Water Quality Risk Management Catalogue
Manual

Prepared for:
Ontario Ministry of the Environment and Climate Change
Ontario Ministry of Natural Resources and Forestry

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The purpose of the Clean Water Act, 2006 ("the act" or "CWA") is to protect Ontario’s existing and future drinking water sources as part of an overall commitment to safeguard human health and the environment. A key focus of the legislation is the preparation of locally developed source protection plans, which will consist of a range of policies that together will reduce the risks posed by threats to water quality and quantity. The act and its regulations ("the legislation"), in particular the General Regulation - Ontario Regulation 287/07 ("the regulation"), establish a legal framework for drinking water source protection in Ontario.

While every effort has been made to ensure the accuracy of the information in this document, it should not be construed as legal advice or relied on as a substitute for the legislation.

The Clean Water Act authorizes the use of certain policy tools in order to manage activities identified in Assessment Reports as significant drinking water threats. These policy tools include (among others) site-specific risk management plans and provincial (prescribed) instruments. The Risk Management Measures Catalogue (RMMC) was developed to help those responsible for implementing these tools.

The Risk Management Measures Catalogue (RMMC)

The RMMC has been prepared for a number of potential users to assist in gathering information in regards to known practices available to reduce the risk posed by activities which have been prescribed by the province as drinking water threat(s) or approved as the “Local Threats”.

The risk management measures included in the RMMC have been evaluated by a number of technical experts from the Ministries of Environment and Climate Change, Natural Resources and Forestry, and Agriculture Food and Rural Affairs, as well as experts from the source protection authorities, municipalities and the private sector. The measures have been identified as those that are known to be effective to some extent in addressing a drinking water threat (or a group of threats) by reducing to some degree the risk of that threat to drinking water sources.

The user of the RMMC is able to select risk management measures in order to ensure that the threat to drinking water is adequately managed. Therefore, users of the RMMC will be applying their professional judgement on determining what particular measure(s) is/are considered to be sufficient to adequately manage a drinking water quality or quantity threat in order to meet the test set out in section 22 the CWA, which is that the threat ceases to be (or never becomes) significant.

The catalogue has been developed to support key stakeholders in identifying potential measures for inclusion in risk management plans and relevant instruments, and is not intended to provide advice or recommendations in relation to any specific circumstance. The Province of Ontario and Toronto and Region Conservation Authority assume no liability for the risk management measures selected by the users.

It is intended that the RMMC will be updated as necessary, for example when new measures emerge or when updated information is obtained regarding the effectiveness of the measures.
1.0 INTRODUCTION

1.1 Background

1.1.1 Source Protection Plans

The purpose of the Clean Water Act is to protect existing and future sources of drinking water. The Act mandates that drinking water source protection plans be developed to address water quality and quantity threats to all municipal residential drinking water systems within each designated Source Protection Area (SPA).

As per subsection 22(1) of Ontario Regulation 287/07, the objectives of the source protection plan are:

1. To protect existing and future drinking water sources in the source protection area.
2. Ensure that, for every area identified in the Assessment Report as an area where an activity is or would be a significant drinking water threat,
   i. the activity never becomes a significant drinking water threat, or
   ii. if the activity is occurring when the source protection plan takes effect, the activity ceases to be a significant drinking water threat.

These plans utilize a range of policy tools to manage existing and future threats to municipal drinking water sources. The tools range from education and outreach activities and incentives, to the development of site-specific risk management plans, one of the new authorities provided in Part IV of the CWA. The range of policy approaches used to reduce risks and manage threats can be seen as a continuum – moving from informal (sometimes called “soft tools”) to approaches that are both formal and legally binding. The CWA aims to avoid regulatory duplication by recognizing existing approaches, such as land use planning and prescribed instruments, as effective means to address threats. In many instances, different tools have been used to address the threat, and the various approaches, and in many cases they have been used in combination. The approaches that may be used by source protection plan policies are listed below:

- Education and outreach programs (leading to voluntary risk reduction);
- Incentive programs (leading to voluntary risk reduction);
- Land-use planning approaches (e.g. official plans, zoning by-laws, development permits);
- “Specify an action” which includes research, stewardship, BMPs, By-laws under the Municipal Act.
- Prohibition or management through provincial instruments (e.g. Environmental; Compliance Approvals);
- Part IV authorities (new)
  o Risk management plans (s. 58);
  o Prohibition (s. 57); and
  o Restricted land uses (s. 59).
Information within the Risk Management Measures Catalogue (RMMC) will assist bodies responsible for implementing source protection plan policies in making decisions as they consider different measures and best management practices to manage or reduce the impact or the risk posed by water quality and quality threats related to their drinking water supplies to ensure that the threat to drinking water is adequately managed.

1.1.2 Risk Management Plans

Where activities cannot be managed through instruments or prohibited through planning, one of the approaches commonly used to address drinking water threats is the negotiation or establishment of site-specific Risk Management Plans, under Section 58 of the CWA. Where an SPC includes policies requiring s.58 Risk Management Plans to address a particular threat, these plans will be established through a local process between the person or business engaged in the threat activity and the local risk management official, after the source protection plan takes effect. Risk management officials do have the authority to negotiate interim risk management plans in advance of the plan taking effect.

Risk management plans offer the opportunity for negotiation and agreement on the required actions to address significant drinking water threats. They are designed to be flexible; reasonable and practical actions are expected to be taken over an agreed period of time to manage the risks from the activity. Considerations should also include existing risk management measures already in place, where applicable.

The RMMC catalogue is a valuable tool in identifying individual measures or groups of measures to effectively reduce risks to drinking water sources. The user of the RMMC may select risk management measures for inclusion in a risk management plan in order to ensure that the threat to drinking water is adequately managed.

1.1.3 Provincial Instruments

Under the CWA, an “instrument” is defined as any document of legal effect, including a permit, licence, approval, authorization, direction or order issued or otherwise created under Ontario legislation¹. The CWA states that instruments may be prescribed for the purposes of the Act, which means that they can be used to implement policies in a source protection plan and address threats to source water. The instruments listed in section 1.0.1(1) of Ontario Regulation 287/07 are prescribed for the purposes of the CWA.

In addition to the CWA, the Province of Ontario has extensive legislation in place to protect the environment and human health. As a result, it is important to note that many threats to drinking water sources are already regulated through provincial instruments.

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¹ An instrument defined under the CWA does not include a regulation within the meaning of Part III of the Legislation Act, 2006.
Legislation (including regulations) typically sets out broad requirements for activities requiring Environmental Compliance Approvals (ECAs), permits, etc. An instrument sets out additional requirements that are specific or customized to the activity being carried out at one site and in some cases, multiple sites operated by one company or person. Instruments manage these site-specific requirements by containing terms and conditions that direct specific ways in which certain activities may be undertaken at the site. The terms and conditions are often designed to protect the environment and/or human health.

It is common for instruments to include additional terms and conditions that establish requirements not listed in the legislation. For example, Environmental Compliance Approvals for waste disposal sites (i.e. landfill sites) often require monitoring of groundwater and/or surface water quality at specified locations around the landfill site. This type of requirement is not stipulated in the broader legislation; instead these types of requirements are left to be addressed by the site-specific instrument. This allows the monitoring program to be customized to fit the needs of the particular landfill site and also considers local conditions.

Instruments are generally issued by government (although in some cases they are created by a private individual) and by different levels of government. Some examples of instruments issued by government include the following:

- Municipal government (e.g., business licences, building permits)
- Provincial government (e.g., Environmental Compliance Approval, permits (i.e. pesticide permits, Permits To Take Water- PTTW, licences, and orders)
- Federal government (e.g., authorization to establish/operate a nuclear facility, authorization for works or undertakings affecting fish habitat, licence/permit for storage/transportation of explosives)

The following list outlines the various provincial instruments that have been prescribed under the CWA and the issuing ministry:

- Ministry of the Environment and Climate Change (MOECC) Issued Instruments
  - Environmental Compliance Approvals (ECAs)– waste disposal sites, waste management systems (not for transport of waste), organic soil conditioning sites, sewage works
  - Permits To Take Water (PTTW)
  - Pesticide Permits (land application of pesticides only)
  - Drinking Water System Permit and Licence
  - Renewable Energy Permit (pending amendments to EPA)
- Ministry of Natural Resources and Forestry (MNR) Issues Instruments (MTO)
  - Aggregate licences, permits, and wayside permits and site plans
- Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Issued Instruments
  - Nutrient Management Strategies and Plans
  - Non-Agricultural Source Material Plans
Instruments often, but not always, include expiry dates. Additionally, the issuing ministries may have powers to revoke or modify instruments based on criteria set out in the enabling statute. Often applicants for instruments are required to submit an application form to the issuing person/body to consider before issuing an instrument.

New or amended instruments may include additional terms and conditions that establish requirements specifically to protect the sustainability of the drinking water sources.

As cited on Section 1.1.2, the RMMC catalogue is a valuable tool in identifying and negotiating individual measures or groups of measures to effectively reduce risks to drinking water sources.
2.0 WATER QUALITY RISK MANAGEMENT MEASURES CATALOGUE

The RMMC has been prepared for a number of potential users to assist in gathering information in regards to known practices available to reduce the risk posed by activities which have been prescribed by the province as drinking water threat(s) or approved as “Local Threats”.

The RMMC has been developed using Microsoft Access™, originally based on literature and jurisdictional reviews carried out on water quality and water quantity risk management measures (MOECC and MNRF, 2009-2011). Overall, the RMMC includes technical, procedural, and physical measures which have been peer reviewed by a number of technical experts from various ministries as well as those external to government. These measures will, either alone or in combination, generally be suitable to manage to some extent a specific threat to the quality or quantity of source water, allowing the user to take local conditions into consideration.

The TRCA undertook an exercise to re-classify the risk management measures and has added additional measures that were not included in the earlier work. These measures have been organized based on the prescribed drinking water threat(s) that they address.

The Catalogue also provides links to additional information, which may be at provincial or broader level (e.g. Canada, North America), and may further assist in the evaluation of the measure and its effectiveness.

The database was then optimized for the web and uploaded to a publicly available and secure website with a basic user interface which enables user friendly searches.

2.1 Objective of the Risk Management Measures Catalogue (RMMC)

The RMMC for water quality threats is a compilation and organisation/grouping of known Best Management Practices that can be applicable to manage Drinking Water Threats, and has been designed with the following objectives:

- provide users with a single point of access to a catalogue of risk management measures that are available to address/manage drinking water threats, allowing the user to take local conditions into consideration;
- assist RMOs, landowners and Person with Qualifications in the negotiations/establishment of RMPs under Part IV of the Act;
- assist SPCs on the development of policies to address drinking water threats; and
- assist municipalities in making decisions in the development and evaluation other implementation tools to manage significant drinking water threats such as Education and Outreach programs;
The use of the RMMC is not mandatory: the user has the discretion to use measures within the Catalogue for his/her own specific purposes.

2.2 Key Elements of the RMMC

The Water Quality RMMC contains information regarding known measures that can be used, single or in combination, to ensure that the threat to drinking water is adequately managed. To select potential risk management measures and obtain background information on the measures, the user opens the Catalogue (www.trcaguing.ca/RmmCatalogue), and then selects the “Water Quality” button.

Two options are then available - “Browse Measures” or “Measures by Threat”. The first option allows the user to look at all water quality risk management measures and further information associated to them, while the second provides a filtered list related to a particular threat.
If the “Browse Measures” button is chosen, this brings up the next website page, with a list of all the water quality measures in the Catalogue, including the title, a short description, and a “magnifying glass” icon for each measure.

The user also can filter the RMMC by contaminant type or water source. These filters are provided in order to help the user to focus the selection of measures that are for example applied to a specific vulnerable area (i.e. WHPA or IPZ), measures related specifically to chemicals or pathogen threats, or a focused on mitigating the threat according to a management target (as detailed in Section 2.2.3).

The user can also search measures related to a specific keyword of interest, for example “inspection”.

[Image of Water Quality Risk Management Measures Catalogue]
The magnifying glass provides access to more detailed information for a particular measure, including:

- management target(s) that the measure addresses,
- water source and contaminant type that the measure applies to,
- other threats that the measure would address, and
- links to further information on the measure and its effectiveness. At the bottom of the detailed measure information page is a link that provides access to individual case study information if available.
## Risk Management Measures

### Measure Information Sheet

**ReferenceID:** QM63  
**Measure Name:** Septic system information management  
**Measure Description:** Requirement for septic system record keeping and information management by the property owner, installer, municipality and/or approval authority. An inventory management system is essential to planning for the community, and can also give owners information regarding the proper operation and maintenance of their system, and the necessity for upgrading or the buildings or changes. As properties will change ownership over time, it is necessary for the local government to be responsible for the maintenance and storage of at least one copy containing information such as:  
- Invention, size, age, usage, storage capacity and maintenance records for septic systems within the jurisdiction.  
- Compilation of data on sewage systems using databases or GIS is recommended to improve planning decisions which can be critical for controlling pollutants leading to sensitive areas.  
- Participation by the homeowner, installer, and sewage handler is necessary for accurate and comprehensive records. It is noted that for large systems (1,000,000 L/day), some of this information will be available in the RDF Code database.

### Management Targets

- Identification of actual and potential impacts from the contaminants generated by the threat.

### Applicable Sectors:

- Agriculture
- Commercial

### Associated Threats:

<table>
<thead>
<tr>
<th>Order</th>
<th>Threat Name</th>
<th>Effectiveness</th>
<th>Effectiveness Comments</th>
<th>Applicability</th>
</tr>
</thead>
</table>
| 2.5   | Sewage System or Sewage Works - Septic System | 3 - Low | Information management will not directly improve septic system performance, but may provide insight into systems that require preventative maintenance, thereby reducing the risk of future contamination. | Groundwater: Yes  
Surface Water: No  
Pathogen: Yes  
Chemical: Yes  
Farm Water Plan: No |
| 2.6   | Sewage System or Sewage Works - Septic System Holding Tank | 2 - Medium | Information management will not directly improve septic system performance, but may provide insight into systems that require preventative maintenance, thereby reducing the risk of future contamination. | Groundwater: Yes  
Surface Water: Yes  
Pathogen: Yes  
Chemical: Yes  
Farm Water Plan: No |

### Additional Information Sources:

- [Website - Ontario Ministry of the Environment, 2012 (Ontario)](source)
- [Fact sheet - Ministry of Agriculture, Food and Rural Affairs, 2012 (Ontario)](source)
If the “Measures by Threat” button is chosen, the user is taken to another website page, which lists the water quality threats prescribed by the province, some with sub-threat categories (ex. Sub-categories for sewage works and waste disposal sites). The user highlights the “sub-threat” of interest, and then clicks on the “View Measures” button below the list of threats. This brings up the next website page, with a list of all relative water quality measures in the Catalogue to that specific “subthreat”, including the title, a short description, and a “magnifying glass” icon for each measure.

2.2.1 Classification of Risk Management Measures

The MOECC has developed a hierarchy to present the risk management measures in the catalogue, which allows the users to categorize the measures that will be useful to them and screen out the various measures that are not applicable for a particular situation. The main purpose is to provide users with the ability to screen measures by considering how the measures manage the threat/activity. The web-based database allows the user to:

1) Filter the measures by contaminant type (i.e., chemical, pathogenic);
2) Filter the measures by water source (i.e., groundwater, surface water);
3) Filter the measures by management target (i.e., effective layout for abatement, identification of impacts, remedial practices, etc.);
4) Explore the potential effectiveness of each measure with reference to specific case studies in the literature, where available.
Users are able to identify the risk management measures most applicable to a specific threat taking into account these categories.

2.2.2 Types of Risk Management Measures

The RMMC includes measures of a “Regulatory” nature (i.e. related to a prescribed instrument as detailed in Section 1.1.3 of this Manual) or “Non-regulatory” nature (e.g. a Best Management Practice) measures.

Regulatory Measures

The Catalogue contains a set of measures that are contained on the Terms and Conditions of a number of provincial instruments. The measures in this category are taken from:

- Terms and Conditions of Environmental Compliance Approvals (ECAs)
- Permits
- Design standards
- Regulations
- Protocols
- Guidance

Examples of “Regulatory” measures are:

<table>
<thead>
<tr>
<th>CWA Threat Category</th>
<th>Regulatory Measure (Instrument) Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>The handling and storage of fuel</td>
<td>The Liquid Fuels Handling Code states that all fuel from an aboveground tank must be pumped, and shall not be dispensed by gravity. Decommission any gravity flow (elevated) storage and replace with approved ground-level storage.</td>
</tr>
<tr>
<td>The establishment, operation or maintenance of a waste disposal site within the meaning of Part V of the Environmental Protection Act</td>
<td>Spill contingency plan and emergency response plan as part of terms and conditions for ECAs.</td>
</tr>
</tbody>
</table>

Best Management Practices

The Catalogue also contains a set of other non-regulated technologies and practices that are known to either contain, attenuate or reduce the threat/activity/contaminant of concern. This category is essentially all remaining risk management measures that are known as effective to some extent of reducing the risk of a certain threat and not contained in the provincial instruments.
Examples of “‘Best management Practices’” measures are:

<table>
<thead>
<tr>
<th>CWA Threat Category</th>
<th>Non-Regulatory Approach Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of land as livestock grazing or pasturing land</td>
<td>Rotational grazing</td>
</tr>
<tr>
<td>The storage of snow</td>
<td>Guidelines to minimize the environmental impact from the snow melt of large piles during plowing operations of large areas, such as parking lots</td>
</tr>
</tbody>
</table>

2.2.3 Management Targets

The user also can filter the RMMs by Management Targets. This filter was added to the catalogue to group risk management measures related to a specific action or desired outcome that would be achieved by applying a measure or a group of measure related to a target. The Management Targets for the Water Quality RMMC are listed below.

<table>
<thead>
<tr>
<th>Management Targets for Water Quality Measures</th>
<th>Short Description of the Management Target</th>
<th>Description of the Management Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in potential adverse effects of contamination between the origin of contaminant generation and threat/activity.</td>
<td>Reduction of Contamination at Origin</td>
<td>land management, structural and/or operational control measures designed to reduce contaminants at the outset through the mechanisms of reduction, containment, attenuation or physical protection</td>
</tr>
<tr>
<td>Effective system design/layout for abatement of concentration/volumes of contaminants</td>
<td>Meet Design Standards</td>
<td>structural measures designed to hold contaminants and prevent their release into the environment (e.g., storage tanks, ponds, wastewater systems, constructed wetlands, oil/water separators)</td>
</tr>
<tr>
<td>Improved operational/best management practices at operating facilities for abatement of concentration/volumes of contaminants</td>
<td>Meet Operational Standards</td>
<td>measures designed to control the manner in which drinking water threat-related systems are operated and maintained in order to reduce risks (e.g., standard operating procedures, best practices for the storage, handling and use of hazardous or toxic substances)</td>
</tr>
<tr>
<td>Reduction in potential for adverse effects of a spill, discharge or release between the system and drinking water</td>
<td>Remedial Action - Physical Systems</td>
<td>land management or structural measures designed to reduce contaminant concentrations as they travel through the environment or to prevent contaminants from penetrating</td>
</tr>
</tbody>
</table>
### Management Targets for Water Quality Measures

<table>
<thead>
<tr>
<th>Short Description of the Management Target</th>
<th>Description of the Management Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>into drinking water sources, subsequent to a spill, discharge or release, through the mechanisms of reduction, containment, attenuation or physical protection (e.g., vegetated buffer strips, permeable reactive barriers, filter strips, hydraulic barriers and diversions, well casings)</td>
<td></td>
</tr>
<tr>
<td>Remedial Action - Programs, Plans or Strategies</td>
<td></td>
</tr>
<tr>
<td>subset of Risk Management Measures focused on controlling risks by developing assessments, providing information, directing a modification of behaviours or land use controls as opposed to physical systems; includes monitoring, site characterization, record, inspection, sampling, contingency plans</td>
<td></td>
</tr>
</tbody>
</table>

### 2.2.4 Measures Effectiveness

The RMMC provides high level information regarding the potential level of effectiveness of each measure related to a threat. The potential effectiveness of these risk management measures is based on qualitative assessment from each technical expert that has reviewed the information contained in the catalogue.

The user must rely on their own professional knowledge and judgement specific to each site’s conditions or circumstances to select the measure or set of measures that have the highest “probability of success”- i.e., a set of measure(s) that is/are suitable to effectively manage a specific threat.

The selected set of measures from the RMMC can be considered by implementing bodies, businesses, qualified persons, and individual property owners as measure(s) that is/are technically suitable to effectively manage a specific threat in order to protect source water.

Further screen captures for the website operation and functionality of the RMMC are provided in Appendix A.

### 2.2.5 Climate Change Considerations

Climate change is expected to affect weather patterns and lead to changes in hydrologic and hydrogeologic conditions, such as the timing and distribution of precipitation or recharge rates. Higher temperatures can lead to higher evapotranspiration rates, reducing stream flows leading...
to contaminant concentration and reduced sediment transport resulting in an increase in algae blooms, which can impact the taste, odour, and safety of drinking water. An increase in precipitation and extreme events can increase erosion and transport pathogens, nutrients, and sediments to lakes, while an increase in freezing rain can increase road sand and salt applications, leading to an increase of chloride releases to groundwater and surface water, potentially affecting the quality of drinking water supplies.

Some of the risk management measures in the catalogue have been flagged as having a response to the impact of climate change. These measures do not have the ability to mitigate the climate change impacts on hydrological parameters such as precipitation and temperature. All these measures are considered to be adaptive responses to climate change and will act as adaptation measures that reduce the climate change effects on the quality of drinking water sources. Selecting risk management measures that reduce the impacts of climate change would benefit both the municipal drinking water system and the person undertaking the activity.

2.2.6 Limitations of the Catalogue

As cited in Section 2.1, the RMMC has been prepared to support implementation of source protection plan policies. The use of the RMMC is not mandated by the province.

Users of the RMMC must apply professional judgement as to what particular measures are considered sufficient to adequately manage a drinking water quality threat in a given circumstance.

The Province of Ontario assumes no liability for the risk management measures selected by the users. By deploying one or several risk management measures in the RMMC, it is understood that the measure may not eliminate completely the risk associated with the threat, but effectively lessens to a certain extent the risk posed by that threat on drinking water sources.

2.3 Future Developments (Upgrades and Enhancements)

Version 4 of the RMMC was posted on the internet on January, 2013, and it is intended that the catalogue will be continuously updated as necessary. With respect to the inclusion of new measures in the RMMC, MOECC will examine the facts associated with the new measure and determine if it is reasonable to consider adding it to the catalogue. There will be several factors that will need to be considered, including but not limited to:

- Scientific evidence to support the risk management measure;
- Demonstrated success of the measure in Ontario (pilot studies or equivalent); and
- A consensus from the working group.

Updates will be made as additional enhancements are incorporated into the RMMC. At this stage, planned enhancements include the following updates:
- Incorporation of additional local threats and measures for local threats
- Verification and incorporation of feedback from technical experts
- Inclusion of new information regarding relevant case studies
- New information and analysis from annual reports that are submitted to the ministry on the progress of implementation.

Other updates will be made available on a periodic basis as determined by user feedback and the MOECC on an as required basis.
3.0 REFERENCES


