Environment

Developing a Municipal Source Water Protection Plan:
A Guide for Water Utilities and Municipalities

Step 3

Identify Potential Contaminants and Assess Risk

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Identify Potential Contaminants and Assess Risk

Designing Plans for Source Water Protection in Nova Scotia

A Drinking Water Strategy for Nova Scotia describes a multiple-barrier approach to clean, safe drinking water for Nova Scotians. The first line of defence in this multiple-barrier approach is to keep clean water clean. This booklet series describes how water utilities and municipalities can do that. It guides you through the process of developing a source water protection plan for your municipal water supply.

To keep clean water clean, we must protect the source water supply area. This guide describes **Step Three** in the process recommended by Nova Scotia Environment (NSE) for implementing a source water protection plan: Identify potential contaminants and assess risk.

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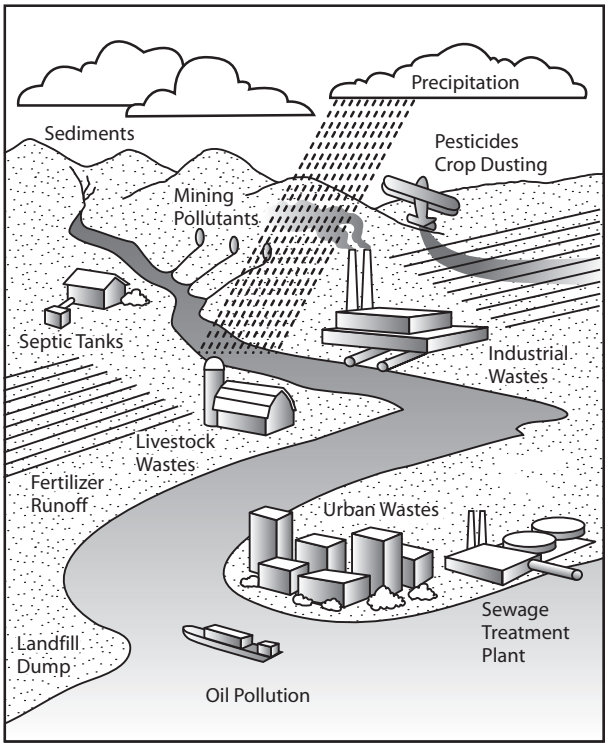
Introduction

Contamination of water occurs when a body of water is adversely affected due to the addition of toxic or sufficient amounts of materials to the water. When it is unfit for its intended use, water is considered to be contaminated. There are two types of water pollutants: point source and non-point source.

Point sources of pollution can, in many instances, be monitored and regulated. Non-point sources are much more difficult to control. Pollution arising from non-point sources accounts for a majority of the contaminants found in water.



This illustration shows the range of pollution that can cause contamination of water resources.

Point Sources

Point sources are contaminants that are released from a specific, known location.

Examples:

- industrial point discharges, as well as leaks of industrial chemicals
- municipal wastewater effluents
- landfill sites
- wastes from existing and abandoned mining sites
- on-site septic systems
- underground storage tanks: chemicals, oil, and gas
- saltwater intrusion

Non-point Sources

Non-point sources of contamination are diffuse in nature. These types of contaminants are difficult to locate, making it hard to identify the source.

Non-point sources of contamination can be transported into drinking water supplies by overland runoff into watercourses or by transport in groundwater to wells.

Examples:

- agricultural activities
- urban runoff from buildings, streets, and sidewalks
- pesticides
- recreational boating
- road salting
- acid rain

Identifying and Assessing Risk

Contaminated water, caused by pollution from either point or non-point sources, can eventually find its way into source water. Contaminated water must be treated before it is distributed for human consumption.

Keeping contaminants from entering source water supply areas is the **first barrier** in the multiple-barrier approach to protecting drinking water quality. Clean water requires less treatment. The types of contamination that present a risk to source water quality fall into several categories. These categories of risk are outlined in the next section.

What Are the Risks to Source Water?

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

- **Inorganic contaminants**, such as salts and metals, which can occur naturally or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, storm water runoff, and residential uses.

- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

- **Radioactive contaminants**, which can be naturally occurring or be the result of oil and gas production and mining activities.

- **Sediment** is associated with the weathering of soil and rock. Human development can cause sedimentation, primarily through soil erosion. Sediment can seriously harm the quality of source water.

- **Nutrients**, such as nitrates and phosphorus can be generated by human activity, and cause **eutrophication**, whereby excessive plant growth depletes oxygen levels in water.

Conducting An Inventory

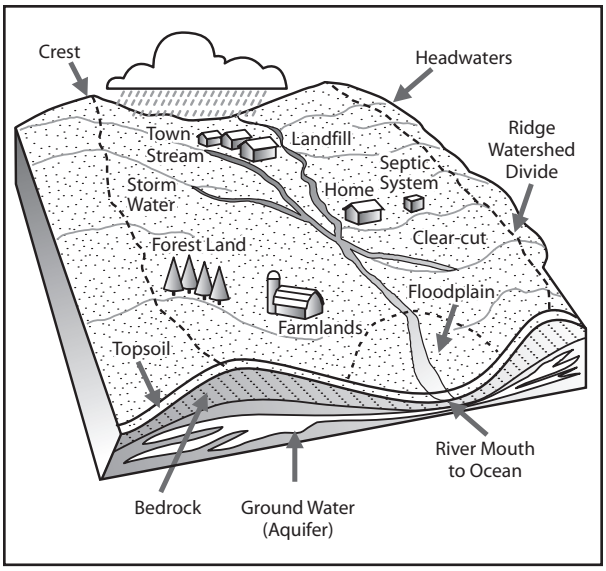
The purpose of **Step Three** is to identify and evaluate risks to source water quality. This is accomplished by identifying activities within your source water supply area that could create contamination.

A methodology can be followed to evaluate the scale of risk posed by activities.

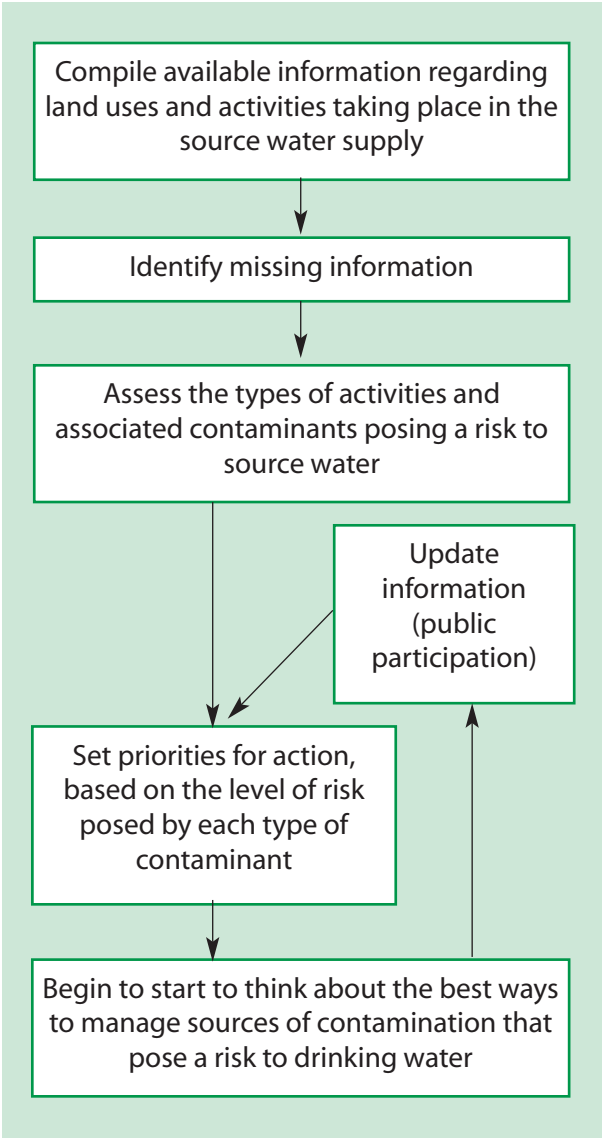
Conducting an inventory of your source water supply area is the best way to identify the types of activities that are associated with contamination. By conducting an inventory of the source water protection area, you will be better able to assess the kinds of risks that need to be addressed through the management plan. An inventory also allows for an evaluation of the scale of risk.

For example, if agriculture only comprises a small fraction of the total area of a source water protection area, then the risk posed by fertilizers, pesticides, and other kinds of agricultural contamination may be minimal. On the other hand, if urban development is predominant, risks associated with urban runoff, chemical and fuel storage, and septic systems, will be priorities.

The next section of this booklet provides some background to conducting an inventory of your source water protection area. There is a wide variety of information available to help you understand the kinds of activities and their related risks to water quality. An inventory can either be very detailed in its analysis, or quite basic, depending on the character of the particular source water supply area. The following section will outline some of the sources of information that can be used to inventory your area.



An inventory of your source water protection area will take into account the types of land uses that characterize the area.



A comprehensive inventory of your source water protection area will lead to a good sense of what kinds of activities are taking place within it.

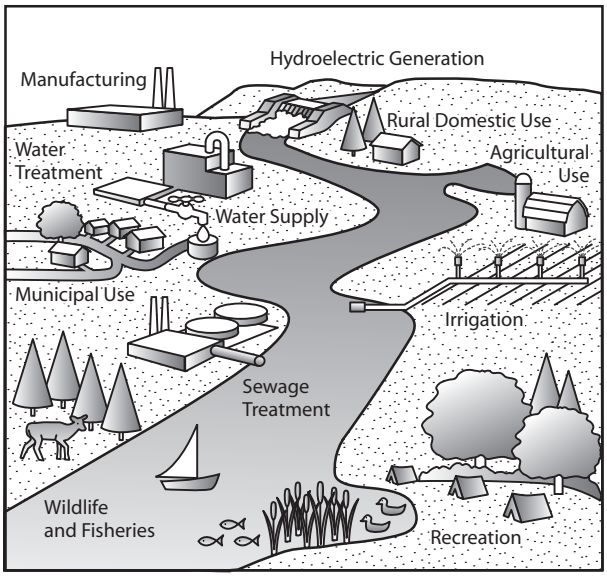
An inventory will allow you to assess the impact of activities occurring within your source water protection area. This approach will help identify activities that are associated with contamination, and consequently pose a risk to the quality of drinking water. The ultimate goal is to produce a management plan (**Step Four**) that recommends ways to avoid or minimize these risks.

Information can be gathered from a variety of sources. We recommend that the inventory begin with a broad look at the source water supply area by examining both the physical and human elements of the area.

Physical Considerations

A good place to begin is with a description of the physical characteristics and conditions within your supply area:

- the size of the source water protection area
- the variety and pattern of land uses (e.g., forestry, agriculture, recreation, urban development, etc)
- the nature of the water source (lake, stream, or groundwater)
- the capacity of the water supply
- the level of water treatment
- known and reasonably suspected concerns about water quality and quantity (e.g., sewage, commercial activity, water withdrawals) and their location
- general resource characteristics (e.g., lands prone to erosion, wetlands, etc.)
- roads and transportation corridors



Common Sources of Water Contamination include:

- *algae growth in surface water, caused by nutrients from agriculture*
- *sedimentation from construction and development*
- *effluent discharges*
- *erosion of bare soil, causing runoff*

Human Population Considerations

Careful accounting of human population considerations such as demographics and population growth trends can also be an important part of the inventory. Population information will help the group to recognize present and future trends in population growth. This will, in turn, affect development and land use activities that may in turn pose a risk to source water. Helpful information can include:

- land ownership patterns
- sub-division activity, size of lots, and development trends
- population characteristics (urban or rural, location of consumers relative to water supply, number of people serviced relative to number of people in the source water supply area, etc)
- demographics (is the population growing or declining? Are growth centres expanding?)
- employers
- number and types of dwellings
- user information (industrial/commercial/domestic)
- existing controls (land-use planning, designation under the *Environment Act*)

Assessing Risk To Source Water

Land Uses and their Relative Risk to Source Water

Least risk

1. Land surrounding reservoir/well, owned by water utility/municipality
2. Permanent open space dedicated to passive recreation
3. Woodlands and managed forests

1. Field crops: pasture, hay, grains, vegetables
2. Low-density residential: lots greater than 2 acres
3. Churches, municipal buildings

1. Institutional uses
2. Medium-density residential: 0.5 to 1.0 acre lot sizes
3. Commercial uses with limited hazardous material storage or underground chemical or fuel storage

1. Agricultural production: dairy, livestock, nurseries, orchards,
2. Golf courses, quarries
3. High-density housing: lots smaller than 0.5 acre

1. Retail commercial: gasoline, farm equipment, automotive, dry cleaners, photo labs, machine shops, furniture strippers
2. Industrial: all forms of manufacturing and processing
3. Underground chemical and fuel storage
4. Waste disposal: pits, dumps, ponds, lagoons, landfills

Greatest risk

Compiling Information

Once the range of contamination risks are identified, compile and rank the information according to the relative threat to the water quality. This can be a difficult task, but it should be based upon scientific fact and experience.

Example:
Scale 1 (high) - 5 (low)

- Agriculture is predominant in the source area: there are issues related to nutrients, microbes, and chemicals. It is assigned a high rank (1)
- Urban development is growing: there are issues related to urban runoff and domestic on-site oil tanks. It is assigned an intermediate rank (3)
- Forestry exists on a small scale: there are a few issues related to sedimentation resulting from forest access road construction. It is assigned a lower rank (4)

Based on this type of ranking system, when the management plan is developed (**Step Four**), agriculture will be given a higher priority for management action than forestry.

Example:

Encouraging Public Participation

The main intent of **Step Three** is to identify and evaluate issues that pose a threat to the quality of drinking water. At this stage, the utility or municipality — in partnership with the advisory committee — may want to invite the public to contribute to the body of knowledge gathered by the utility. The people and businesses within the source water protection area will know their own activities. They may also know additional sources of contamination or other risks which may pose a threat to water quality. It is beneficial for the utility to invite local stakeholders to an open-house type gathering, in order to collect information from them.

Once activities that are associated with specific kinds of contamination are identified, you can start to think about the most appropriate ways to manage these activities in order to reduce their impact to source water.

Contamination Issue	Activity/Cause	Scale of Problem*	Priority Rank**
Nutrients	• Agriculture	3	2
Fuel Leaks	• Domestic oil tanks	4	1
Sedimentation	• Construction • Agriculture • Forestry	1 2 4	1 2 3
Pesticides	• Agriculture	4	2
Bacteria	• Domestic septic systems • Manure • Municipal effluent	2 3 3	1 2 3
Salt	• Road de-icing	3	4

** 1 = Severe, 3 = Moderate, 5 = Minimal ** 1 = High, 3 = Moderate, 5 = Low*

Public Input: Benefits

- The utility or municipality can promote a clear identification and understanding of the problem and the solutions
- Public participation will help to promote community ownership of the problems and the solutions
- Integrate public feedback into policy decisions and final management implementation.

Final Products

By the end of **Step Three** the utility should have a clear understanding of issues and concerns relevant to the source water supply area. Potential sources of water contamination will be known and ranked according to the risk they pose to the safety of the source water supply.

As a result of **Step Three** of the process, the utility or municipality should have:

- a complete listing of all identified existing and potential issues that pose a risk to drinking water quality
- a list of existing and potential issues prioritized in the order in which they are to be addressed in the management plan

For More Information

Nova Scotia Environment can review the committee's risk assessment of the source water supply area and provide comments.

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