet the applicable minimum required certification level for each aspect of the reclaimed water operation. Certification requirements may include distribution system operations.
It is anticipated that the plant operators at the Water Reclamation Centre will require a Class 4 Wastewater Treatment Licence due to the size and complexity of the treatment plant. In accordance with MOE regulations, facilities are classified as Class 1, Class 2, Class 3, and Class 4. The larger and more operationally complex a facility is, the higher classification rating it will receive. It is proposed that the reclaimed water distribution system be operated by staff with drinking water distribution certification. York Region has an excellent record of compliance and already undertakes cross-training of some staff between water and wastewater. York Region could consider a program specific to the Water Reclamation Centre to provide additional cross-training, as required, to manage reclaimed water with its combined water and wastewater systems. Any additional training specific to reclaimed water management can be done using general guidance from industry professionals, the American Water Works Association or from the Water Environment Federation.

### 6.2.6 Documentation and Monitoring

Consistent with other York Region operating system reporting requirements, a comprehensive record-keeping system will be established so that adherence to generally accepted practices in the reclaimed water field can be verified. Such practices are important when dealing with reclaimed water because a higher standard of care must be exhibited due to potential public health considerations associated with the use of reclaimed water. Generally, this means that the procedure is established, documented, implemented, and maintained.

Based on the experience with many other reclaimed water systems, documentation practices generally include the following:

- Documented statements of quality policy and quality objectives
- Standard operating procedures needed by the Water Reclamation Centre to achieve the effective planning, operation, and control of those processes associated with the production of reclaimed water
- Standard operating procedures for the operation and maintenance of the reclaimed water pumping station and distribution system

To best manage the reclaimed water system, York Region will build on global experience of reclaimed water systems. York Region already has many best management practices in place that meet the high standards for reclaimed water facilities around the world and fully understands the additional requirements to be undertaken to operate a world class reclaimed water facility.

York Region will maintain records of operations according to existing York Region requirements. These records are generally considered controlled records to account for potential public health concerns. Records must be established and maintained to provide evidence of conformity to requirements and to the effective operation of the reuse facilities. If at all possible, records should remain readily identifiable, and retrievable, ideally in electronic format. A documented
procedure also should be established to define the controls needed for the identification, storage, protection, retrieval, retention time, and disposition of records.

6.3 Contract Models

Contracts between York Region (as the reclaimed water provider) and the customer generally cover the following areas:

- Location and use of reclaimed water
- Reclaimed water quality available
- Anticipated delivery volumes and/or restrictions, defining average, minimum, and maximum use expectations
- Conditions under which service disruptions may occur
- Financial model
- Duration of contract
- Monitoring and reporting requirements
- User/customer plans for reclaimed water system inspections to meet operating requirements
- Compliance with project-specific guidelines, requirements or potential future regulations including backflow prevention and cross contamination control requirements
- Termination of service

York Region will develop customer reclaimed water use agreements and guidelines which clearly identify the applicable project-specific guidelines, requirements, or potential future regulations to the customers and require compliance as a condition of service.

The regulation and enforcement mechanism with the end user will be established in consultation with the Regulatory Agency. York Region will have documented customer agreements that meet both York Region’s legal requirements as well as those of the Regulatory Agency.

6.4 Financial Model

A typical financial model that outlines a procedure to recover the costs of operating a reclaimed water system is generally based on the costs associated with producing the reclaimed water and the value of the product to the customer. The cost of producing reclaimed water is comprised of:

- Operating costs (savings) for the production of reclaimed water
- Operating costs associated with the administration of the program
- Capital cost replacement reserve funds
The value of the reclaimed water to the customer is related to off-set costs associated with the costs for their current supply and the less tangible security of the customers’ water supply in times of water scarcity.

### 6.4.1 Rate Setting

Reclaimed water will be distributed by York Region at a marketable rate established taking into consideration the true "cost of service" for the production of reclaimed water and savings from displacing the use of potable water or water taken from the environment.

The objective of the development of capital and operating cost allocations is to arrive at a marketable "cost of service" for the production of reclaimed water. The cumulative effect of these cost allocation assumptions is that the reclaimed water production cost (annualized for five months of operation) would be much less than costs for surface water discharge production. This credit results from the cost savings due to the reduction chiefly in energy and chemical costs for the production of reclaimed water.

York Region has adopted an approach of multi-year water rate increases to achieve full cost recovery instead of varying annual increases. Such a strategy is consistent with good management practices and is deployed by effectively managed utilities. This multi-year strategy was adopted by Council in May 2011 which recommended combined water and wastewater rate increases of 10 percent annually to March 31, 2016 with the explicit objective of building asset replacement reserves for the future.

A key component of achieving full cost recovery is a comprehensive asset management program. York Region has been implementing and refining its asset management program to strategically manage York Region’s water and wastewater infrastructure and to assist in forecasting future funding requirements. A similar strategy should be adopted for reclaimed water infrastructure.

The developed rates also must reflect the realities of the current expenses which the golf courses and sod farms pay for their current water supply. Based on the analysis of the potential users of reclaimed water (see Section 3.0), most sod farmers and golf course operators only pay for the pumping costs associated with their irrigation operations at this time. However, there is a potential nutrient value associated with the reclaimed water which also should factor into the establishment of a reclaimed rate. Some sod farmers indicated a willingness to pay for the nutrient value provided the costs were at least in line with the current costs for nitrogen and phosphorus which they must purchase on the open market and apply to their fields or golf courses.

This section has laid out a strategy for developing a fair and marketable reclaimed water rate that can be charged to the customer by York Region.
6.5 Summary

Models were identified for the three key components of a reclaimed water program: Administration, Contracts with the Customers, and Financial Management.

York Region will establish an agreement template and reclaimed water rates for the anticipated customer base that has indicated an interest in purchasing reclaimed water when it becomes available upon completion of the Water Reclamation Centre.

This section has laid out a strategy for developing a fair and marketable reclaimed water rate that can be charged to a customer. In part, and given the absence of reclaimed water programs in Ontario, this strategy has been developed after consideration of typical reclaimed water rates in the United States, and review of the potential reclaimed water value that could be charged by York Region to potential customers.

This new water resource will become a part of York Region’s sustainability and water conservation program, consistent with both the spirit and concepts embraced in Water for Tomorrow.

Section 7.0 References


Ogilvie, Ogilvie & Company, 2010. Stakeholder/Public Attitudes towards Reuse of Treated Wastewater, Lake Simcoe Region Conservation Authority, Conservation Ontario.


## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advanced Treatment (tertiary treatment, quaternary treatment, and disinfection)</strong></td>
<td>Additional treatment needed to remove constituents remaining after conventional secondary treatment. Advanced treatment includes Tertiary Treatment, Quaternary Treatment, as well as Disinfection. The treatment train producing effluent for discharge to surface water would include the following major treatment units after conventional treatment: microfiltration, reverse osmosis, disinfection, and post-conditioning of the effluent. For production of reclaimed water, the post-secondary treatment will consist of tertiary filtration and disinfection.</td>
</tr>
<tr>
<td><strong>Advantage</strong></td>
<td>A relative term used to indicate that a particular condition is deemed to offer a benefit when compared to another condition.</td>
</tr>
<tr>
<td><strong>Agronomic Loading Rate</strong></td>
<td>A specific rate of effluent applied that provides the precise amount of water and nutrient loading, which selected crops require without having any excess water or nutrients percolate beyond the root zone.</td>
</tr>
<tr>
<td><strong>Alkalinity</strong></td>
<td>The capacity of water for neutralizing an acid solution.</td>
</tr>
<tr>
<td><strong>Alternative</strong></td>
<td>Both alternative methods and alternatives to a proposed undertaking.</td>
</tr>
<tr>
<td><strong>Alternative Methods of Carrying Out the Undertaking (Interchangeable with Alternative Methods)</strong></td>
<td>Different ways of doing the same activity. Alternative methods could include consideration of one or more of the following alternative technologies; alternative methods of applying specific technologies; alternative sites for a proposed undertaking; alternative design methods; and alternative methods of operating any facilities associated with a proposed undertaking.</td>
</tr>
<tr>
<td><strong>Alternatives To the Undertaking (Interchangeable with Alternatives To)</strong></td>
<td>Functionally different ways of approaching and dealing with a problem or opportunity.</td>
</tr>
</tbody>
</table>
# Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia (un-ionized)</td>
<td>The neutral form of ammonia-nitrogen in water. Un-ionized ammonia is the principal form of ammonia that is toxic to aquatic life. The percentages of un-ionized ammonia (NH3) in aqueous ammonia solution are dependent on temperature and pH conditions. The PWQO for un-ionized ammonia is 20 µg/L.</td>
</tr>
<tr>
<td>Aquatic</td>
<td>Refers to an environment that consists of, relates to, or is in water; or to animals and plants living or growing in, on, or near the water.</td>
</tr>
<tr>
<td>Aquifer</td>
<td>Rock or soil in a formation that is saturated and sufficiently permeable to transmit water in sufficient quantities to serve as a source of water supply.</td>
</tr>
<tr>
<td>Aquitard</td>
<td>Rock or soil in a formation that is saturated but is not sufficiently permeable to transmit water in sufficient quantities to serve as a source of water supply.</td>
</tr>
<tr>
<td>Available Soil Moisture</td>
<td>Term used to define the difference between the amount of water in the soil at field capacity and the amount at the permanent wilting point.</td>
</tr>
<tr>
<td>Bacteriophage</td>
<td>A virus that infects and replicates within bacteria. Bacteriophages are used as an indicator of enteric (relating to the intestine) viruses.</td>
</tr>
<tr>
<td>Beneficial reuse</td>
<td>The use of reclaimed water to benefit the end user or receiver (e.g., for irrigation of crops), as opposed to disposal, where there is no positive impact resulting from the discharge of water.</td>
</tr>
<tr>
<td>Best management practices</td>
<td>Scientific, technical, and operational-based approaches to resource management that when applied should allow the user to meet required standards or achieve objectives in a sustainable manner.</td>
</tr>
</tbody>
</table>
### Glossary of Terms

**Biosolids**
Wastewater sludge that has been stabilized through one of many stabilization processes (e.g., digestion, alkaline stabilization).

- Class A Biosolids are biosolids in which pathogens are reduced to below detectable levels, as defined by the US EPA.
- Class B Biosolids are biosolids in which pathogens are reduced to levels that are unlikely to pose a threat to public health and the environment under specific use conditions, as defined by the US EPA. Class B Biosolids cannot be sold or given away in bags or other containers or applied on lawns or home gardens (i.e. site restrictions exist on land application).

**Biochemical Oxygen Demand (BOD)**
A measure of the organic content in wastewater. BOD represents the amount of oxygen required by microorganisms to degrade the organic matter.

**5-day Biochemical Oxygen Demand (BOD₅)**
A measure of the organic content in wastewater after 5 days. BOD₅ represents the measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of the organic matter.

**Buffer**
A protective barrier; any of various devices or pieces of material for reducing shock or damage due to contact.

**5-day Carbonaceous Biochemical Oxygen Demand (cBOD₅)**
A measure of the organic content in the wastewater after 5 days (BOD₅) less the nitrous oxygen demand of the wastewater.

**Carbon Sequestration**
The natural or artificial process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form.

**Chemically Enhanced Primary Treatment (CEPT)**
The process of adding metal salts or polymers to the primary sedimentation process to cause the suspended particles to coagulate and flocculate. The flocs or larger particles will settle faster thus enhancing the efficiency of the sedimentation process.

**Chemical Oxygen Demand (COD)**
A measure of the organic and inorganic content in wastewater. COD represents the amount of oxygen required to degrade the organic and inorganic matter.
<table>
<thead>
<tr>
<th>Glossary of Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composite sample</strong></td>
</tr>
<tr>
<td><strong>Contingency Plans</strong></td>
</tr>
<tr>
<td><strong>Conventional Treatment (preliminary through secondary treatment)</strong></td>
</tr>
<tr>
<td><strong>Customer (Interchangeable with End User)</strong></td>
</tr>
</tbody>
</table>
| **Criteria / Criterion** | A set of principles or standards used to compare and judge alternatives.  
(plural = "criteria", singular = "criterion") |
| **Discharge (Water Reclamation Centre Discharge)** | The flow of treated sewage effluent from a sewage treatment plant, In this case the flow of treated sewage effluent from the Water Reclamation Centre. |
| **Disinfection** | Destruction or removal of disease-causing organisms (pathogens) from wastewater. Disinfection is usually the last stage in the wastewater treatment process. |
| **Disruption** | An action that results in a negative change in the way people undertake activities, stopping the activity or negatively changing the schedule. |
| **Disturbance** | An action that negatively influences people's activities or enjoyment of those activities. |
| **Easement** | A legally recognized property right held by a person or a group to make use of land for a limited purpose, such as construction. |
## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. coli</strong></td>
<td>A common organism that is found in untreated wastewater. Some forms of <em>E. coli</em> may be pathogenic and along with other pathogenic organisms are damaged or removed during disinfection so that they are no longer a threat to human health.</td>
</tr>
<tr>
<td><strong>Effluent</strong></td>
<td>Refers to water flowing from a pipe, treatment process, or treatment plant.</td>
</tr>
<tr>
<td><strong>Effluent Limit</strong></td>
<td>Limit or level of discharge water quality to be achieved by a sewage treatment plant.</td>
</tr>
<tr>
<td><strong>End User (Interchangeable with Customer)</strong></td>
<td>Recipient of reclaimed water for approved uses.</td>
</tr>
</tbody>
</table>
| **Environment** | The *Environmental Assessment Act* defines "environment" broadly to include:  
   i) air, land or water  
   ii) plant or animal life, including human life  
   iii) social, economic, and cultural conditions influencing the life of humans or a community  
   iv) any building, structure, machine or other device or thing made by humans  
   v) any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from the human activities  
   vi) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario |
### Glossary of Terms

| **Environmental Assessment (EA)** | A generic term for a study that assesses the potential environmental effects (positive or negative) of a proposal. Key components of an environmental assessment include consultation with government agencies and the public; consideration and evaluation of alternatives; and the management of potential environmental effects. Conducting an environmental assessment promotes good environmental planning before decisions are made about proceeding with a proposal. For the purposes of this Terms of Reference, an Environmental Assessment refers to the process and related documentation, including the submission of a Terms of Reference and final Environmental Assessment Report for approval by the Minister of the Environment, in accordance with the requirements of Part II of the *EA Act*. |
| **Environmental Compliance Approval (ECA)** | The ECA is an instrument of environmental approval issued by the Ontario Ministry of Environment (MOE) and has replaced the Certificate of Approval. Businesses in Ontario must have MOE-issued environmental approvals if they release contaminants into the air, onto land or into water, or store, transport or dispose of waste. |
| **Eutrophication** | Eutrophication describes an excess of nutrients in a water body, which leads to an overgrowth of plants and depletion of dissolved oxygen, which may cause death to fish and other animals. |
| **Evaluation** | A formal process for comparatively assessing the advantages and disadvantages of alternatives (see Evaluation Methodology). |
| **Evapotranspiration Values (ET)** | Evapotranspiration is the loss of water from a vegetative surface through the combined processes of plant transpiration and soil evaporation. |
| **Framework** | Criteria based on the Framework provided in the Assessment of the Proposed Reclaimed Water Program Report which are incorporated into the Environmental Compliance Approval (ECA) for the Water Reclamation Centre and ECAs for End Users of reclaimed water from the Water Reclamation Centre. |
| **Grab sample** | A single sample taken at a specific time. |
## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groundwater</strong></td>
<td>Water below the surface of the ground that occupies a zone of the earth's mantle that is saturated with water.</td>
</tr>
<tr>
<td><strong>Growth Plan for the Greater Golden Horseshoe (Growth Plan)</strong></td>
<td>Established under the authority of subsection 7 (6) of the Places to Grow Act, 2005, the Growth Plan aims to manage growth and development in Ontario in a way that supports economic prosperity, protects the environment, and develops a culture of conservation.</td>
</tr>
<tr>
<td><strong>Guidelines</strong></td>
<td>Not legally enforceable, guidelines are established by government or other agencies to provide general guidance.</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>The physical location or type of environment in which an organism or biological population occurs or lives, grows, and carries out life processes.</td>
</tr>
<tr>
<td><strong>Hypoxia</strong></td>
<td>Refers to deficiency in oxygen amount.</td>
</tr>
<tr>
<td><strong>Holland Marsh</strong></td>
<td>Consists of 2900 ha of organic (muck) soil draining to the Holland River used for farming. The region is the largest area of organic soil developed for agriculture in the province and one of the most intensive areas of agricultural production in the country (From: The University of Guelph Muck Crops Research Station, <a href="http://www.uoguelph.ca/plant/stations/muck_crops/">http://www.uoguelph.ca/plant/stations/muck_crops/</a>).</td>
</tr>
<tr>
<td><strong>Indicator</strong></td>
<td>An aspect of a criterion that characterizes the potential effects on the environment.</td>
</tr>
<tr>
<td><strong>Infiltration</strong></td>
<td>Extraneous flow that enters a wastewater collection system from groundwater through broken pipes, pipe joints, connections, and manhole walls.</td>
</tr>
<tr>
<td><strong>Inflow</strong></td>
<td>Extraneous flow that enters a wastewater collection system from overland flow (e.g., stormwater and snowmelt) through drains, manhole covers, and cross connections.</td>
</tr>
<tr>
<td><strong>Influent</strong></td>
<td>Refers to water flowing from a pipe, treatment process, into a treatment plant.</td>
</tr>
</tbody>
</table>
## Glossary of Terms

### Innovative Wastewater Treatment Technologies Alternative

One of the four Alternatives To the Undertaking examined in the UYSS EA. Under this alternative, wastewater from approved growth in East Gwillimbury and a portion of Newmarket would be conveyed to a Water Reclamation Centre within the Lake Simcoe watershed. Wastewater from the remaining approved growth in Newmarket and Aurora would be conveyed to the existing York Durham Sewage System for treatment and discharge to Lake Ontario.

### Irrigation

Application of water to land or soil, often for the purposes of supporting plant growth.

### Jacking and Boring (Auger Boring)

Auger bores are generally short in nature (200 metres maximum) and can only be installed in a straight line. Auger bores are ideal for crossing heavily travelled roadways or small environmentally sensitive areas. Auger boring is not conducive to working in sandy soils or in locations where there is high ground water. In these cases auger boring can be substituted with Pipe Jacking. Similar to auger boring, the main difference with pipe jacking is that the casing or product pipe is fully installed prior to spoil removal.

### Lagoon

Also referred to as a wastewater stabilization pond, lagoons provide biological and physical treatment of wastewater.

### Lake Simcoe Phosphorus Reduction Strategy (PRS)

The Lake Simcoe Protection Plan commits the Province, working with the Lake Simcoe Region Conservation Authority, local stakeholders, municipalities and other partners, to develop a comprehensive Phosphorus Reduction Strategy. The Strategy identifies specific reduction goals and potential reduction opportunities to achieve phosphorus loading targets for Lake Simcoe. In addition, the Strategy incorporates several key concepts and strategic directions including: adaptive management, watershed approach, stewardship and community action, source-specific actions, monitoring and compliance, and research, modeling and innovation.

### Lake Simcoe Protection Act, 2008

Enacted in 2008, provides the authority for the Minister of the Environment to establish the Lake Simcoe Protection Plan. The purpose of the Act is to protect and restore the ecological health of the Lake Simcoe watershed.
## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Simcoe Protection Plan</td>
<td>Established under the authority of <em>Lake Simcoe Protection Act, 2008</em> The objectives of the Lake Simcoe Protection Plan, approved June 2009, include to protect, improve or restore the elements that contribute to the ecological health of the Lake Simcoe watershed, including, water quality, hydrology, key natural heritage features and their functions, and key hydrologic features and their functions.</td>
</tr>
<tr>
<td>Lake Simcoe Region Conservation Authority (LSRCA)</td>
<td>Established under the <em>Conservation Authorities Act (1946)</em>, the LSRCA prepares and delivers programs for the management of the renewable natural resources within watersheds in its jurisdiction.</td>
</tr>
<tr>
<td>Low Nutrient Reclaimed Water</td>
<td>Reclaimed water containing low amounts of phosphorus and/or nitrogen.</td>
</tr>
<tr>
<td>Membrane filtration</td>
<td>A physical solids separation process where water and other small molecules are forced across a thin, porous membrane while larger solid particles are unable to pass through the pores and are effectively removed from the stream.</td>
</tr>
<tr>
<td></td>
<td>- Microfiltration (MF) can remove solids that are 0.08 to 2.0 micrometres (um) in size. Microfiltration can remove TSS, turbidity, micro-organisms, and some bacteria and viruses. Water and dissolved solutes are allowed to pass through the membrane.</td>
</tr>
<tr>
<td></td>
<td>- Ultrafiltration (UF) can remove solids that are 0.005 to 0.2 micrometres in size. Ultrafiltration can remove some dissolved solutes, most bacteria, and some viruses and proteins. Water and small molecules are allowed to pass through the membrane.</td>
</tr>
</tbody>
</table>

Definitions for Microfiltration and Ultrafiltration based on *Metcalf and Eddy, Wastewater Engineering Treatment and Reuse, 2003.*
## Glossary of Terms

**Microfiltration**
Membrane filtration is a physical solids separation process where water and other small molecules are forced across a thin, porous membrane while larger solid particles are unable to pass through the pores and are effectively removed from the stream. Microfiltration can remove solids that are 0.08 to 2.0 micrometres (um) in size. Microfiltration can remove TSS, turbidity, micro-organisms, and some bacteria and viruses. Water and dissolved solutes are allowed to pass through the membrane.

Definition for Microfiltration based on Metcalf and Eddy, *Wastewater Engineering Treatment and Reuse*, 2003

**Ministry of Agriculture, Food and Rural Affairs (OMAFRA)**
A (former) provincial ministry committed to supporting Ontario's agricultural food sector, enforcing, and improving food safety, protecting the environment, and strengthening Ontario's rural communities. In 2013, this Ministry was split into two ministries: Ministry of Agriculture and Food and Ministry of Rural Affairs.

**Minister of the Environment (Minister)**
The Minister of the Environment is responsible under the *EA Act* for final approval of the ToR and the EA.

**Ministry of the Environment (MOE)**
The Ministry of the Environment is responsible for protecting air, land, and water to ensure healthy communities, ecological protection, and sustainable development for present and future generations of Ontarians.

**Monitoring**
A systematic method for collecting information using standard observations according to a schedule and over a sustained period of time.

**Natural Environment**
A term that encompasses all living and non-living things occurring naturally on Earth or some region thereof.

**Non-Potable Water**
Water that is not intended for human consumption and therefore intended for non-drinking water uses only.

**Nutrient-Rich Reclaimed Water**
Reclaimed water rich in phosphorus and/or nitrogen.

**Oak Ridges Moraine (ORM)**
An environmentally sensitive, geological landform in south central Ontario, covering 190,000 hectares and is delineated and protected by the Oak Ridges Moraine Conservation Plan.
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oak Ridges Moraine Conservation Act, 2001 (ORMCA)</strong></td>
<td>Enacted in 2001, provides the authority for the Minister of the Environment to establish the Oak Ridges Moraine Conservation Plan.</td>
</tr>
<tr>
<td><strong>Ontario Water Resources Act (OWRA)</strong></td>
<td>The OWRA provides for the conservation, protection, and management of Ontario's waters and for their efficient and sustainable use to promote Ontario's long-term environmental, social, and economic well-being.</td>
</tr>
<tr>
<td><strong>Parameter</strong></td>
<td>A measurable or quantifiable characteristic or feature of water quality.</td>
</tr>
<tr>
<td><strong>Pathogen</strong></td>
<td>A disease causing bacterium, virus, or other microorganism.</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>A measure of the acidity or alkalinity of a solution.</td>
</tr>
<tr>
<td><strong>Phosphorus</strong></td>
<td>A chemical element that occurs naturally in the environment and is an essential nutrient needed by plants and animals. Because phosphorus is a nutrient, high levels in a lake encourage the growth of plants and algae. Although some phosphorus is required to support a healthy aquatic ecosystem, too much phosphorus leads to excessive growth of plants and algae in the lake. As these plants decay, dissolved oxygen required by fish and other aquatic species is depleted.</td>
</tr>
<tr>
<td><strong>Phosphorus Loading Targets</strong></td>
<td>Established by the Phosphorus Reduction Strategy under the Lake Simcoe Protection Plan, the phosphorus loading targets aim to reduce the amount of phosphorus entering streams and Lake Simcoe from the subwatersheds and other specific areas within the Lake Simcoe watershed. This will help the Lake Simcoe watershed reduce the amount of phosphorus discharged to surface waters and meet the long-term phosphorus reduction goals in the Lake Simcoe Phosphorus Reduction Strategy.</td>
</tr>
<tr>
<td><strong>Phosphorus Reduction Strategy (PRS)</strong></td>
<td>See Lake Simcoe Phosphorus Reduction Strategy.</td>
</tr>
</tbody>
</table>
Glossary of Terms

**Places To Grow Act, 2005**
Enacted in 2005, provides the authority for the Minister of Energy and Infrastructure to establish the Growth Plan for the Greater Golden Horseshoe (the Growth Plan). The purpose of the *Places to Grow Act, 2005* is:

a) to enable decisions about growth to be made in ways that sustain a robust economy, build strong communities and promote a healthy environment and a culture of conservation

b) to promote a rational and balanced approach to decisions about growth that builds on community priorities, strengths and opportunities and makes efficient use of infrastructure

c) to enable planning for growth in a manner that reflects a broad geographical perspective and is integrated across natural and municipal boundaries

d) to ensure that a long-term vision and long-term goals guide decision-making about growth and provide for the co-ordination of growth policies among all levels of government

**Potable water**
Water that is suitable for human consumption.

**Preferred Alternative**
The alternative selected as the undertaking for which approval will be sought, based on an approach for identifying a preferred alternative, namely:

a) Identify a recommended alternative

b) Consult review agencies and the public on the recommended alternative

c) Confirm or select the preferred alternative based on the comments received

**Primary treatment**
The first stage of wastewater treatment, involves removal of a portion of suspended solids and organic matter, usually by sedimentation.

**Permit to Take Water (PTTW)**
The Permit to Take Water program is the principal means by which the Ontario Ministry of the Environment regulates the taking of water in the province. Water takings in Ontario are governed by Ontario Regulation 387/04 under the *Ontario Water Resources Act.*
## Glossary of Terms

<table>
<thead>
<tr>
<th><strong>Project-Specific Guidelines</strong></th>
<th>Criteria based on the Framework provided in the Assessment of the Proposed Reclaimed Water Program Report which are incorporated into the Environmental Compliance Approval (ECA) for the Water Reclamation Centre and ECAs for End Users of reclaimed water from the Water Reclamation Centre.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public</strong></td>
<td>Means the general public, individual members of the public who may be affected by or have an interest in a project and special interest groups.</td>
</tr>
<tr>
<td><strong>Quaternary treatment</strong></td>
<td>Refers to advanced treatment processes implemented following tertiary treatment to remove remaining constituents that cannot be removed through conventional processes.</td>
</tr>
<tr>
<td><strong>Rank</strong></td>
<td>Of a specified order or position in relation to others in a series.</td>
</tr>
<tr>
<td><strong>Ranking</strong></td>
<td>To arrange (alternatives) according to their rank from first to last.</td>
</tr>
<tr>
<td><strong>Reclaimed water</strong></td>
<td>Wastewater that has gone through various treatment processes to meet specific water quality criteria with the intent of being used in a beneficial manner (e.g., irrigation and industrial uses).</td>
</tr>
<tr>
<td><strong>Recommended Alternative(s)</strong></td>
<td>An alternative or alternatives that are selected as first place based on the results of a comparative evaluation process.</td>
</tr>
<tr>
<td><strong>Reuse (Interchangeable with Reclaimed water)</strong></td>
<td>Wastewater that has gone through various treatment processes to meet specific water quality criteria with the intent of being used in a beneficial manner (e.g., irrigation and industrial uses).</td>
</tr>
<tr>
<td><strong>Reverse Osmosis (RO)</strong></td>
<td>A high-pressure membrane separation process in which a liquid is forced across a membrane against osmotic pressure. Osmosis is the passage of pure solvent (such as water) between two solutions separated by a semi-permeable membrane in response to a concentration gradient (i.e., from the lesser to the greater solute concentration). The term osmotic pressure refers to the pressure exerted by the flow of the solvent through the membrane separating two solutions with different concentrations of solute. Reverse Osmosis membranes are effective in removing dissolved constituents with a membrane pore size of 0.001 micrometres (μm) or less.</td>
</tr>
<tr>
<td><strong>Glossary of Terms</strong></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>(UYSS) Service Area</strong></td>
<td>Area to be serviced by the undertaking consisting of the growth portions of the Towns of Aurora, Newmarket, and East Gwillimbury, including Holland Landing, Queensville, and Sharon.</td>
</tr>
<tr>
<td><strong>Secondary Treatment</strong></td>
<td>The second stage of the wastewater treatment process, involves removal of biodegradable organic matter and suspended solids.</td>
</tr>
<tr>
<td><strong>Sewer System</strong></td>
<td>A network of service branches, trunk and local sewers, pumping stations, and appurtenances all for purposes of conveying sewage.</td>
</tr>
<tr>
<td><strong>Sodium Adsorption Ratio (SAR)</strong></td>
<td>Method used to measure the proportion of sodium ions compared to the concentration of calcium and magnesium.</td>
</tr>
<tr>
<td><strong>Soil Moisture Deficit (SMD)</strong></td>
<td>Refers to the amount of water required to raise the soil-water content of the crop root zone to field capacity.</td>
</tr>
<tr>
<td><strong>Stormwater</strong></td>
<td>Water that is discharged from a surface as a result of rainfall, snow melt, or snowfall.</td>
</tr>
<tr>
<td><strong>Stakeholder</strong></td>
<td>A party that has interest or concern in an organization, enterprise, or project.</td>
</tr>
<tr>
<td><strong>Substation</strong></td>
<td>A part of an electrical generation, transmission and distribution system used to transform voltage from high to low or low to high.</td>
</tr>
<tr>
<td><strong>Subwatershed</strong></td>
<td>A smaller geographic section of a larger watershed unit (See definition of watershed).</td>
</tr>
<tr>
<td><strong>Supervisory Control and Data Acquisition (SCADA)</strong></td>
<td>A computer controlled system that monitors and controls physical processes.</td>
</tr>
<tr>
<td><strong>Surface Water</strong></td>
<td>Water that exists above the substrate or soil surface, including runoff from precipitation events and snow melt, typically occurring in streams, creeks, rivers, lakes, ponds and wetlands.</td>
</tr>
</tbody>
</table>
# Glossary of Terms

| Terms of Reference (ToR) | The first step in an application for approval to proceed with a project or undertaking under the *Environmental Assessment Act* is the submission of a Terms of Reference (ToR) for the Environmental Assessment (EA). Public and agency consultation is required on the preparation and submission of the ToR to the Ministry of the Environment. Approval is required by the Minister of the Environment. If approved, the ToR provides a framework / work plan for the EA. |
| Total Suspended Solids (TSS) | A measure of the non-filterable solids particles in suspension. |
| Total Phosphorus (TP) | The total concentration of all forms of phosphorus in a solution. |
| Turbidity | A measure of water clarity. |
| Undertaking | An enterprise, activity, proposal, plan or program in respect of a commercial or business enterprise or activity of a person or persons that has potential environmental effects and is assessed in accordance with the requirements of the *Environmental Assessment Act*. |
| Upper York | Upper York is defined as the general area of York Region within the Lake Simcoe watershed. |
| UV Disinfection | The use of ultraviolet (UV) light to kill microorganisms. |
| Wastewater | Used water discharged from homes, businesses, cities, industry, and agriculture. |
| Water Reclamation Centre | A wastewater (sewage) treatment plant for treatment or processing of wastewater to make it reusable by meeting appropriate water quality criteria. |
| Water Quality Trading | An approach to achieving water quality targets or objectives in which a point source may off-set with or purchase pollutant reduction off-sets from another point source in a defined geographic area (e.g., the same watershed) which can then be used to meet the point source’s discharge requirements for the same pollutant. Water quality trading will be further defined by regulations (rules, requirements, conditions, etc.) if enabled through regulation. |
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watercourse</td>
<td>A body of water having defined bed and banks with permanent or intermittent flow that may include rivers, creeks, streams, and springs.</td>
</tr>
<tr>
<td>Watersheds</td>
<td>An area that is drained by a river and its tributaries.</td>
</tr>
<tr>
<td>Wetland</td>
<td>Lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of soils saturated with water and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs, and fens.</td>
</tr>
<tr>
<td>York Durham Sewage System (YDSS)</td>
<td>A centralized wastewater collection and treatment system for both York and Durham Regions.</td>
</tr>
</tbody>
</table>
APPENDICES

Appendix A
Irrigation and Fertilization Practices at Potential Reclaimed Water User Facilities Questionnaire

Appendix B
Proposed Water Reclamation and Reuse Framework for Non-Potable

Appendix C
Definitions Associated with Water Reclamation Systems

Appendix D
Reclaimed Water Regulations in Canada
Appendix A

Irrigation and Fertilization Practices at Potential Reclaimed Water User Facilities Questionnaire
Assessment of the Proposed
Reclaimed Water Program
Upper York Sewage Solutions EA

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<td>Table A.2:</td>
<td></td>
</tr>
<tr>
<td>Findings of Reclaimed Water Questionnaire</td>
<td>A-3</td>
</tr>
</tbody>
</table>
Section 1.0
Introduction

To better understand the actual water quantity and nutrient requirements of potential reclaimed water users, potential users were contacted and invited to participate in a questionnaire. The questionnaire was developed to focus on irrigation of non-food crops only and was set up with general, open-ended questions relating to the project and detailed questions on the irrigation and fertilization practices of the questionnaire participants.

Section 2.0
Potential Reclaimed Water Users

The complete list of opportunities identified in this study for provision of reclaimed water at the start-up of the Water Reclamation Centre, including sod farms and golf courses, are provided in Table A.3.

Table A.3: Reclaimed Water Potential Opportunities Identified for this Study

<table>
<thead>
<tr>
<th>Use Type</th>
<th>Stakeholder</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sod farm</td>
<td>Queensville Sod Farm</td>
<td>21468A Leslie St, Queensville</td>
</tr>
<tr>
<td>Sod farm</td>
<td>Brouwer Sod Farm</td>
<td>23965 Warden Ave, Keswick</td>
</tr>
<tr>
<td>Sod farm</td>
<td>J. Lipani and Sons Sod Farms</td>
<td>2374 Holborn Rd, Queensville</td>
</tr>
<tr>
<td>Sod farm</td>
<td>Carruthers Sod Limited</td>
<td>3441 Queensville Side Rd E, Queensville</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Silver Lakes Golf and Country Club</td>
<td>21114 Yonge Street, Newmarket</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Shawneeki Golf Club</td>
<td>18543 Woodbine Ave, Sharon</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Pheasant Run Golf Club</td>
<td>18033 Warden Ave, Sharon</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Cardinal Golf Club</td>
<td>2740 Davis Drive West, King</td>
</tr>
<tr>
<td>Golf Course</td>
<td>St Andrews Valley Golf Club</td>
<td>4 Pinnacle Trail, Aurora</td>
</tr>
<tr>
<td>Golf Course</td>
<td>King Valley Golf Club</td>
<td>15675 Dufferin St, King City</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Magna Golf Club</td>
<td>14780 Leslie St, Aurora</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Westview Golf Club</td>
<td>1563 Vandorf Rd, Aurora</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Highland Gate Golf Club</td>
<td>21 Golf Links Dr, Aurora</td>
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<tr>
<td>Golf Course</td>
<td>Beacon Hall Golf Course</td>
<td>400 Beacon Hall Dr, Aurora</td>
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<tr>
<td>Golf Course</td>
<td>Kings Riding Golf Club</td>
<td>14700 Bathurst St. King City</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Emerald Hills Golf and Country Club</td>
<td>14001 Concession #5, Stouffville</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Orchard Beach Golf and Country Club</td>
<td>273 Metro Rd N, Keswick</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Lyndhurst Park Golf Club</td>
<td>24198 Highway 48, Baldwin</td>
</tr>
</tbody>
</table>

Interviews were conducted in early 2013 with the following:

- Queensville Sod Farm
- Brouwer Sod Farm
- Silver Lakes Golf and Country Club
- Beacon Hall Golf Course
In total, nine interviews were conducted: two sod farms and six golf courses were interviewed for specific irrigation and fertilization practice information and one golf course representative was interviewed for general reclaimed water use at the respective golf courses managed. The interview with the water and sewage representative for the four golf courses mentioned above was more general and did not cover specifics of irrigation or fertilization. The length of the interviews ranged from 30 minutes to one and a half hours in duration.

Section 3.0
Questionnaire Set-Up

The first part of the questionnaire was structured to determine the familiarity of the stakeholder with the project and with reclaimed water use. Based on the level of familiarity gauged more details of the project were provided when necessary. The questionnaire outlined the key benefits of the Water Reclamation Centre to be read to all interviewees, as follows:

- The Water Reclamation Centre is a "made in York solution" that applies proven technology to reclaim wastewater for beneficial uses
- The Water Reclamation Centre will provide a reliable local water supply that is available year-round and protects against climate change impacts
- The Water Reclamation Centre will improve the water quality in Lake Simcoe
- The Water Reclamation Centre will reduce the amount of water discharged to Lake Ontario that comes from the Lake Simcoe watershed.

This section of the questionnaire also provided the interviewee with an opportunity to ask any questions they may have on the Water Reclamation Centre or reclaimed water uses and benefits.

The second part of the questionnaire asked each interviewee about the specifics of their irrigation and fertilizations practices. This information is key to determining the actual seasonal demands of both water and nutrients (nitrogen and phosphorus) to each property.

The final part of the questionnaire was structured to assess the interviewee’s willingness to sign a contract for reclaimed water use and whether or not the interviewee was favourable to the provision of reclaimed water containing nitrogen and/or phosphorus. Finally, this part enabled the interviewee to share any information or thoughts they may have on the project or reclaimed water use that had not been covered in the questionnaire.
Each interviewee was informed that questionnaire assessment documentation would include a list of those interviewed but that no specific input would be attributed to any specific person or entity.

Section 4.0
Questionnaire Findings

The results of the interviews conducted with the stakeholders are summarized in Table A.4 below. As per the agreement with the interviewees, specific input has not been attributed to the corresponding stakeholder; instead, a summary of key themes as well as individual answers has been provided.

There were nine respondents to the general questions and eight respondents to the specific irrigation and fertilization questions as the water and sewage representative for the four golf courses did not answer the specific questions.

Table A.4: Findings of Reclaimed Water Questionnaire

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<td></td>
<td>General Introductory Questions</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Have you heard about this project?</td>
<td>Three of the interviewees were familiar with the project; One interviewee indicated that they had heard of the project but were not familiar with it. Five of those interviewed had not heard of the project.</td>
</tr>
<tr>
<td>2</td>
<td>Do you have any questions about what a Water Reclamation Centre is?</td>
<td>Two interviewees responded that they did not have any questions or concerns to be raised. Two interviewees are currently using reclaimed water for irrigation and did not have any questions or concerns with this practice. One interviewee responded that they were aware of the benefit of nutrients in the reclaimed water for fertilization. Four of those interviewed indicated they were concerned about, or would like more information on, the reclaimed water quality, specifically the potential presence of heavy metals, pharmaceuticals, salts, sodium, bicarbonate, and pH.</td>
</tr>
<tr>
<td></td>
<td>Are you familiar with reclaimed water?</td>
<td></td>
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<tr>
<td></td>
<td>Do you have any questions or concerns about reclaimed water, how it is produced, or how it can be used?</td>
<td></td>
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<tr>
<td></td>
<td>Are you aware of the potential benefits of using reclaimed water?</td>
<td></td>
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<tr>
<td>#</td>
<td>Question</td>
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<tr>
<td>3</td>
<td>What additional information might you need to be even more comfortable with reclaimed water use? Who do you consider reliable sources of information about water and wastewater issues? For example: OMAFRA, Medical officer of health, Conservation authority, MOE?</td>
<td>Four interviewees responded that they did not require any additional information. Of those that would require more information two requests were made for information from similar irrigation schemes in the United States and three requests were made for water quality information (general, nutrients levels and sodium levels). Two of those interviewed stated that there were no reliable/qualified authorities that could provide information on reclaimed water use in the area.</td>
</tr>
<tr>
<td>4</td>
<td>If you were to use reclaimed water, would your employees understand what this is? Is there any additional information you would need to make them feel more comfortable with reclaimed water use? How about your customers – do they need any particular information to be comfortable with reclaimed water use?</td>
<td>Responses from three of the interviewees indicated that no additional information would be required. One interviewee requested additional water quality information (specifically on bacteria levels and chemicals and technologies used to treat the reclaimed water). Two interviewees asked for sufficient information to be provided to answer employee and public enquiries. One responded stated that it did not matter what the employees thought. One interviewee did not directly respond to the question.</td>
</tr>
<tr>
<td></td>
<td><strong>Technical Questions – Irrigation</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>For sod farmers only: What is your growing cycle? When do you plant, produce, harvest? Do you stagger planting throughout the year?</td>
<td>Both sod farmers interviewed said that planting was in August, with harvest from April through to the end of November or mid-December. Typically sod is planted every two years and occasionally every three years.</td>
</tr>
<tr>
<td>6</td>
<td>Where do you get your irrigation water now?</td>
<td>Currently one interviewee sources water exclusively from groundwater ponds. Two interviewees source water from deep groundwater wells. One interviewee uses both groundwater ponds and a deep groundwater well. Two interviewees source exclusively from surface water sources. One interviewee has a permit for both surface water and groundwater. One interviewee uses reclaimed water and has a permit to take water from a deep well.</td>
</tr>
</tbody>
</table>
### Question

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<th>Responses</th>
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<tbody>
<tr>
<td>7</td>
<td>Do you have a Permit to Take Water? If so:,</td>
<td>All interviewees had permits to take water.</td>
</tr>
<tr>
<td></td>
<td>Is it for groundwater or surface water?</td>
<td>Two of the interviewees have surface water permits, five interviewees have groundwater permits, and one interviewee has a permit for both groundwater and surface water.</td>
</tr>
<tr>
<td></td>
<td>What volume limits are incorporated in the permit?</td>
<td>Seven of the interviewees provided volume limits. The lowest limit was just under 1 MLD, the highest was 3.8 MLD, and the average was 2.5 MLD. One interviewee was unsure of the volume limit contained in the permit.</td>
</tr>
<tr>
<td></td>
<td>What requirements are incorporated in the permit?</td>
<td>Six interviewees were able to provide information on the requirements of their permits. Taking water was limited to certain durations during the year for all respondents. The longest permitted time 6 months (four respondents), the shortest permitted time was 4 months, and one interviewee responded that the permit limited taking water to &quot;seasonal&quot; demands but could not elaborate further. Six respondents gave information on daily restrictions: five were permitted to take water 24 hours/day and one was limited to 12 hours/day.</td>
</tr>
<tr>
<td></td>
<td>Are the requirements expensive or onerous?</td>
<td>Four of the interviewees indicated that the permits were onerous Two interviewees denied they were onerous Two interviewees were unsure as they were not involved in the permitting process</td>
</tr>
<tr>
<td>8</td>
<td>When do you irrigate?</td>
<td>Seven respondents indicated they commenced irrigation in May, June or rarely in July, depending on whether it was a dry or wet year and one interviewee commenced irrigation in April. One respondent indicated that irrigation finished in August. The remainder of the interviewees indicated the finish date for irrigation was highly dependent on the weather but that typically irrigation would end around October.</td>
</tr>
<tr>
<td></td>
<td>Time of year?</td>
<td>All of the respondents also indicated that they mostly irrigate in the late evening, overnight and/or in the early morning. Three of those interviewed also indicated they occasionally watering during the day.</td>
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<tr>
<td></td>
<td>Time of day?</td>
<td></td>
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<td>Question</td>
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<td>9</td>
<td>Do you monitor the quality of the water you use? If so, for what parameters?</td>
<td>Two of those interviewed do not monitor water quality. Three of the respondents had tested the water quality once, all three tested for pH, one also tested for phosphorus, and one also tested for salts. Regular water quality tests were conducted at three interviewee properties, two interviewees monitored for pH, sodium and bicarbonate and the other interviewee was unsure which parameters were monitored.</td>
</tr>
<tr>
<td>10</td>
<td>What is the typical application rate? Does your irrigation schedule vary seasonally? How does it vary?</td>
<td>All of the interviewees indicated that the irrigation rate was heavily dependent on the weather and therefore highly variable. Most indicated that they do not irrigate every day, one responded that they irrigate approximately 60 percent of the days of the growing season. Six of those interviewed provided some information on application rates. The low applications rates ranged were on the order of 0.1 MLD to 0.4 MLD and the higher application rates ranged from 1 MLD to 2 MLD. For golf courses, this corresponds to an average minimum of 0.3 MLD, average of 0.6 MLD and an average maximum of 1 MLD for an average irrigated golf course area of 28 ha. At the sod farms, the average minimum irrigation is 5.4 MLD, the average of 10 MLD and an average maximum of 20 MLD for the average 180 ha irrigated area. One interviewee indicated the volume of water that a given field would receive per day when irrigated, but did not indicate frequency of irrigation and another interviewee was unsure of irrigation rates.</td>
</tr>
<tr>
<td>11</td>
<td>Do you store water? If so: where, what type of storage/how much?</td>
<td>All eight interviewees replied that they had one or more onsite ponds for water storage. Three of those indicated a known pond capacity, ranging from 0.3 ML to 57 ML. Five respondents did not know the storage volume of the pond/s.</td>
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<tr>
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<tr>
<td>12</td>
<td>What prompts you to irrigation? Would you irrigate more if a dependable supply were available?</td>
<td>Most interviewees use multiple methods of determining when irrigation is necessary. All eight interviewees use visual inspections (including crop wilting and/or yellowing), three use a moisture meter, and two use a soil probe and two look at weather patterns. The general opinion was that there is currently sufficient water available and additional irrigation would not occur if more water was made available. One of those interviewed said a greater area could be irrigated than currently watered if more water was available. One interviewee indicated that their facility was actively trying to reduce water consumption as a measure of reducing environmental impacts.</td>
</tr>
<tr>
<td>13</td>
<td>How many hectares do you typically have under irrigation?</td>
<td>Of the eight interviews, the smallest area under irrigation is 8 ha and the largest is 200 ha. The average area of irrigation is 73 ha.</td>
</tr>
<tr>
<td>14</td>
<td>What type of nitrogen (N) do you currently apply, soluble or slow release?</td>
<td>Five of those interviewed apply both soluble and slow release nitrogen. Two interviewees apply slow release nitrogen only. One interviewee applies biosolids from a non-York Region wastewater treatment plant.</td>
</tr>
<tr>
<td>15</td>
<td>What is the total annual weight of nitrogen applied (kg-N/ha)?</td>
<td>The application of nitrogen was found to vary depending on turf type. The following average application rates were recorded: Sod: 230-240 kg-N/ha Golf course greens: 3-5 kg-N/ha Golf course tees: 4-5 kg-N/ha Golf course fairways: 3 kg-N/ha Golf course roughs: generally not fertilized, although two golf courses fertilized at approximately 1.2-1.9 kg-N/ha.</td>
</tr>
<tr>
<td>16</td>
<td>What is the total annual weight of phosphorus applied (kg-P/ha)?</td>
<td>Two of the respondents do not apply phosphorus and an additional two apply phosphorus incidentally and in small amounts as it is included in the fertilizer blend used. Three respondents apply phosphorus at an average rate of 37 kg-P/ha.</td>
</tr>
<tr>
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<tr>
<td>17</td>
<td>How is this application distributed throughout the year?</td>
<td>It was found that often multiple methods were used to determine the frequency of fertilizer application. Four interviewees use visual inspections (including grass colour), three base frequency off past experiences, two conduct annual soil tests, one measures grass clipping growth, one uses weather patterns and one bases application off supplier recommendations.</td>
</tr>
<tr>
<td></td>
<td>Do you generally follow the OMAFRA guidelines relative to prior to seeding after seeding during production?</td>
<td></td>
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<tr>
<td>18</td>
<td>How many times a year do you apply fertilizer, particularly during production?</td>
<td>Nitrogen application was typically different to phosphorus application, where phosphorus was applied. For sod production, nitrogen was typically applied four to six times per year (not during winter). Golf course greens are typically fertilized with nitrogen every one to two weeks and fairways between one and four times per year. Phosphorus is typically only applied once per year or at seeding of turf and incidentally as part of the fertilizer mix for golf courses.</td>
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<td></td>
<td><strong>Final General Questions</strong></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>What costs do you incur for irrigation now?</td>
<td>None of the interviewees currently pay for water usage. Costs incurred with irrigation were those associated with permitting, pumping (predominantly electricity or diesel costs) and operation and maintenance of the irrigation system.</td>
</tr>
<tr>
<td>20</td>
<td>Reclaimed water would be delivered through a contract between you and York Region:</td>
<td>Six of those interviewed stated that they would be willing to sign a contract, provided that the reclaimed water quality, volume, and cost were acceptable. Three interviewees indicated they would not be willing to sign a contract if the cost of the reclaimed water to them was greater than their current irrigation costs.</td>
</tr>
<tr>
<td></td>
<td>- The contract would provide for a defined amount of water</td>
<td></td>
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<td></td>
<td>- The contract would define the quality of the water to be provided</td>
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<td></td>
<td>- It would have a price for the water which is lower than potable water</td>
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<td></td>
<td>Would you be willing to sign a contract?</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>What information would you need to know to make the decision about whether to use it?</td>
<td>Five of the interviewees indicated they would want to know the reclaimed water quality and nutrient level. Two interviewees would need to know the cost. Two interviewees would need information on the flow rate and control of the flow. One interviewee would need to know what volume of water they would be required to take. One interviewee does not need any additional information at this stage of the project but assumes more details will be discussed and worked through as the design progresses.</td>
</tr>
<tr>
<td>#</td>
<td>Question</td>
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<tr>
<td>22</td>
<td>The reclaimed water will also contain nutrients such as phosphorus and/or nitrogen. Would this increase the value or make you more inclined to use reclaimed water over your current irrigation water?</td>
<td>One interviewee affirmed that nutrients such as nitrogen and phosphorus would make the reclaimed water move valuable. Five interviewees indicated they are interested in the potential for nutrients to be provided in the reclaimed water but would need more information (e.g., nutrient levels and types) to make an informed decision. Two interviewees did not feel that the presence of nutrients in the reclaimed water would be beneficial to them.</td>
</tr>
</tbody>
</table>
| 23 | Is there anything else you’d like to share that we haven’t talked about? Is there anyone else you think we should meet with to discuss this project?                                                                 | Five respondents did not have any additional information to share. One respondent asked if natural treatment methods such as wetlands had been considered for the process design. Another interviewee reiterated concern about potential current and future impacts of reclaimed water, particularly heavy metal accumulation in soils and presence of pharmaceuticals. The interviewees provided names of several stakeholders and agencies who may be interested in using reclaimed water or whose opinions on reclaimed water use could be useful. The following were suggested:  
  - Adrian Simpson at Wessuc (biosolids supplier)  
  - Irina Solntseva, University of Guelph (monitors biosolids applications)  
  - Pam Charbonneay, University of Guelph Turf Grass Institute  
  - Joe Uyenaka, NutriAg (fertilizer supplier)  
  - Chapman Farms, local vegetable grower  
  - Asian Farms, local vegetable grower  
  - Goodyear, local vegetable grower  
  - Golf courses and farms currently using reclaimed water  
  - OMAFRA  
  - Food inspection agencies  
  Additionally three of the interviewees and one golf course identified as a potential user, but with whom an interview could not be arranged, were suggested, but are not included in the list above. Contact with this stakeholders and agencies will be considered as part of ongoing consultation throughout the environmental assessment process. |
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<tr>
<td>24</td>
<td>Was this meeting time convenient?</td>
<td>Seven of those interviewed prefer future contact via telephone, one interviewee prefers email contact, and one is happy to be contacted via telephone or email.</td>
</tr>
<tr>
<td></td>
<td>As the project goes forward, when is the best time / time of year to speak with you?</td>
<td>For sod farmers, the start of the year (January-February) is their least busy and they preferred to be contacted then.</td>
</tr>
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Appendix B

Proposed Water Reclamation and Reuse Framework for Non-Potable
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Introduction

The following framework for governing water reuse for York Region is structured into three basic groupings of Articles. Article I deals with definitions that apply to the entire document. Articles II – III deal with Reclaimed Water uses and their management in the distribution system. Articles IV - VII deal with the production of Reclaimed Water.

Article I. Definitions

Section 1.01 "Class A Reclaimed Water" means a Filtered Wastewater that has been subsequently disinfected and meets the following criteria:

(a) The wastewater has been disinfected by either:

(i) A chlorine Disinfection process following Filtration that provides a CT value (the product of total chlorine residual and modal contact time measured at the same point) of not less than 300 milligram-minutes per litre at all times with a modal contact time of at least 30 minutes, based on peak design flow; or,

(ii) A Disinfection process combined with Filtration:

1. When combined with the Filtration process, has been demonstrated to inactivate and/or remove 99.999 percent (5-log10) of the plaque-forming units of F-specific Bacteriophage MS2 or polio virus in the wastewater. A virus that is at least as resistant to Disinfection as polio virus may be used for purposes of the demonstration. The virus removal credit attributed to media filtration depends on the type of filtration (e.g., media, filtration rate, whether polymers or coagulants are used and their dosage, etc.) or membranes that are employed.

2. Granular media filters typically remove approximately 1 log of particulate-associated viruses based on the Pomona Virus Study conducted by the Sanitation Districts of Los Angeles County (1977), while reverse osmosis currently can receive credit for removing approximately 2 logs of virus (both particulate-associated viruses and non-particulate viruses via size exclusion) depending on the type of membrane used, although actual removal is likely considerably higher with the improved membranes used in recent years.

(iii) Where ultraviolet (UV) light is used for Disinfection, the following requirements apply:

1. When using non-membrane Filtration as part of the treatment process train upstream of UV Disinfection, the UV design dose shall be at least 100 millijoules per square centimetre (mJ/cm²) at maximum day flow, the filtered effluent UV transmittance shall be 55 percent or greater at 254 nanometres (nm), and the turbidity shall conform to Article I, Section 1.08(a),(i),(ii), and (iii).

2. When using microfiltration, ultrafiltration, or nanofiltration as part of the treatment process train upstream of UV Disinfection, the UV design dose shall be at least
80 mJ/cm² at maximum day flow, the filtered effluent UV transmittance shall be
65 percent or greater at 254 nm, and the turbidity shall conform to Article I,
Section 1.08(b),(i), and (ii).

3. When using reverse osmosis as part of the treatment process train upstream of UV
Disinfection, the UV design dose shall be at least 50 mJ/cm² at maximum day flow,
the filtered effluent UV transmittance shall be 90 percent or greater at 254 nm, and
the turbidity shall conform to Article I, Section 1.08(b),(i), and (ii).

(b) The median concentration of fecal coliform bacteria measured in the disinfected effluent is
non-detectable per 100 millilitres utilizing the bacteriological results of the last seven days
for which analyses have been completed. No sample shall exceed 14 fecal coliform
bacteria per 100 millilitres [Note: It is recognized E. coli is de facto standard in Canada].

Section 1.02 Other classes of Reclaimed Water may be defined as appropriate by York
Region.

Section 1.03 "Coagulated Wastewater" means secondary effluent in which colloidal and finely
divided suspended matter has been destabilized and agglomerated prior to Filtration by the
addition of floc-forming chemicals.

Section 1.04 "Disinfection" means the destruction or inactivation of pathogenic
microorganisms by any means.

Section 1.05 "Dual Plumbed System" means a system that utilizes separate piping systems
for Reclaimed Water and potable water within a facility and where Reclaimed Water is used for
the following purposes:

(a) To serve plumbing outlets within a building, or

(b) Outdoor landscape irrigation at individual residences or other areas served with by a
municipal drinking water system.

Section 1.06 "End User" is defined as a customer who contracts with York Region to use
Reclaimed Water for one of the intended uses as defined in these criteria.

Section 1.07 "F-specific Bacteriophage MS2" means a strain of a specific type of virus that
infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC
15597B1) and is grown on lawns of E. coli (ATCC 15597).

Section 1.08 "Filtered Wastewater" means Municipal Wastewater that has received
Secondary Treatment and has been coagulated and filtered pursuant to the following:

(a) At a rate that does not exceed 35 litres per minute per square metre of surface area of filter
cloth media in a cloth disk filter, and the turbidity of the Filtered Wastewater does not exceed
any of the following:
(i) An average turbidity of 2 nephelometric turbidity units (NTU) within a 24-hour period,

(ii) 5 NTU more than 5 percent of the time within a 24-hour period, and

(iii) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the Filtered Wastewater does not exceed any of the following:

(i) 0.2 NTU more than 5 percent of the time within a 24-hour period, and

(ii) 0.5 NTU at any time.

Section 1.09 "Filtration" means the removal of particulate matter from wastewater by passing the water through a filtering medium such as cloth media, membranes, or other comparable media or combination of filter media.

Section 1.10 "Landscape Impoundment" means an impoundment of Reclaimed Water which is used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a function not intended to include public contact.

Section 1.11 "Ministry" means the Ontario Ministry of the Environment.

Section 1.12 "Municipal Wastewater" means domestic sewage originating primarily from residential dwellings and business buildings but may include contributions from:

(a) Holding tanks in recreational vehicles, boats, and houseboats,

(b) Septage,

(c) Commercial, institutional, and industrial sources, and

(d) Inflow and infiltration.

Section 1.13 "Person" includes any individual, firm, association, organization, partnership, business trust, corporation, company, city, agency, district, county, or province to the extent authorized by Canadian law.

Section 1.14 "Reclamation Plant" means an arrangement of devices, structures, equipment, processes, and controls which produce Reclaimed Water suitable for the intended reuse. In this case the Reclamation Plant is the Water Reclamation Centre owned and operated by York Region, located at 20908/20854 2nd Concession, East Gwillimbury, Ontario.

Section 1.15 "Reclaimed Water" means effluent from a Municipal Wastewater treatment plant that is suitable for a direct designated water use.

Section 1.16 "Reclaimed Water Agency" means reclaimed water provider or York Region.
Section 1.17  "Regulatory Agency" means the provincial ministry with jurisdiction over the area under discussion (e.g. MOE, OMAF etc.).

Section 1.18  "Residual Disinfection Limit(s)" means maintenance of chlorine residual of at least 0.5 mg/L to safeguard against microbial regrowth.

Section 1.19  "Restricted Access" means that access by the general public to a site irrigated with Reclaimed Water is controlled.

Section 1.20  "Secondary Treatment" means any form of treatment, excluding dilution, that produces an effluent quality with a carbonaceous biochemical oxygen demand (cBOD$_5$) not exceeding a 30-day average of 30 mg/L, a total suspended solids (TSS) not exceeding a 30-day average of 30 mg/L, achieves at least 85 percent removal of cBOD$_5$ and TSS (30-day average), and contains dissolved oxygen.

Section 1.21  "Standby Unit Process" means an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment of the actual flow through the unit for which it is a substitute.

Section 1.22  "Unrestricted Access" means that access by the general public to a site irrigated with Reclaimed Water is uncontrolled.

Section 1.22  "Use Area" means an area with defined boundaries that has been approved for the use of Reclaimed Water and permitted by the Regulatory Agency. A Use Area may contain one or more facilities.

Article II. Uses of Reclaimed Water

Section 2.01  Irrigation Uses

(a) Reclaimed Water used for irrigation of the following shall be Class A Reclaimed Water or better:

(i) Unrestricted Access golf courses,

(ii) Sod farms,

(iii) Tree farms, and

(iv) Any other irrigation use not specified in this Framework and not otherwise prohibited.

Section 2.02  Impoundments

(a) Reclaimed Water used as a source of supply for unrestricted impoundments (storage ponds, and other similar impoundments) shall be Class A Reclaimed Water or better where
mono- and multi-media filters, cloth disk filters, microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membranes are used for the Filtration unit process.

Section 2.03 Cooling Water

(a) Reclaimed Water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates aerosols or mist shall be Class A Reclaimed Water or better.

(b) Whenever a cooling system using Reclaimed Water in conjunction with an air conditioning facility utilizes a cooling tower or otherwise creates aerosols or mist that could come into contact with employees or the public, the cooling system shall comply with the following:

(i) A drift eliminator shall be used whenever the cooling system is in operation.

(ii) The cooling system recirculating water shall be disinfected to minimize the growth of Legionella and other microorganisms.

Section 2.04 Firefighting

(a) Reclaimed Water used for fire protection of structures shall be Class A Reclaimed Water or better as follows:

(i) in hydrants or in sprinkler systems located in commercial or industrial facilities or buildings, hotels, or motels

(b) Reclaimed Water used for non-structural firefighting shall be Class A Reclaimed Water or better.

Section 2.05 Other Uses of Reclaimed Water

(a) Uses of Reclaimed Water other than those identified may be acceptable to the Regulatory Agency and are subject to approval on a case-by-case basis.

Article III. Use Area and Management Requirements

Section 3.01 General

(a) The public and employees shall be notified of the use of Reclaimed Water at all Use Areas. This shall be accomplished by the posting of advisory signs at Use Areas, distribution of written notices to residents or employees, notices on scorecards at golf courses, or by other methods.

(b) Adequate measures shall be taken to prevent unplanned ponding of Reclaimed Water.
(c) Precautions shall be taken to assure that Reclaimed Water will not be sprayed on people or any facility or area not designated for reuse, including but not limited to buildings, passing vehicles, and drinking water fountains.

(d) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating places, or food handling facilities.

(e) Runoff of Reclaimed Water shall be confined to the designated Use Area unless otherwise authorized.

(f) Drinking water facilities shall be protected against contact with Reclaimed Water spray, mist, or runoff.

(g) Adequate measures shall be taken to prevent the breeding of vectors of health significance and the creation of odours, slimes, or aesthetically displeasing deposits.

(h) All Use Areas where Reclaimed Water is used that are accessible to the public shall be posted with signs that include the wording "CAUTION: RECLAIMED WATER – DO NOT DRINK." The Regulatory Agency may accept alternative signage and wording, or an educational program, provided the applicant demonstrates to the Regulatory Agency that the alternative approach will assure an equivalent degree of public notification.

(i) Portions of the Reclaimed Water piping system that are in areas subject to access by the general public shall not include any hose bibs usable by the public. Only quick couplers or other devices that differ from those used on the potable water system shall be used on portions of the Reclaimed Water piping system in areas subject to public access.

(j) All Reclaimed Water pipelines, valves, outlets, and other appurtenances shall be colour-coded purple (Pantone 522 or similar shade) or otherwise permanently marked to identify the source of the water as being Reclaimed Water and not suitable for drinking.

(k) For metal or concrete pipelines, identification may be accomplished by colour-coding the pipe purple (Pantone 522 or similar shade) or labeling piping using purple-coloured adhesive tape along the entire length of the pipe. If tape is used to mark the pipe, the tape shall be permanently affixed to the top and each side of the pipe (three locations parallel to the axis of the pipe). Identification tape should be at least 7.5 cm wide and have black or white on a purple (Pantone 522 or similar shade) field. For pipes less than 600 mm in diameter, a single tape may be used along the top of the pipe.

(l) Non-metallic pipe shall have the colour purple (Pantone 522 or similar shade) integral to the material.

(m) The identification system for all Reclaimed Water pipelines shall be installed so the wording "CAUTION: RECLAIMED WATER – DO NOT DRINK" is clearly visible.

(n) Purple pipe or tape is not required for pipes used for Reclaimed Water at agricultural use and at municipal or industrial facilities that have established a labeling or marking system for
Reclaimed Water on their premises, as otherwise required by a local legislation that clearly distinguishes Reclaimed Water from potable water.

(o) It is recommended, but shall not be required, that existing Reclaimed Water pipelines, valves, outlets and other appurtenances located on private properties, including residential properties, be colour-coded purple.

(p) Reclaimed Water impoundments and storage ponds shall not result in contamination of groundwater that is used as, or is suitable for use as, a source of water supply for domestic purposes. Reclaimed Water impoundments and storage ponds that are not lined or sealed to prevent seepage are acceptable if it is demonstrated to the satisfaction of the Regulatory Agency that such contamination will not occur.

(q) A groundwater monitoring program may be required by the Ministry. Where required, the groundwater monitoring program shall be approved by the Ministry. The monitoring program shall be based on Reclaimed Water quality and quantity, site-specific soil and hydrogeologic characteristics, and other considerations.

Section 3.02 Tanker Trucks

(a) Tanker trucks and other equipment used to distribute Reclaimed Water shall be clearly identified with advisory signs.

(b) Tanker trucks used to transport Reclaimed Water shall not be used to transport potable water that is used for drinking or other potable purposes.

(c) Tanker trucks used to transport Reclaimed Water shall not be filled through on-board piping or hoses that may subsequently be used to fill tanks with water from a potable water supply.

Section 3.03 Setback Distances

(a) For Class A Reclaimed Water, the following setback distances will apply:

(i) There shall be a minimum of 15 metres between any Reclaimed Water pipeline and potable water supply well.

(ii) Where Reclaimed Water is used for spray or surface irrigation, there will be a minimum of 20 metres between the area subject to irrigation and any potable water supply well. This requirement is waived if all of the following conditions are met:

1. An aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.
2. The well contains an annular seal extending from the surface into the aquitard.
3. The well is protected by a housing to prevent any Reclaimed Water spray from coming into contact with the wellhead facilities.
4. The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

5. The owner of the well approves elimination of the setback distance.

(iii) Where Reclaimed Water is used for an impoundment that is lined or sealed to prevent measurable seepage, there shall be a minimum of 30 metres between the perimeter of the impoundment and any potable water supply well.

(iv) Where Reclaimed Water is used for an impoundment that is not lined or sealed to prevent measurable seepage, there shall be a minimum of 100 metres between the perimeter of the impoundment and any potable water supply well.

Section 3.04 Separation Distances

Separation distances between Reclaimed Water pipelines and potable water lines shall be as prescribed by the Regulatory Agency, including the following:

(a) Reclaimed Water pipelines and potable water lines located parallel to each other shall be constructed in separate trenches maintaining a minimum horizontal separation distance of 2.5 metres between the outside of the Reclaimed Water pipeline and the outside of the potable water pipeline.

(i) When it is not practical to maintain a separate trench and a minimum horizontal separation distance, the crown of the Reclaimed Water pipeline shall be at least 0.5 metres below the invert of the potable water pipeline and separated by in situ material or compacted backfill. Joints should be offset as much as possible between Reclaimed Water pipelines and potable water pipelines.

(b) Where Reclaimed Water pipelines and potable water pipelines cross, a minimum vertical distance of 0.5 metres between the outside of the Reclaimed Water pipeline and the outside of the potable water pipeline shall be provided.

(i) When Reclaimed Water pipelines lines cross above potable water pipelines, the length of water pipe shall be centered at the point of crossing such that the joints will be at least 3 metres from the outside of the Reclaimed Water pipeline or the potable water pipeline shall be encased in a watertight carrier pipe which extends at least 3 metres on both sides of the crossing.

Section 3.05 Cross Connection Control

(a) Except as may be permitted by the Regulatory Agency, no physical connection shall exist between a Reclaimed Water system and any separate system conveying potable water.

(b) Where both Reclaimed Water and potable water are supplied to a Reclaimed Water Use Area, a reduced pressure principle backflow prevention device, or an approved air gap separation shall be installed at the potable water service connection to the Use Area.
(c) Where potable water is used to supplement a Reclaimed Water system, there shall be an air gap separation, approved and regularly inspected by the potable water supplier, between the potable water and Reclaimed Water.

(d) Reclaimed Water shall not enter a dwelling unit or a building containing a dwelling unit except as allowed in Article II, Section 2.03.

Article IV. Other Methods of Treatment

Treatment methods other than those included in these requirements and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the Ministry that the treatment methods and reliability features will assure an equal degree of treatment and reliability.

Article V. Sampling and Analysis

(a) Reclaimed Water shall be sampled at a water reclamation centre at least daily for fecal coliform bacteria. Grab samples shall be taken from the disinfected effluent, which is the compliance point for meeting the fecal coliform limits.

(b) Class A Reclaimed Water shall be continuously sampled for turbidity after Filtration using a continuous recording turbidity meter. Compliance with the daily average operating filter effluent turbidity shall be determined by averaging the levels of recorded turbidity taken at four-hour intervals over a 24-hour period. Compliance with turbidity pursuant to Article I, Section 1.08 (a)(ii) and (b)(i) shall be determined using the levels of recorded turbidity taken at intervals of no more than 1.2-hours over a 24-hour period.

(c) The carbonaceous biochemical oxygen demand (cBOD₅) in the secondary effluent for the production of Reclaimed Water shall be sampled at least weekly using composite samples.

(d) The total suspended solids (TSS) in the secondary effluent for the production of Reclaimed Water shall be sampled at least daily using composite samples.

(e) Grab samples for dissolved oxygen shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities.

(f) Samples collected for cBOD₅, TSS, dissolved oxygen, turbidity, and fecal coliform analyses shall be analyzed by approved laboratory methods, and analyses shall be conducted in laboratories accredited in accordance with Ministry requirements.

(g) Grab samples for chlorine residual shall be collected as determined necessary at the point of delivery to the end user.
Article VI. Engineering Report and Operational Requirements

Section 6.01 Engineering Report

(a) No Person shall produce or supply Reclaimed Water for direct use from a Water Reclamation Centre without first filing an engineering report.

(b) The report will be prepared by a properly qualified engineer registered in Ontario and experienced in the field of environmental engineering and will contain a description of the proposed water reclamation processes that are generating reclaimed water. The report shall clearly indicate the means for water quality compliance and any other features specified by the Ministry.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately treated wastewater will be delivered to the Use Area.

(d) The report shall detail the program for cross connection control and identify the Regulatory Agency that will be responsible for compliance and testing of cross connection control activities.

Section 6.02 Personnel

(a) Each Water Reclamation Centre will be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel will be those meeting requirements established by the Ministry.

Section 6.03 Maintenance

A preventive maintenance program shall be provided at each Water Reclamation Centre to ensure that all equipment is kept in a reliable operating condition.

Section 6.04 Operating Records and Reports

(a) Operating records shall be maintained at the Water Reclamation Centre or a central depository within the operating Reclaimed Water Agency for a period of five years from the date of creation. These records will include all analyses specified in these requirements, records of operational problems, plant and equipment breakdowns, diversions to emergency storage or disposal, and all corrective or preventive actions taken.

(b) Any discharge of untreated or partially treated wastewater to the Use Area, and the cessation of same, shall be reported immediately by telephone to the Regulatory Agency and the York Region Medical Officer of Health with a written report to follow within five business days.
Section 6.05  By-pass

There shall be no by-pass of any untreated or partially treated wastewater from the Water Reclamation Centre for use as reclaimed water. Permitted points of discharge for reclaimed water from the Water Reclamation Centre are from the microfiltration train, the Reverse Osmosis train, or the cloth disc filter train, all of which must receive disinfection (see Article 1, Section 1.01) before delivery to distribution system.

Section 6.06  Disinfection

A chlorine residual of at least 0.5 mg/L shall be maintained in the Reclaimed Water distribution system during conveyance from the Reclamation Plant to the Use Area unless otherwise authorized by the Ministry. The chlorine residual shall be dosed to the Reclaimed Water during the secondary disinfection stage, after primary disinfection with UV.

Article VII. General Design Requirements – Water Reclamation Centre

Section 7.01  Flexibility of Design

The design of process piping, equipment arrangement, and unit structures in the Water Reclamation Centre must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the required level of treatment to be obtained under varying conditions.

Section 7.02  Alarms

(a) Alarm devices required for various unit processes specified in these requirements shall be installed to provide warning of the following:

(i) Loss of power from the normal power supply,

(ii) Failure of a biological treatment process,

(iii) Failure of a coagulation process,

(iv) Failure of a Filtration process,

(v) Failure of a Disinfection process, and

(vi) Any other specific process failure for which warning is required by the Ministry.

(b) All required alarm devices shall be independent of the normal power supply of the water reclamation centre.
(c) The Person to be warned will be the centre operator or any other responsible Person designated by the management of the water reclamation centre and capable of taking prompt action.

(d) If the Water Reclamation Centre is not attended full time, the alarm(s) shall be connected to a SCADA system operated by the Reclaimed Water Agency at a central location.

Section 7.03 Power Supply

The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source,

(b) Alarm and automatically-actuated short-term retention or disposal provisions, or

(c) Automatically-actuated long-term storage or disposal provisions.
Appendix C

Definitions Associated with Water Reclamation Systems
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<th>Section</th>
<th>Page</th>
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<td>Definitions Associated with Water Reclamation Systems</td>
<td>C-1</td>
</tr>
</tbody>
</table>
Definitions Associated with Water Reclamation Systems

1. Air-gap separation: A physical separation of at least double the diameter of the supply pipe between the free-flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel, measured vertically above the overflow rim of the vessel. In no case shall the air-gap be less than one inch.


3. Backflow prevention assembly: One of several approved devices, selected according to the cross-connection risk, to protect higher quality water from contamination from any lesser quality water. Such a device may include devices to protect potable water from degradation by reclaimed water, wastewater or graywater, or degrading reclaimed or recycled water from degradation by wastewater or graywater.

4. Cross connection: A physical or potential connection in a plumbing system through which a potable water supply could be contaminated by non-potable water.

5. Delivery Point: point of connection to the reclaimed water system at which the reclaimed water is delivered by York Region and accepted by the customer.

6. Double check valve assembly: An assembly composed of two independently acting valves, including tightly closing resilient-seated shutoff valves attached at each end of the assembly and fitted with properly located resilient-seated test cocks.

7. Dual distribution systems: Two separate water piping systems distributing water to customers, one carrying potable water and the other conveying lesser-quality water (e.g., non-potable reclaimed water) for reuse purposes.

8. Mandatory Reuse Zone: An area where the use of reclaimed water is required if available.

9. Non-potable water: Water that is considered unsafe, unpalatable, or both for drinking.

10. Potable water: Water that meets drinking water standards and is considered safe and satisfactory for drinking, and cooking.

11. York Region: The producer and distributor of reclaimed water.

12. Reclaimed Water: Wastewater that becomes suitable for beneficial use as the result of treatment at the Water Reclamation Centre and is managed, and distributed to specific reclaimed water users by York Region.

13. Reclaimed water user agreement: Legally binding utility service agreement York Region and reclaimed water users that establishes terms and conditions of service; reclaimed
water supply availability (average, minimum, maximum) and timing, quality and cost; and responsibilities of both parties for signage, use control and compliance monitoring.

14. Stakeholders: A group, organization, person, or agency that has an interest in, decision-making responsibility for, or authority over a process and is affected by or will benefit from the outcome of a process.

15. Use site: Area of reclaimed water use with defined boundaries.

16. Wastewater: A combination of the liquid and water-carried waste from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and storm water that may be present. Water containing the wastes from households, commercial facilities, and industrial operations; it may be mixed with surface water, stormwater, or groundwater that infiltrated the collection.
Appendix D

Reclaimed Water Regulations in Canada
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Reclaimed Water Regulations in Canada

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| Table D.3: | Effluent Quality Guidelines for Unrestricted Access Irrigation in Several Canadian Provinces | D-3 |
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Reclaimed Water Regulations in Canada


Table D.1: Health Canada Guidelines Values for Domestic Reclaimed Water Used in Toilet and Urinal Flushing

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Water Quality Parameters(^1)</th>
<th>Median</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD(_5)</td>
<td>mg/L</td>
<td>≤ 10</td>
<td>≤ 10</td>
<td>≤ 20</td>
</tr>
<tr>
<td>TSS(^2)</td>
<td>mg/L</td>
<td>≤ 10</td>
<td>≤ 10</td>
<td>≤ 20</td>
</tr>
<tr>
<td>Turbidity(^3)</td>
<td>NTU</td>
<td>≤ 2</td>
<td>≤ 2</td>
<td>≤ 5</td>
</tr>
<tr>
<td>E. coli(^4)</td>
<td>CFU/100 mL</td>
<td>Not detected</td>
<td>Not detected</td>
<td>≤ 200</td>
</tr>
<tr>
<td>Thermotolerant coliforms(^3)</td>
<td>CFU/100 mL</td>
<td>Not detected</td>
<td>Not detected</td>
<td>≤ 200</td>
</tr>
<tr>
<td>Total chlorine residual(^5)</td>
<td>mg/L</td>
<td>≥ 0.5</td>
<td>≥ 0.5</td>
<td>≥ 0.5</td>
</tr>
</tbody>
</table>

\(^1\) Unless otherwise noted, recommended quality limits apply to the reclaimed water at the point of discharge from the treatment facility or treatment unit.
\(^2\) Measured prior to disinfection point. Only one of TSS and turbidity needs to be monitored in a given system.
\(^3\) Only one of E. coli and thermotolerant coliforms needs to be monitored in a given system.
\(^4\) Measured at the point where the treated effluent enters the distribution/plumbing system.

Table D.2 illustrates guidelines for disposal of treated effluent on land in Ontario per the MOE Design Guidelines for Sewage Works (2008).
### Table D.2: Effluent Treatment Requirements for Land Application of Treated Effluent per MOE Design Guidelines for Sewage Works

<table>
<thead>
<tr>
<th>Treated Effluent Use</th>
<th>Effluent Quality Requirements</th>
<th>Treatment Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops for animal consumption(^1)</td>
<td>0.5 mg/L total chlorine residual and 30 minutes contact time</td>
<td>Lagoon effluent or disinfected secondary effluent</td>
</tr>
<tr>
<td>Dairy cattle pasture(^1)</td>
<td>&lt; 100 E. coli / 100 mL</td>
<td>Secondary treatment plus disinfection, or, 30 days retention time since last addition of raw sewage prior to spraying (no disinfection)</td>
</tr>
<tr>
<td>Pasture, silage, haylage, orchards and other food crops(^1)</td>
<td>0.5 mg/L total chlorine residual and 30 minutes contact time</td>
<td>Disinfection. Non-spray methods of irrigation should be used in orchards. Crop should be allowed to dry before harvest/pasturing.</td>
</tr>
<tr>
<td>Recreational lands (e.g. golf courses)</td>
<td>0.5 mg/L total chlorine residual and 30 minutes contact time</td>
<td>Secondary biological activated sludge treatment or equivalent. Two connected storage ponds each with minimum retention time 30 days. Disinfection.</td>
</tr>
</tbody>
</table>

\(^1\) – If land is not used for at least one-half year after spraying, disinfection is not necessary.

The MOE Design Guidelines of Sewage Works state that for irrigation systems relying primarily upon evapotranspiration the limit of the irrigation season is the frost-free period. The amount of effluent sprayed will depend on the infiltration/permeability of the soil and the crop water deficit. The document also states that although the length of the frost-free period varies by climatic region in Ontario and irrespective of the crop water deficit, the spray season cannot be in excess of 100 days and the average effluent application rate cannot exceed 55,000 L/(ha.d).

Table D.3 illustrates guidelines for unrestricted access irrigation in the provinces of British Columbia, Alberta, Nova Scotia, New Brunswick, Newfoundland and Labrador and Prince Edward Island. The table illustrates the wide differences in the standards among the provinces.
Table D.3: Effluent Quality Guidelines for Unrestricted Access Irrigation in Several Canadian Provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Effluent Quality Requirements</th>
<th>Treatment Requirements</th>
</tr>
</thead>
</table>
| British Columbia\(^1\)           | pH 6.5-9  
≤ 10 mg/L BOD\(_5\)\(^2\)/TSS  
average 2 NTU, maximum 5 NTU at all times.  
< 1 FCU/100 mL or < 2.2 MPN (median value of last 5 samples for which analyses have been completed) and maximum 14 CFU  
≥ 0.5 mg/L total chlorine residual | Virus removal via:  
a) Chemical addition of coagulant or polymer, plus filtration, and/or,  
b) 60-day storage after secondary treatment, and/or,  
c) Equivalent treatment authorized by director  
Disinfection (maintain chlorine residual)  
Alternate disposal method or 48 hours storage outside of treatment system |
| Alberta\(^3\)                    | pH 6.5-8.5  
< 100 mg/L cBOD\(_5\)  
< 150 mg/L COD  
< 100 mg/L TSS  
< 1000 / 100 mL Fecal Coliform  
(geometric mean of weekly samples if storage provided or daily samples if storage not provided)  
< 200 / 100 mL Total Coliform  
(geometric mean of weekly samples if storage provided or daily samples if storage not provided)  
< 1.0 dS/m Electrical Conductivity  
< 4 SAR |                                                                                                    |
| Atlantic Canada (Nova Scotia, New Brunswick, Newfoundland and Labrador, Prince Edward Island)\(^4\) | pH 6.5-8.5  
< 10 mg/L BOD\(_5\)  
< 20 mg/L COD  
< 10 mg/L TSS  
< 2 MPN / 100 mL E. coli  
< 1.0 dS/m Electrical Conductivity  
< 4 SAR |                                                                                                    |

1 British Columbia Ministry of Environment, Municipal Wastewater Regulation (2012), requirements for reclaimed water categorized as “greater exposure potential”, that is, for uses which public contact is likely.
2 “BOD\(_5\)” means the carbonaceous 5-day biochemical oxygen demand.
Only British Columbia has standards for industrial use which are illustrated in Table D.4. These standards are slightly less restrictive than those for unrestricted access irrigation.

**Table D.4: Effluent Quality Guidelines for Industrial Use in British Columbia**

<table>
<thead>
<tr>
<th>Province</th>
<th>Effluent Quality Requirements</th>
<th>Treatment Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>pH 6.5-9, ≤ 45 mg/L BOD$_5$/TSS, ≤ 200 CFU/100 mL, ≥ 0.5 mg/L total chlorine residual</td>
<td>If frequent worker contact, disinfect to maximum fecal coliform CFU &lt; 14 / 100 mL (or equivalent MPN), Disinfection (maintain chlorine residual), Alternate disposal method or 48 hours storage outside of treatment system</td>
</tr>
</tbody>
</table>

1 – British Columbia Ministry of Environment, Municipal Wastewater Regulation (2012), requirements for reclaimed water categorized as “lower exposure potential”, including uses commercial or industrial in nature.

2 – "BOD$_5$" means the carbonaceous 5-day biochemical oxygen demand.