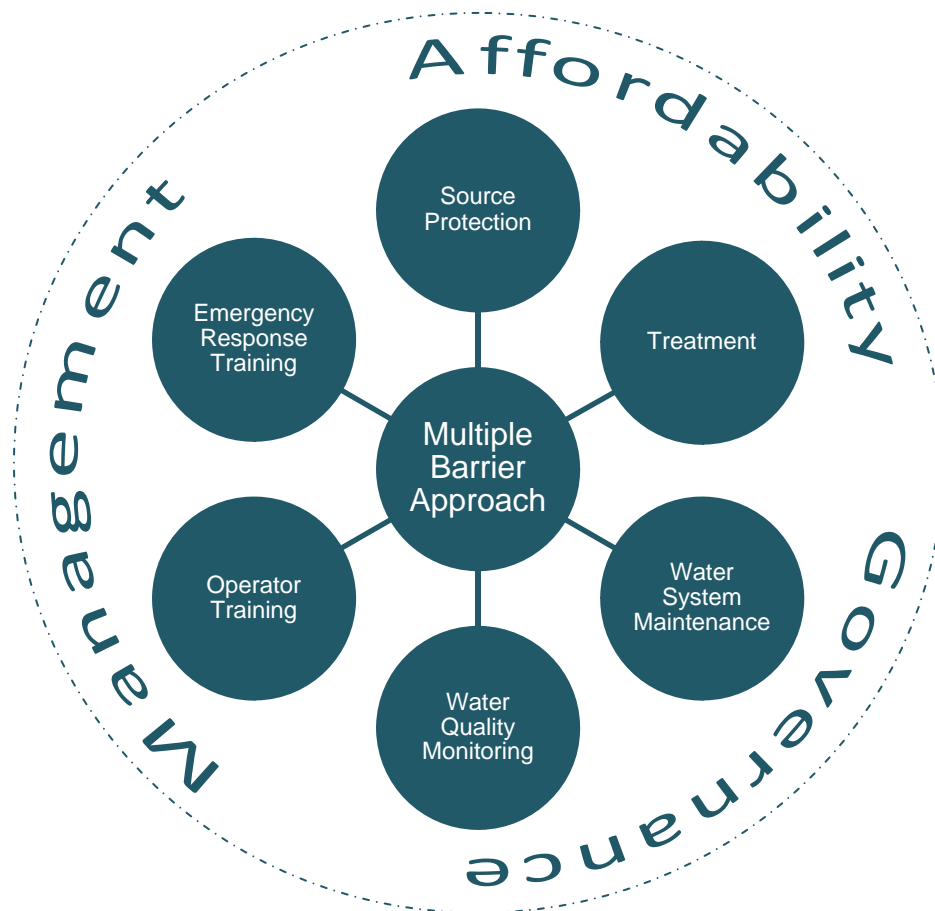


# COMPREHENSIVE DRINKING WATER SOURCE-TO-TAP ASSESSMENT GUIDELINE

## MODULE 8

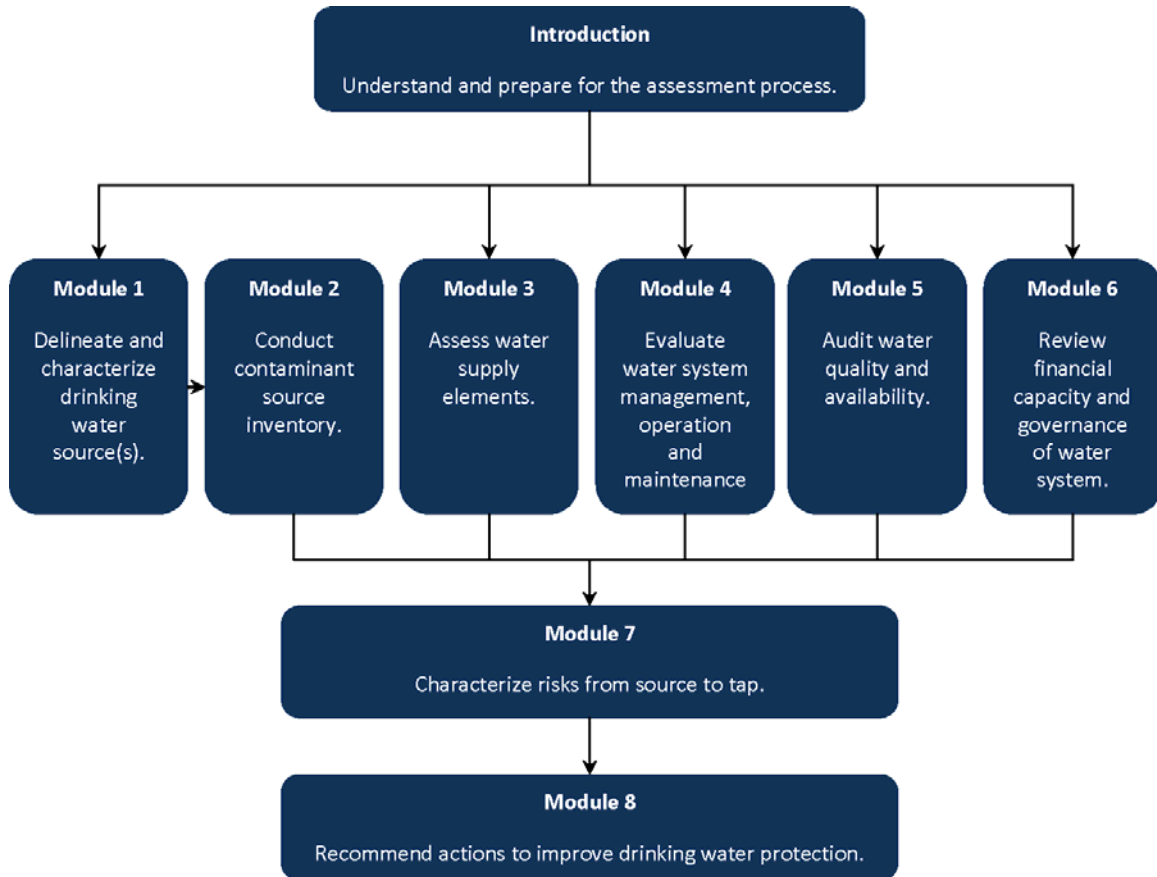
### RECOMMEND ACTIONS TO IMPROVE DRINKING WATER PROTECTION



2010

Ministry of Healthy Living and Sport

## Comprehensive Drinking Water Source-to-Tap Assessment Guideline Process



Here are the steps in the source-to-tap assessment process, through the Introduction and eight modules. Note that the Introduction should be read prior to undertaking any assessment.

## TABLE OF CONTENTS

1.	INTRODUCTION.....	4
1.1	MODULE 8 ASSESSMENT TEAM.....	6
2.	ASSESSMENT COMPONENTS .....	6
2.1	RECOMMEND RISK MANAGEMENT ACTIONS .....	9
2.2	PRIORITIZE RISK MANAGEMENT ACTIONS .....	9
3.	ASSESSMENT DOCUMENTATION AND REPORTING .....	10
	APPENDIX 8A: MODULE 8 ASSESSMENT AT A GLANCE.....	11
	APPENDIX 8B: RECOMMENDED RESOURCES .....	12

## LIST OF TABLES

8-1.	SUGGESTED TIME CATEGORIES FOR RISK MANAGEMENT ACTIONS.....	9
------	--	---

## LIST OF BOXES

8-1.	SMART PRINCIPLES.....	6
8-2.	SUGGESTED PRIORITIZATION FACTORS FOR RISK MANAGEMENT ACTIONS.....	9

## LIST OF FIGURES

8-1.	PHASES, ACTIONS AND RESPONSIBILITIES IN THE DRINKING WATER RISK ASSESSMENT/RISK MANAGEMENT CONTINUUM .....	5
8-2.	PROCESS FOR IDENTIFYING AND SELECTING MULTIPLE RISK MANAGEMENT OPTIONS IN THE SOURCE-TO-TAP ASSESSMENT AND SUBSEQUENT RISK MANAGEMENT PLANNING PROCESS .....	8

## 1. INTRODUCTION

Throughout Modules 1 to 6 of the source-to-tap assessment, hazards to and vulnerabilities in the drinking water supply system are identified and documented. In Module 7, risks associated with these hazards are characterized and an integrated assessment is made of the water supply system as a whole. Lastly, in this module (Module 8), actions are recommended to effectively manage the risks identified through the assessment process, and to enhance the safety and sustainability of the drinking water supply.

Establishing priorities for drinking water protection requires the participation of the entire source-to-tap assessment team. Considerable experience and knowledge of drinking water supply systems are required to carry out this step, as the recommendations are intended to help the water supplier achieve improved drinking water protection.

First, the assessment team collectively formulates recommendations to address the risks posed by the hazards and vulnerabilities identified in Modules 1 to 6, identifying opportunities that most significantly reduce risks to public health or water sustainability. For each action, the hazard(s) addressed, barriers enhanced, accountability and suggested timeline for implementation are identified. Next, the team prioritizes each recommendation for implementation based on criteria such as<sup>1</sup>: cost, risk level, public health implications, risk reduction benefit, ease of implementation and the need to enhance weak barrier(s).

What results from Module 8 is the assessment team's collective professional judgment about the best opportunities for improving drinking water protection, in the form of a set of recommended actions to prevent, reduce or mitigate drinking water risks. Recommendations should be clear and stand alone. This provides the water supplier and drinking water officer with the seeds to develop a risk management plan, whether that is an assessment response plan (*Drinking Water Protection Act, s. 22*) or a voluntary drinking water risk management plan. The water supplier, drinking water officer and any other agencies that would be involved in implementing the recommendations should also be involved in developing them. This will ensure that the recommendations are realistic and financially sound, and any possible negative consequences are considered up front.

At the end of the assessment process, the assessment team submits its assessment report and recommendations to the water supplier and DWO, who then review and consider the findings before deciding on next steps. Neither the water supplier nor the DWO are under any obligation to accept the advice given by the assessment team, but it does represent the counsel of a team of knowledgeable and experienced professionals who have just undertaken a detailed water supply system assessment. Both the water supplier and the DWO are empowered to act on the results of the assessment and establish a plan to improve drinking water protection in the water supply. The water supplier may voluntarily

---

<sup>1</sup> This is not intended to be a prescriptive list of prioritization criteria. These criteria form a basic set upon which to prioritize drinking water protection actions. Other criteria important for the water supply system being assessed may be used if rationalized in the assessment report.

COMPREHENSIVE DRINKING WATER SOURCE-TO-TAP ASSESSMENT GUIDELINE

act on the results of the assessment, or the DWO may order an assessment response plan or some other action deemed appropriate. See Figure 8-1 for a visual representation of the risk assessment/risk management continuum and where this assessment guideline fits. It is recommended that the water supplier communicate to the public that a review of the system has been conducted, and make the recommendations and risk/hazard tables available.

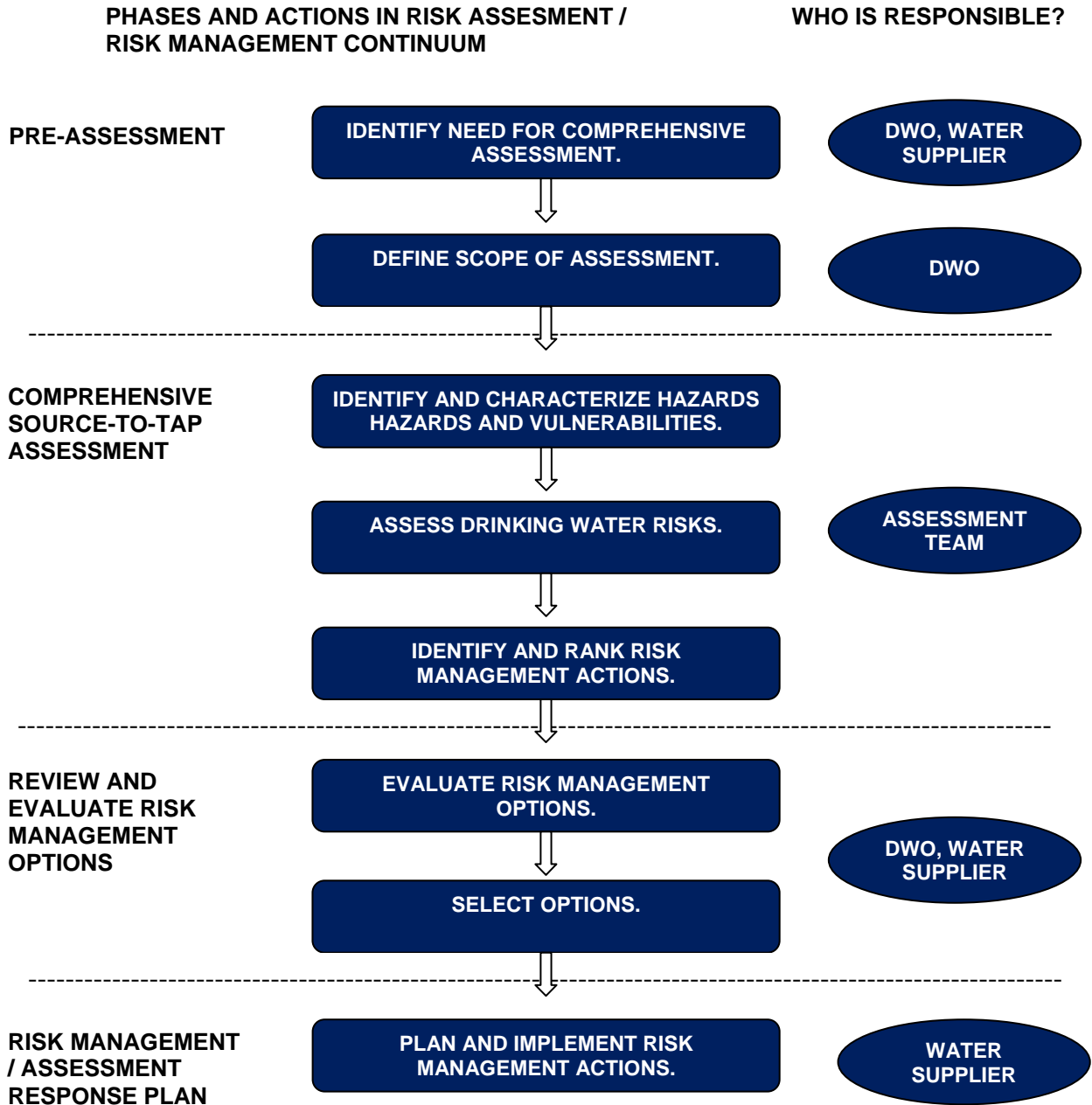


Figure 8-1. Phases, Actions and Responsibilities in the Drinking Water Risk Assessment / Risk Management Continuum

## 1.1. Module 8 Assessment Team

A broad range of issues can exist in a water supply system from source-to-tap. As a result, comprehensive drinking water assessments require a multidisciplinary assessment team rather than a single assessor. Each module of the Comprehensive Drinking Water Source-to-Tap Assessment Guideline requires some specialized skills and a unique spectrum of knowledge related to water sources and systems.

Collectively, the assessment team for Module 8 should have the knowledge and experience required for the modules being incorporated into the risk characterization process. See assessment team sections in each of the modules used in the overall assessment.

## 2. ASSESSMENT COMPONENTS

### 2.1. Recommend Risk Management Actions

Using the results of the assessment—particularly the information emerging from Module 7—recommendations for managing risk are formulated to address the hazards and vulnerabilities identified in Modules 1 to 6, and characterized in Module 7. Recommendations can take the form of risk prevention, risk reduction or risk mitigation strategies. For water systems that have obvious primary priority hazards, the recommendations should focus on identifying tasks and decisions required to address this hazard. In particular, if a water system does not have any treatment, the recommendations should focus on identifying tasks and decisions required to implement treatment.

Professional judgment will play a major role in developing recommendations in Module 8; therefore, formal guidance plays a lesser role. The following tips are suggested as guidance in developing effective risk management actions (adapted from CCME, 2004):

- Identify what/where the most critical problems for the water supply system are.
- Direct resources most immediately to actions with the highest potential for improvement.
- Protect unimpaired areas from degradation.

#### BOX 8-1. SMART Principles

(Source: *Well Protection Toolkit*, Province of British Columbia, 2000)

##### Specific

- What precisely is to be done?
- Who is going to do it?

##### Measurable

- Can the effectiveness of the risk management action be measured?
- What indicators will be used to measure this?

##### Achievable

- In practice, is it within the means of the water supplier to implement the recommendation?
- Are there sufficient funds and technical resources to complete the task?

##### Realistic

- Can the risk management action be successfully implemented?
- Is it cost-effective?
- Are there risks?

##### Timebound

- Considering available resources, can the recommendation be implemented within a reasonable timeframe?

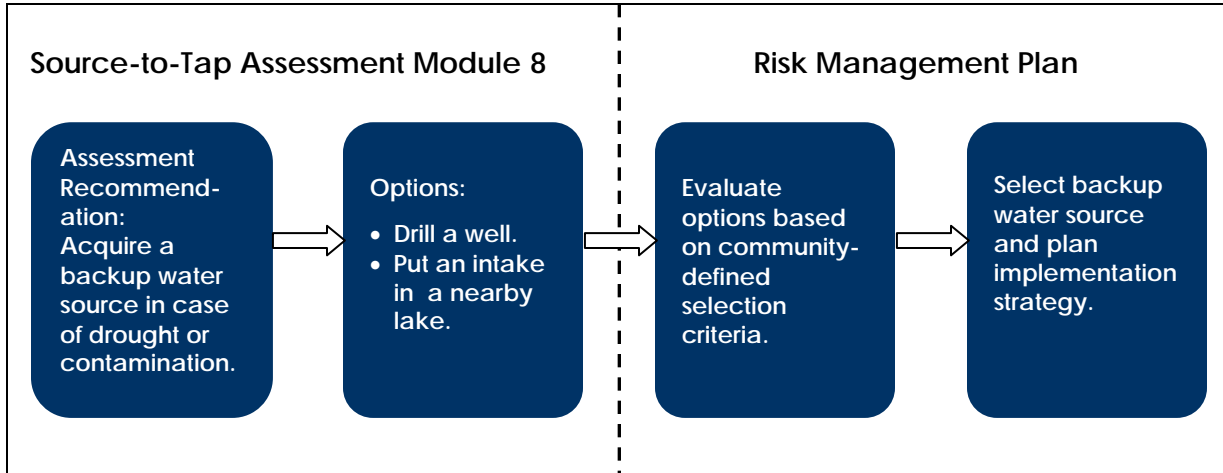
- Identify areas where there is a need to coordinate multiple remedial/protective priorities.
- Follow the SMART principle to develop risk management actions that are: specific, measurable, achievable, realistic and timebound (see Box 8-1).

It is important to note that not all hazards require the same level of attention, but the complete set of recommendations should address all drinking water hazards identified in the assessment. One action could address multiple hazards—either directly through common mitigation approaches, or indirectly, by augmenting a barrier that protects against multiple hazards.

Possible responses to drinking water hazards range from simple corrective actions to broader systemic changes to management or infrastructure. Some hazards have one clear solution. For instance, the obvious solution to the lack of a cross-connection control program is to develop one. In other cases, two or more reasonable risk management options with similar benefits may exist for a single hazard, requiring comparative analysis of each option to determine which one to implement. If an assessment recommendation is to improve treatment, for example, a number of treatment methods could be effective in providing removal of pathogens and other undesirable elements. In such situations, the best available options—including the advantages and disadvantages of each—should be outlined as part of the recommendations. This will allow the water supplier to weigh the options, and consult with water users and the DWO, before making a decision about priorities and drinking water risk management planning.

Figure 8-2 illustrates the process for identifying multiple drinking water risk management options in the source-to-tap assessment, using a hypothetical recommendation to acquire a backup water source as an example. Risk management options are identified in this module. Using information supplied in the assessment report and from other sources, the water supplier evaluates the options, based on selection criteria defined at the community level (e.g., cost, effectiveness, etc.), and then selects the best suited option as part of the assessment response plan that often follows an assessment.

Potential contaminant sources or intrinsic vulnerabilities identified in Modules 1 and 2 can be numerous and dominate the list of hazards. One suggestion for approaching hazards in the source is to group them (e.g., by type or location) and make recommendations addressing the grouped hazards. For example, identification of multiple contaminant sources could result in a recommendation for the water supplier to enhance source water monitoring focusing on particular contaminants of concern. Alternatively, if it is feasible and deemed necessary, one recommendation to develop a source protection plan may address all the hazards associated with the source.



**Figure 8-2. Process for Identifying and Selecting Multiple Risk Management Options in the Source-to-Tap Assessment and Subsequent Risk Management Planning Process**

To be meaningful in the context of the assessment and to facilitate risk management planning, each recommended drinking water risk management action should identify:

- Hazards/vulnerabilities addressed.
- Barriers enhanced.
- Accountability.
- Suggested timeline for implementation.

To identify hazards addressed and barriers enhanced, review the risk characterization table. Accountability refers to the entity responsible for implementing risk management actions. For the most part, the water supplier may be accountable; however, there may be others with responsibility for preventing the degradation of the drinking water source. Source protection issues in multi-use, multijurisdictional watersheds can be flagged, and recommendations may be made for other responsible parties/agencies to implement.

In some cases, it will be necessary to outline the type of expertise required to implement risk management actions, especially where this expertise is not currently available to the water supplier. For example, if there is no treatment for a small water system, expertise in drinking water treatment technology and financial management may need to be found to develop a cost-effective solution. If, at the discretion of the assessment team, an outline of the expertise required to fulfill an action item is necessary, see Appendix 8B for a list of online resources available to help identify and locate water-related expertise.

Establishing timelines for implementing recommendations provides a sense of the urgency associated with each action. To provide flexibility, general timeframes can be used as suggested timelines for implementation. Table 8-1 provides an example of four time categories that could be applied, with guidance on the types of actions appropriate for each.



**Table 8-1. Suggested Time Categories for Risk Management Actions**

Category	Timeframe	Type of Risk Management Actions
Immediate	Within 3 months	Actions addressing regulatory violations, imminent public health threats or water shortages
Short Term	Within 1 year	Actions that are easy to implement or those addressing significant public health concerns or water quantity issues, enhancement of weak barriers
Medium Term	1-3 years	Actions addressing moderate water quality or quantity concerns, broad systemic issues
Long Term	3 years +	Actions addressing hazards representing chronic health implications or long-term threats to water availability, broad systemic issues.

The focus of risk management is to emphasize continuous and incremental improvement in a water supply system. Not all risks can be addressed at once, so assessors need to consider the resources reasonably available to the water supplier when prioritizing recommendations. Emphasis should be on developing a strategy that is realistic for the water supplier to implement as well as significantly reducing risk for consumers.

## 2.2. Prioritize Risk Management Actions

It is not usually possible for all risks in a water supply system to be addressed at once, due to resource limitations. As a result, we need to decide which actions are most important by developing and applying meaningful prioritization criteria. Prioritization is a process of ranking or categorizing actions based on their level of significance for drinking water protection.

Risk level is not the only factor to consider when prioritizing actions. One goal of this exercise is to identify the best overall risk reduction opportunities, not just the highest risks. Cost and public health risks associated with hazards are also very important factors to consider.

Another objective in managing risk is to strengthen drinking water protection barriers, which may mean giving a higher priority to an action that will augment a weak barrier. Finally, some recommendations are relatively easy to implement, especially changes in operation or maintenance of a water supply system, and these actions collectively can have significant positive effects for drinking water protection. As a result, recommendations that can be applied easily should be given high priority.

### BOX 8-2: Suggested Prioritization Factors for Risk Management Actions

#### Cost

- Risk level(s) for hazard(s) addressed in recommendation
- Public health implications of hazard(s)
- Risk reduction benefit achieved by the action
- Ease of implementation of recommendation
- Need to enhance weak barrier(s)

As an assessment team, you are providing the water supplier and the drinking water officer with your collective expertise and judgment indicating which actions are most important and urgent to complete. The assessment team may select and use any reasonable prioritization criteria and methodologies in this step, as long as the rationale for their use is provided. Box 8-2 contains a list of suggested prioritization factors.

As explained in Module 7, when a drinking water hazard constitutes a violation of regulations or operating permit, the associated risk is not assessed and it is given highest priority because mandatory action is required under law.

### 3. ASSESSMENT DOCUMENTATION AND REPORTING

The outcome of Module 8 will be a recommended “road map” for the water supply system and health authority to consider when proceeding with risk management planning. Actual decisions about how to address drinking water risks will be made by the water supplier in consultation with the DWO and water users—taking into consideration the findings and recommendations of the comprehensive source-to-tap assessment.

The results of Module 8 provide a natural conclusion for the source-to-tap assessment report and segue for the water supplier in developing a drinking water risk management plan following the assessment:

1. A set of prioritized risk management actions recommended to improve drinking water safety and sustainability in the water supply system assessed, including the following information:
  - Hazards/vulnerabilities addressed.
  - Barriers enhanced.
  - Accountability.
  - Suggested timeline for implementation.
2. Process and principles used to develop risk management recommendations.
3. Description of the risk management prioritization process and criteria used. Record assumptions and rationale, where applicable, to help water supplier and DWO to understand why one action has a higher priority over another.

**APPENDIX 8A:  
MODULE 8 ASSESSMENT AT A GLANCE**

Components	Recommended Methods	Scope	Documentation and Reporting
<p>1. Recommend risk management actions to improve drinking water protection.</p>	<ul style="list-style-type: none"> <li>• Identify what/where the most critical problems for the water supply system are.</li> <li>• Direct resources most immediately to actions with the highest potential for improvement.</li> <li>• Protect unimpaired areas from degradation.</li> <li>• Identify areas where there is a need to coordinate multiple remedial/protective priorities. (CCME, 2004)</li> <li>• Follow the SMART principles to develop risk management actions: Specific, Measurable, Achievable, Realistic and Timebound. (See Box 8-1)</li> </ul>	<ul style="list-style-type: none"> <li>• Address all hazards and vulnerabilities identified in the assessment.</li> </ul>	<ul style="list-style-type: none"> <li>• Draft a list of recommended risk management actions including:                             <ul style="list-style-type: none"> <li>○ Hazards/vulnerabilities addressed.</li> <li>○ Barriers enhanced.</li> <li>○ Accountability.</li> <li>○ Suggested timeline for implementation. (To be completed in step 2 of Module 8)</li> </ul> </li> <li>• Describe the process and principles used to develop risk management recommendations.</li> </ul>
<p>2. Prioritize risk management actions.</p>	<ul style="list-style-type: none"> <li>• Use a criteria and prioritization process developed and agreed upon by the assessment team.</li> <li>• See Box 8-2 for a recommended set of criteria.</li> </ul>	<ul style="list-style-type: none"> <li>• Address all recommendations developed in step 1 of Module 8.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a set of prioritized recommendations for improving drinking water safety and sustainability in the water supply assessed.</li> <li>• Provide a description and rationale for the prioritization process and criteria used.</li> </ul>

## APPENDIX 8B: RECOMMENDED RESOURCES

### Drinking Water Risk Management

New Zealand Ministry of Health. 2005. *A Framework on How to Prepare and Develop Public Health Risk Management Plans for Drinking-water Supplies*. Wellington: Ministry of Health.

[http://www.moh.govt.nz/moh.nsf/0/CCA65C18B2E29251CC256A7900082B9C/\\$File/aframeworkfordevelopingaphrmp.pdf](http://www.moh.govt.nz/moh.nsf/0/CCA65C18B2E29251CC256A7900082B9C/$File/aframeworkfordevelopingaphrmp.pdf)

NHMRC/ARMCANZ Co-ordinating Group. 2001. *Framework for Management of Drinking Water Quality: A Preventive Strategy from Catchment to Consumer*. National Health and Medical Research Council/Agriculture and Resource Management Council of Australia.

[http://www.nhmrc.gov.au/files/nhmrc/file/publications/synopses/adwg\\_11\\_06\\_chapter\\_2.pdf](http://www.nhmrc.gov.au/files/nhmrc/file/publications/synopses/adwg_11_06_chapter_2.pdf)

### Online Resources for Drinking Water Risk Management Actions

British Columbia Water and Waste Association <http://www.bcwwa.org>

Waterbucket <http://www.waterbucket.ca/>

Small Community Infrastructure Sustainability

<http://drinkingwater.smallcommunityinfrastructure.ca/index.asp>

Sustainable Infrastructure Society <http://www.sustainis.org>

Water Supply Association of BC <http://www.wsabc.com>

Canadian Water and Wastewater Association <http://www.cwwa.ca>

BC Ground Water Association <http://www.bcgwa.org>

Small Water Users Association <http://www.smallwaterusers.com>

Coastal Water Suppliers Association <http://www.cwsa.net>