

NORTHWEST TERRITORIES

**SOURCE WATER
ASSESSMENT
AND PROTECTION
(SWAP)
GUIDANCE
DOCUMENT**

WORKBOOK

NAME OF YOUR COMMUNITY

Photo Credit: Holly Norris

“The first barrier to the contamination of drinking water involves protecting the sources of drinking water.”

- Justice Dennis O'Connor, Walkerton Inquiry 2002



NOTE: The SWAP Guidance Document is a living document. This February 2012 version is intended to assist with source water protection planning at the community and regional level in the Northwest Territories as part of the NWT Water Stewardship Strategy and Action Plan.

Note: Tables found in this workbook are for a community source water assessment and protection plan. As such, table numbers are not sequential because regional source water protection planning tables have been omitted. All table numbers in this workbook correspond to those found in the Source Water Assessment and Protection (SWAP) Guidance Document. For more detailed instructions and information about each stage of a source water protection plan, please see the SWAP document.

INTRODUCTION

This source water assessment and protection planning WORKBOOK has been prepared for the Government of the Northwest Territories (GNWT) for voluntary use by communities interested in source water protection planning. This document is intended to guide source water protection planning at the community or regional level, recognizing the uniqueness of each community with regards to land use activities and source water conditions.

Source water is raw water from aquifers, streams or lakes supplying drinking water systems. Protecting source water is a vital first step in the multi-barrier approach to safe drinking water (Figure 1). A source water protection plan is developed from information collected in a source water protection assessment report. The assessment report collects relevant technical information specific to water quality, quantity, land use activities and general watershed characteristics. Regulatory and non-regulatory tools and activities are available for inclusion in a source protection plan. Bylaw regulations and zoning are examples of a regulatory approach. A non-regulatory approach might include education and monitoring.

Figure 1: Multi-barrier Approach to Safe Drinking Water

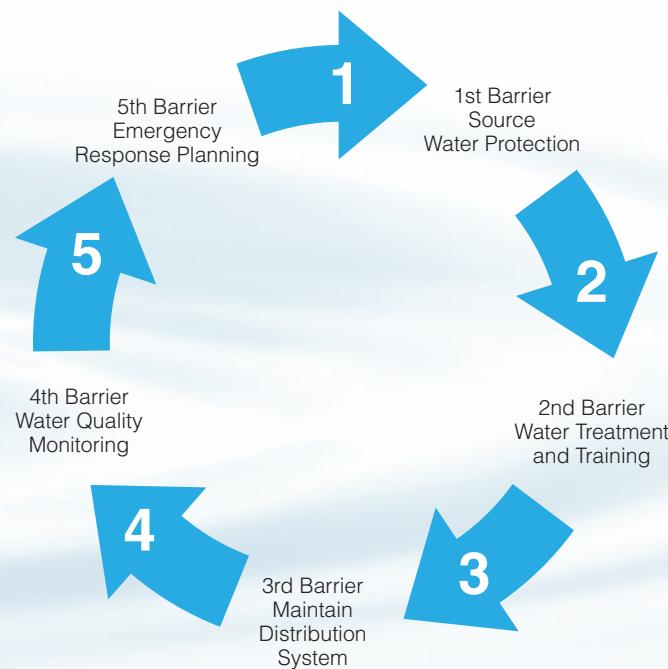




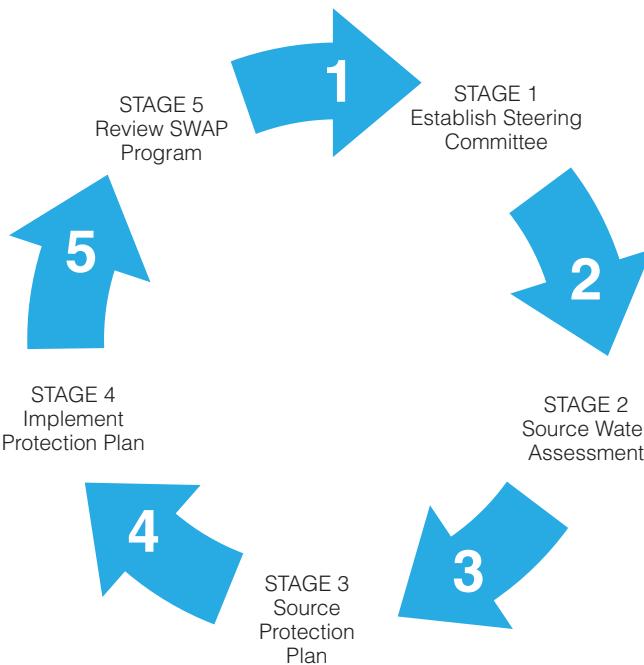
Photo Credit: Courtney Simpson

NWT SOURCE WATER ASSESSMENT AND PROTECTION (SWAP) PROGRAM

The importance of source water protection in the NWT is identified in the NWT Water Stewardship Strategy. The SWAP program is a multi-stage planning process (Figure 2) designed to assist public water systems in preventing contamination of their source water supplies, while minimizing water treatment challenges, saving financial resources and ensuring environmental stewardship through ecosystem science and traditional knowledge.

The five stages include: establishing a steering committee; developing a source water assessment report; producing a source protection plan; implementing the plan; and reviewing the plan every five years or as needed. The SWAP program is meant to be completed in sequence, beginning at Stage 1 and ending at Stage 5. To be at Stage 3 means that you have completed Stage 2. “Stage jumping” is not allowed – such practice will not facilitate effective plan making! How long it will take to reach Stage 5 depends on many variables. Generally, it will take one year at a minimum.

The SWAP program is meant to be completed in sequence, beginning at Stage 1 and ending at Stage 5.

Figure 2: Source Water Assessment and Protection (SWAP) Program

STAGE 1: Establishing a Steering Committee

Required Action

Establish a Steering Committee with broad stakeholder representation from sectors and groups, including industry, environmental organizations, forestry, mining, land owners, land and water boards, those responsible for land use planning, Aboriginal governments and organizations, recreation interests, community associations, local and territorial government, and federal government agencies.

Table 2: Steering Committee Membership

Name	Steering Committee Position	Affiliation	Contact Info	Membership Start Date

Once the Steering Committee is created and rules of operation established, the next order of business is to begin development of a source water assessment report.

STAGE 2: Source Water Assessment Report

Required Action

The Steering Committee must determine its capacity and expertise to conduct a community source water assessment or a regional source water assessment. Factors determining community capacity can include: financial resources; technical knowledge; human resources; and legal and jurisdictional access.

Community Source Water Assessment

i) Community water system inventory

The purpose of the inventory is to: (1) ensure that all land uses, activities or natural processes that could degrade water quality are identified; (2) estimate the extent of the resulting contaminants; and (3) rank the sources in terms of their priority for control. The land use activity of concern should be noted, along with its location and community concern ranking (Table 3).

Table 3: Community Land Use Inventory of Potential Contaminants

Potential Contaminants (Land Use/Activity/Natural Condition)	Location of Activity	Community Concern

ii) Community risk assessment

The purpose of the community risk assessment is to interpret the land use inventory data to estimate the different types and amounts of contaminants entering the water supply source (Table 4).

Table 4: Community Land Use and Pollutant Analysis Matrix

Land Use	Turbidity	pH	Nitrogen Phosphate	Viruses	Bacteria	THM Precursors	Heavy Metals	Iron, Mangan

Source: Modified from Triton 2006

Table 5 is intended to provide a community “snap shot” of existing conditions and protection measures being undertaken for the water system. The objective is to provide a list of potential protection measures to help ensure safe access to drinking water. This list is not exclusive, other protection measures may be added. The presence, or absence, of factors listed in Table 4 will allow the Steering Committee to make more informed decisions respecting source protection and water system vulnerability. The public will also be better informed by this information.

Table 5: Protection Measures

Factors Considered	Yes/No	Comments
Does the water supplier control all activities in the source area?		
Are source protection plans in place?		
Is watershed use limited, regulated and designated to certain areas only?		
Is there a backup water intake in place?		

Table 5: Protection Measures (continued)

Factors Considered	Yes/No	Comments
Is there a backup source available?		
Are water users in the community aware of the impact of human activity on source water quality and quantity?		
Is the raw water source monitored?		
Does the intake ensure the best quality source water is captured?		
Etc.		

Note: Tables 6 to 8 correspond with regional source water assessment and, as such, have been omitted from this workbook (see SWAP document for omitted tables).

iii) Potential risks

The potential risk associated with each identified potential source of contamination, or hazard, can be qualitatively characterized as the likelihood of occurrence multiplied by the consequence if the hazard occurred (WHO, 2004). This means it is necessary to determine the likelihood and consequence of each hazard before characterizing the risk as high, moderate or low.

Table 9 shows the rankings (high, possible, unlikely) and associated criteria used to determine likelihood of a hazard based on a fixed likelihood descriptor. The likelihood descriptor for the purposes of this SWAP Guidance Document is the probability of a hazard occurring in the next ten-year period.

Table 9: Likelihood Determination

Likelihood Descriptor	Likelihood		
	High	Possible	Unlikely
Likelihood of hazard to occur in next 10 years (probability of occurrence)	Probably will occur (>70% chance)	Possible to occur (30-70% chance)	Could occur at some time (<30% chance)

Source: Adapted from Triton (2006)

Table 10 shows the rankings (high, moderate, low) and the criteria for each consequence descriptors. The consequence of a hazard was defined as high if at least one of the four descriptors was ranked as high. If no descriptors were ranked as high and at least one was ranked as moderate, the consequence was defined as moderate. If all descriptors were ranked as low the consequence was defined as low.

Table 10: Consequence Determination

Hazard	Consequence Descriptors	High	Moderate	Low
1	Is the contaminant linked to health concerns?	Yes	Indirect	No
2	What is significance of potential health effects?	Serious	Limited	No effect
3	What is effect on aesthetic quality of drinking water?	High	Moderate	Low
4	Could the hazard compromise water quality?	Yes	-	No

Source: Adapted from Triton (2006)

Table 11 provides the actual risk level of a particular hazard using a qualitative risk analysis matrix based on the likelihood determination and the consequence descriptors. The risk level of any potential hazard will be determined to fall within a range of very high to low depending on the likelihood ranking and the consequence descriptor ranking.

Table 11: Qualitative Risk Analysis Matrix

Likelihood	Consequence Descriptors		
	High	Moderate	Low
	RISK LEVEL		
Likely	Very high	High	Moderate
Possible	High	Moderate	Low
Unlikely	Moderate	Low	Low

iv) Vulnerability assessment

The potential risk associated with each identified hazard can be qualitatively characterized as the likelihood of hazard occurrence (Table 9) multiplied by the consequence of the hazard (Table 10). The risk level is then indicated based on the rankings provided in Table 11 ranging from very high to low. The risk level for specific drinking water hazards are shown in Table 12.

Table 12: Risk Characterization

Hazard #	Drinking Water Hazard	Likelihood Level	Consequence Level	RISK LEVEL (Likelihood x Consequence)
1				
2				
3				
4				
5				
Etc.				

STAGE 3: Source Water Protection Plan

Management Actions

The source water assessment summary itemizes the identified hazard, risk level, existing measures taken to address the hazard, and recommended action (Table 13). Watershed management actions will need to be established from careful consideration of natural and human impact risks identified. Table 13 introduces land and water management actions to help address each prioritized hazard based on risk levels determined in Table 12. Existing measures may also be listed in this table as a means of providing a history of management actions.

Table 13: Source Water Assessment Summary

Hazard #	Drinking Water Hazard	RISK LEVEL	Existing Measures	Recommended Actions
1				
2				
3				

Table 13: Source Water Assessment Summary (continued)

Hazard #	Drinking Water Hazard	RISK LEVEL	Existing Measures	Recommended Actions
4				
5				
Etc.				

Watershed Management Measures

Structural and non-structural control measures implemented by water utilities, other agencies, or a combination of agencies make up the building blocks of a watershed protection program. A list of structural and non-structural control measures is provided in Table 14.

Table 14: Structural and Non-structural Measures

Structural	Non-structural
Stormwater collection and treatment	Land use planning
Sewage lagoon restoration	Vegetation buffer
Intake pipe repair	Signage
Road culverts	Education
Landfill relocation	Enforcement, inspection

STAGE 4: Plan Implementation**Required Action**

Often a mix of implementation strategies is required to implement any plan.

Table 15: Implementation Strategy

Hazard #	Drinking Water Hazard	RISK LEVEL	Recommended Actions	Implementation Strategy
1				
2				
3				
4				
5				
Etc.				

Emergency Response Action Plan

In the event of contamination of a water supply with potential to affect human or ecosystem health (eg. fuel spill, forest fire, land slippage), the public, Aboriginal officials, GNWT, the local government, and local media must be notified. The Steering Committee must develop an Emergency Response Action Plan (ERAP) containing a full list of names and contact information. These contacts will include water treatment operators, mayor's office, public health officials, Administrative Officer, Circuit Rider, Medical Health Office and the NWT Spill Report Line. The ERAP will outline the steps to efficiently notify the public of a water contamination event and safety steps to be followed (boil water, do not consume, etc.) Appropriate levels of action will be determined by officials acting in authority. Each SWPP should identify a lead person, and an alternate, to take the lead in reporting a water contamination event.

STAGE 5: Review SWAP Program**Required Action**

The SWAP program review should occur on a five year interval, beginning with the establishment of a Steering Committee (Stage 1). Stage 2 should produce a revised source water assessment report; based on the revised assessment, an updated SWPP may be developed to address any new developments or problems in the SWPP area.

The intention of the SWAP program review is to ensure the SWPP is addressing the main risk priorities identified in the initial assessment; the source protection measures are appropriately matched to the main risks; and to make note of results of the source protection measures, both positive and negative.

Based on this review, the Steering Committee will make the necessary changes to the existing SWPP in consultation with the community and broad stakeholder interests. Local and traditional knowledge will be an important source of information.

**CONGRATULATIONS – YOU HAVE COMPLETED A
PRACTICE SWAP FOR YOUR COMMUNITY**



Photo Credit: Jennifer Skelton

REFERENCES

AWWA (American Water Works Association). 1991. Effective Watershed Management for Surface Water Supplies. Robbins, Richard W.; Glicker, Joseph L.; Bloem, Douglas M.; Niss, Bruce M.

British Columbia Ministry of Environment, Lands and Parks (MELP). 1999. Ambient Water Quality Guidelines for Organic Carbon. Overview Report prepared for the Water Management Branch. Updated August 7, 2001.

Canadian Council of Ministers of the Environment. 2004. Source to Tap. The multi-barrier approach to safe drinking water. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water.

Environment Canada. Groundwater. Available at: <http://ec.gc.ca/eau-water/default.asp?lang=En&n=300688DC-1#sub5> [Last accessed January 27, 2012]

Health Canada. 2003. Guidelines for Canadian Drinking Water Quality: Supporting Documentation – Turbidity. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

National Health and Medical Research Council (NHMRC). 2003. Australian Drinking Water Guidelines.

Nova Scotia Environment and Labour. 2002. Developing a Source Water protection Plan: A guide for water utilities and municipalities.

Nova Scotia Environment. 2009. Developing a Municipal Source Water Protection Plan. Step 2; Step 3.

Royal Bank of Canada Blue Water Project. Viewable at: <http://bluewater.rbc.com/> [Accessed July 15, 2011]

Triton Environmental Consultants Limited. 2006. Chapman Creek Watershed Drinking Water Source Assessment. Prepared for the Sunshine Coast Regional District, BC, Canada. Available at: <http://www.scrd.ca/Reports> [Accessed October 11, 2011]

World Health Organization (WHO). 2004. Guidelines for drinking water quality, Third Edition.

