

ASSESSMENT REPORT: DRAFT GUIDANCE MODULES

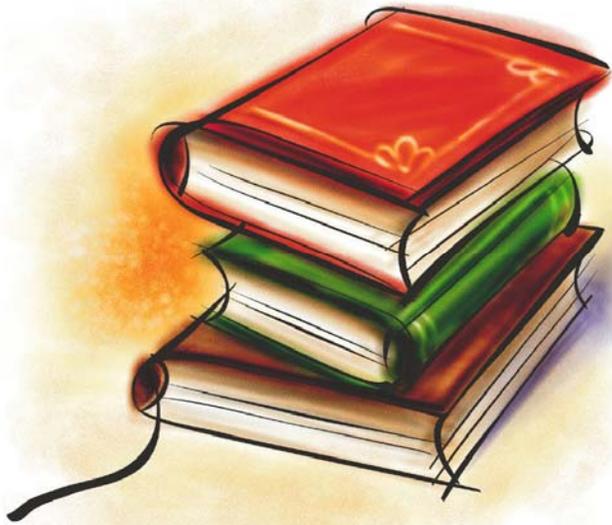
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The attached guidance modules have been posted to provide guidance for Source Protection Technical Studies being undertaken through the Ministry of the Environment Technical Studies Request for Grant Proposals. In some cases the modules are not complete. Where modules are not complete, the Request for Grant Proposals will provide direction on completing grant applications for those areas of study.

In addition to providing guidance for the Source Protection technical studies, the province is proposing to consider these Draft Guidance Modules in developing regulations, rules, and in particular guidance materials related to source protection if the Clean Water Act receives Royal Assent. If you have comments on the draft guidance materials, please provide them through the following email address: source.protection@ene.gov.on.ca.

Posted October 2006

Source Water Protection Glossary



Draft Glossary of Terms

Abandoned Well

A well that is deserted because it is dry, contains unpotable water, discontinued before completion, not being properly maintained, constructed poorly, or determined that natural gas may pose a hazard.

Activity

One or a series of related processes, natural or anthropogenic that occur within a geographical area and may be related to a particular land use.

Aggregate Risks

Multiple risks in a municipal water supply protection area that are considered together relative to the overall risk to drinking water sources

Ambient water

Natural concentration of water quality constituents prior to mixing of either point or non-point source load of contaminants

Aquifer

An underground saturated permeable geological formation that is capable of transmitting water in sufficient quantities under ordinary hydraulic gradients to serve as a source of groundwater supply.

Aquifer Vulnerability Index (AVI)

A numerical indicator of an aquifer's intrinsic or inherent vulnerability susceptibility, to contamination expressed as a function of the thickness and permeability of overlying layers.

Bankfull stage

Stage at which a stream first overflows its natural banksⁱ

Bog

Bogs are peat-covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly *Sphagnum*. The water table is at or near the surface in the spring, and slightly below during the remainder of the year. The mosses often form raised hummocks, separated by low, wet interstices. The bog surface is often raised, or, if flat or level with the surrounding wetlands, it is virtually isolated from mineral soil waters. Hence, the surface bog waters and peat are strongly acid and upper peat layers are extremely deficient in mineral nutrients.

Broader Landscape

The watershed or Source Water Protection Study area. Applies to regional rather than local aquifer vulnerability assessments usually using an indices method of vulnerability assessment.

Chemical

A substance used in conjunction with, or associated with, a land use activity or a particular entity, and with the potential to adversely affect water quality.

Conceptual Water Budget

A written description of the overall flow system dynamics for each watershed in the Source Protection Area taking into consideration surface water and groundwater features, land cover (e.g. proportion of urban vs. rural uses), human-made structures (e.g. dams, channel diversions, water crossings), and water takings.

Confined Aquifers

An aquifer that is bounded above and perhaps below by layers of geological material that do not transmit water readily.

Consumptive Water Demand

The net amount of water that is taken from a source, and not returned locally to the same source in a reasonable time

Contaminant

Chemicals and pathogens.

Contaminant of Concern

A chemical or pathogen that is or may be discharged from a drinking water threat.

Cumulative (water quality) Effects

The consequence of multiple threats sources, in space and time, which affect the quality of drinking water sources.

Cumulative (water quantity) Effects

The consequence of multiple threats sources, in space and time, which affect the quantity of drinking water sources.

Data Gaps

The lack of raw information for a specific geological area and/or specific type of information.

Decommissioned Wells

Capped, plugged and sealed in compliance with regulatory requirements by the Ministry of the Environment

Designated System

A drinking water system that is included in a terms of reference, pursuant to resolution passed by a municipal council under subsection 8(3) of the proposed Clean Water Act, 2005.

Developed / Developable

Reference to the useable portion of a parcel of land that meets the regulatory zoning provisions, particularly those pertaining to defining the area of occupation for buildings, structures, facilities and infrastructure.

Drinking Water Concern

A purported drinking water issue that has not been substantiated by monitoring, or other verification methods; will be identified through consultations with the

public, stakeholder groups, and technical experts (e.g. water treatment plant operators).

Drinking Water Issue

A substantiated (through scientific means) condition relating to the quality of water that interferes or is anticipated to soon interfere with the use of a drinking water source by a municipal residential system or designated system.

Drinking Water Threat

Has the same meaning as in the proposed Clean Water Act, 2005. [An existing activity, possible future activity or existing condition that results from a past activity, (a) that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water, or (b) that results in or has the potential to result in the raw water supply of an existing or planned drinking-water system failing to meet any standards prescribed by the regulations respecting the quality or quantity of water, and includes an activity or condition that is prescribed by the regulations as a drinking water threat.]

Entity

One or a series of related objects, natural or anthropogenic that may be related to a specific process. Examples: Storage Tank, Bird Colony, Abandoned Well, Mine Tailing, Natural Radiation Source

Event

Occurrence of an incident (isolated or frequent) with the potential to promote the introduction of a threat into the environment. An event can be intentional as in the case of licensed discharge or accidental as in the case of a spill.

Existing Drinking Water Source

The aquifer or surface water body from which municipal residential systems or other designated systems currently obtain their drinking water. This includes the aquifer or surface water body from which back-up wells or intakes for municipal residential systems or other designated systems obtain their drinking water when their current source is unavailable or in the event of an emergency.

Exposure

The extent to which a contaminant or pathogen reaches a water resource. Exposure, like a drinking water threat, can be quantified based on the intensity, frequency, duration and scale. The degree of exposure will differ from that of a drinking water threat dependent on the nature of the pathway or barrier between the source (threat) and the target (receptor) and is largely dependent on the vulnerability of the resource.

Fen

Fens are peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. The waters and peat in fens are less acid than in bogs, and often are relatively nutrient rich and minerotrophic since they receive water through groundwater discharge from adjacent uplands.

Fens usually develop in situations of restricted drainage where oxygen saturation is relatively low and mineral supply is restricted. Usually very slow internal drainage occurs through seepage down very low gradient slopes, although sheet surface flow may occur during spring melt or periods of heavy precipitation or if a major local or regional aquifer discharges into the wetland. Some fen wetlands develop directly on limestone rock where minerotrophic waters are emerging through constant groundwater discharge.

Future Municipal Water Supply Areas

An area corresponding to a wellhead protection area or a surface water intake protection zone, or an aquifer or surface water area identified for potential future municipal water supply.

Goals

High level achievements to aim for with respect to source protection (e.g. to protect drinking water sources). Provides an opportunity to add value statements. Not measurable through numeric means.

Great Lakes

The five (large) lakes located in Canada and United States: Lake Ontario, Lake Superior, Lake Huron, Lake Erie, and Lake Michigan.

Great Lakes Connecting Channels

The large rivers that connect the Great Lakes (e.g. St. Clair River, St. Lawrence River, Ottawa River)

Groundwater

Subsurface water that occurs beneath the water table in soils and geological formations that are fully saturated.

Groundwater Recharge Area

The area where an aquifer is replenished from (a) natural processes, such as the infiltration of rainfall and snowmelt and the seepage of surface water from lakes, streams and wetlands, (b) from human interventions, such as the use of storm water management systems, and (c) whose recharge rate exceeds a threshold specified in the regulations. The Director's rules will specify the acceptable methodologies to determine groundwater recharge rates i.e. what qualifies as significant.

Hazard

In the context of this guidance, a hazard is equivalent to a contaminant and pathogen threat.

Hazard Rating

The numeric value which represents the relative potential for a contaminant of concern to impact drinking water sources at concentrations significant enough to cause human illness. This numeric value is determined for each contaminant of concern in the Threats Inventory and Issues Evaluation of the Assessment Report.

Highly Vulnerable Aquifer (HVA)

An aquifer that can be easily changed or affected by contamination from both human activities and natural processes as a result of (a) its intrinsic susceptibility, as a function of the thickness and permeability of overlaying layers, or (b) by preferential pathways to the aquifer. The Director's rules will permit the use of various methods, such as the Intrinsic Susceptibility Index (ISI), to determine those aquifers that are highly vulnerable. Ontario's ISI defines a highly vulnerable aquifer as having a value of less than 30. An ISI is a numerical indicator that helps to indicate where contamination of groundwater is more or less likely to occur as a result of surface contamination due to natural hydrogeological features. The ISI is the most commonly used method of index mapping and was the prescribed method set out in the provincial 2001/2002 Groundwater Studies.

Hydrogeology

Hydrogeology is the study of the movement and interactions of groundwater in geological materials.

Imminent Threat to Health

A contaminant of concern that can affect human health in a short period of time.

Inland Lake

An inland body of standing water, usually fresh water, larger than a pool or pond or a body of water filling a depression in the earth's surface.

Inland Rivers

A creek, stream, brook and any similar watercourse inland from the Great Lakes that is not a connecting channel between two Great Lakes

Intrinsic Vulnerability

The potential for the movement of a contaminant(s) through the subsurface based on the properties of natural geological materials.

Impact

Often considered the consequence or effect, the impact should be measurable and based on an agreed set of parameters. In the case of source water protection, the parameters may be an acceptable list of standards which identify a maximum raw water levels of contaminants and pathogens of concern. In the case of water quantity, the levels may relate to a minimum annual flow, piezometric head or lake level.

Knowledge Gaps

Lack of referenced materials or expertise to assess certain characteristics of the specific watershed that can be adequately described without tabular or spatial data.

Land Use

A particular use of space at or near the earth's surface with associated activities substances and events related to the particular land use designation.

Liaising

Business act to refine logistics around gathering data and information.

Local Area

Specific area around a wellhead or surface water intake as determined through the Tier 2 analysis and within which a Tier 3 analysis is undertaken. This area must encompass a drinking water system and surrounding potential quantity threats.

Marsh

Marshes are wet areas periodically inundated with standing or slowly moving water, and/or permanently inundated areas characterized by robust emergents, and to a lesser extent, anchored floating plants and submergents. Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mud flats.

Model

An assembly of concepts in the form of mathematical equations or statistical terms that portrays a behavior of an object, process or natural phenomenon

Model Calibration

The process for generating information over the life cycle of the project that helps to determine whether a model and its analytical results are of a quality sufficient to serve as the basis of a decision

Model Evaluation

A comparison of model results with numerical data independently derived from experiments or observations of the environment

Model Validation

A test of a model with known input and output information that is used to adjust or estimate factors for which data are not available

Model Verification

The examination (normally performed by the model developers) of the numerical technique in the computer code to ascertain that it truly represents the conceptual model and that there are no inherent numerical problems with obtaining a solution

Municipal Residential System

All municipal drinking-water systems that serve or are planned to serve a major residential development (i.e. six or more private residencies).

Naturally Occurring Processes

Processes that occur in nature and that are the result of human activity. For example, erosion along a stream that provides a source of drinking water of the leaching of naturally occurring metals found in bedrock into groundwater.

Parcel Level

A parcel is a conveyable property, in accordance with the provisions of the Land Titles Act. The parcel is the smallest geographic scale at which risk assessment and risk management are conducted.

Pathogen

A disease causing organism.

Peak Demand Tolerance

A measure of ability for a water supply system to reduce short-term water demands.

Percentage (%) Water Demand

The ratio of estimated consumptive water demand to difference between groundwater or surface water source supply and water reserve

Planned Drinking Water Source

The drinking water source (i.e. aquifer or surface water body) from which planned municipal residential systems or other planned designated systems are projected to obtain their drinking water from in the future and for which specific wellhead protection areas and surface water intake protection zones have been identified. The planned drinking water sources are described in the Municipal Long Term Water Supply Strategy component of the Assessment Report. The associated wellhead protection areas and intake protection zones are further described in other components of this posting.

Preferential Pathways

Any structure of land alteration or condition resulting from a naturally occurring process or human activity which would increase the probability of a contaminant reaching a drinking water source.

Raw Water

Water that is in a drinking-water system or in plumbing that has not been treated in accordance with, (a) the prescribed standards and requirements that apply to the system, or (b) such additional treatment requirements that are imposed by the license or approval for the system.

Raw Water Supply

Water outside a drinking-water system that is a source of water for the system.

Receptor

The exposed target in danger of incurring a potential impact. An example would be any aquifer or surface water body used for drinking water consumption.

Recharge

Recharge is the process by which water moves from the ground surface, through the unsaturated zone, to arrive at the water table.

Regulated Areas

Those areas for which Conservation Authorities delineate and restrict land uses by making regulations under subsection 28(1) of the Conservation Authority Act. This subsection applies to water courses, streams, lakes, valleys, flood plains, and wetlands in Ontario. Provincially approved standards and methodologies for delineating Regulated Areas are outlined in draft guidance documents prepared by Conservation Ontario in cooperation with the Ministry of the Natural Resources, expected to be finalized in 2006.

Reliability Influence Area

A geographic area within which water users could have a possible influence on the reliability of a municipal water supply. For surface water intakes, the Reliability Influence Area would be defined as the total contributing drainage area to the intake. For groundwater, the area would be defined by subtracting the simulated groundwater levels under pumping conditions from those without pumping to estimate the drawdown of the municipal pumping system.

Reserve Amounts

Minimum flows in streams that are required for the maintenance of the ecology of the ecosystem.

Response Factor

Typical factors affecting the response include dilution, rate of discharge, absorption, and degradation of the contaminant or pathogen in question. Because of the nature of the water resource, certain contaminants and pathogens may not have an impact (see definition), great enough to warrant concern or responsive action. The level of impact may not effectively degrade the water resource and therefore would not require a mitigative action.

Riparian Area

The area that lies as a transition zone between upland areas such as fields, etc. and streams, wetlands, lakes, rivers, etc. The zone is intermittently inundated and usually supports wet meadow, marshy or swampy vegetation.

Risk

The likelihood of a drinking water threat (a) rendering an existing or planned drinking water source impaired, unusable or unsustainable, or (b) compromising the effectiveness of a drinking water treatment process, resulting in the potential for adverse human health effects.

Security of well or intake infrastructure

An evaluation of structures/measures that are in place or are needed to protect a municipal groundwater supply well or surface water intake from potential contamination from external sources.

Semi-Quantitative

Describes an approach or methodology that uses measurable or ranked data, derived from both quantitative and qualitative assessments, to produce numerical values to articulate results.

Sensitivity Analysis

Sensitivity analysis evaluates the effect of changes in input values or assumptions on a model's results.

Sensitivity Area

That portion of a defined vulnerable area that has been assigned a vulnerability score.

Severity

The degree to which an impact is measured compared to an idealized value of some parameter of concern. In the case of water quality, the severity may relate to degree of measurable exceedance of some contaminant or pathogen. In the case of water quantity deviation from some measurable parameter (e.g. minimum annual flow, piezometric head or lake level) must also be established.

Significant Hydrologic Features

(a) A permanent and intermittent stream, (b) wetlands, (c) kettle lakes and their surface catchment areas, (d) seepage areas and springs, and (e) aquifers and recharge areas, that have been identified as significant by the Ministry of Natural Resources, using evaluation procedures established by that Ministry, as amended from time to time.

Site-level

The most refined scale at which technical assessment of hydrological and hydrogeological conditions can be conducted. These assessments may contribute to water budgets, vulnerability assessments, and issues evaluation..

Sub-Watershed

An area that is drained by an individual tributary into the main watercourse of a watershed.

Surface to Aquifer Advection Time (SAAT)

The average time required by a water "particle" to travel from a point at the surface to the aquifer of concern. The SAAT is approximated by using the vertical component of the advective velocity integrated over the vertical distance and the average porosity.

Surface to Well Advection Time (SWAT)

The average time required by a water "particle" to travel from a point at the ground surface to the well, including both vertical and horizontal movement.

Surface Water

Water that is present on the earth's surface and may occur as rivers, lakes, wetlands, ponds, etc.

Surface Water Intake Protection Zone (IPZ)

The contiguous area of land and water immediately surrounding a surface water intake, which includes:

- the distance from the intake;
- a minimum travel time of the water associated with the intake of a municipal residential system or other designated system, based on the minimum response time for the water treatment plant operator to respond to adverse conditions or an emergency;
- the remaining watershed area upstream of the minimum travel time area (also referred to as the Total Water Contributing Area) – applicable to inland water courses and inland lakes only.

Swamp

Wooded wetlands with 25% cover or more of trees or tall shrubs. Standing to gently flowing waters occur seasonally or persist for long periods on the surface. Many swamps are characteristically flooded in spring, with dry relict pools apparent later in the season.

Targets

In the context of technical guidance documents, these are detailed goals that are often expressed as numeric goals. (e.g. to reduce contaminant X in this aquifer by 10% by 2009)

Threat Assessment - Tier 1

Preliminary examination of a drinking water threat based on readily accessible information.

Threat Assessment - Tier 2

Advanced examination of a drinking water threat through accessing more detailed information, interviews and perhaps when warranted, additional monitoring, modeling or studies.

Tier 1, 2, and 3 Water Budgets

Numerical analysis at the watershed/subwatershed (Tier1 and 2) or local area (Tier 3) level considering existing and anticipated amounts or water use within the watershed, as well as quantitative flow between the groundwater and surface water systems.

Time of Travel (TOT)

An estimate of the time required for a particle of water to move in the saturated zone from a specific point in an aquifer into the well intake.

Tolerance of a Water Supply System

A measure of the ability to sustain required pumping levels even during exposure events.

Uncertainty Analysis

Uncertainty analysis investigates the effects of lack of knowledge and other potential sources of error

Uncertainty Score

Uncertainty addresses known gaps in data/information about, or deficiencies in methods of assessment for, threats and/or vulnerability. It reflects the degree of confidence in the semi-quantitative data used to calculate risk.

Unconfined Aquifer

An aquifer whose upper boundary is the water table .

Valuation of the Supply

An evaluation of the importance of a particular municipal well or intake to the whole municipal drinking water supply. For example, where there are multiple supplies, value may be smaller, versus a single supply where value may be greater.

Vulnerable Area

An area referring to a groundwater recharge area, a highly vulnerable aquifer, and a surface water intake protection zone or wellhead protection area.

Water Intake Reliability

The probability that a wellhead or surface water intake can meet demand

Water Reserve

A proportion of surface water flow that must be sustained to support anthropogenic or ecological requirements.

Water Source

An aquifer or surface water body being used to supply drinking water.

Water Source Supply

The total amount of water flowing through a surface water or groundwater system.

Water Supply System

The group of surface water intakes and/or groundwater wells that pump water to supply a municipal water distribution system.

Water Quantity Exposure

The extent to which a threat or group of threats affects the availability of water at an intake or wellhead.

Water Quantity Receptor

A competing water demand or requirement in danger of incurring a potential impact. This includes other anthropogenic or ecological water uses within the watershed, particularly those that are required to be maintained by provincial or federal law (e.g. permitted wastewater assimilation flows, other PTTWs, or fish habitat protected by DFO legislation).

Water Quantity Risk

The likelihood that the threats to water quantity may render an existing or planned drinking water source impaired, unusable or unsustainable.

Water Quantity Targets / Water Reserve Targets

These are detailed physical goals that are often expressed as numeric goals. (e.g. to maintain streamflow above X)

Watershed

An area that is drained by a river and its tributaries.

Wellhead Protection Area

The surface and subsurface area surrounding a water well or well field that supplies a municipal residential system or other designated system through which contaminants are reasonably likely to move so as to eventually reach the water well or well. The wellhead protection areas are described in the Groundwater Vulnerability Analysis Guidance Module.

Wetlands

Land such as a swamp, marsh, bog or fen (not including land that is being used for agricultural purposes and no longer exhibits wetland characteristics) that, (a) is seasonally or permanently covered by shallow water or has the water table close to or at the surface, (b) has hydric soils and vegetation dominated by hydrophytic or water-tolerant plants, and (c) has been further identified, by the Ministry of Natural Resources or by any other person, according to evaluation procedures established by the Ministry of Natural Resources, as amended from time to time.

ⁱ Langbein, W.B and Iseri, K.T (1995) **Manual of Hydrology: Part 1. General Surface-Water Techniques**. Geological Survey Water-supply Paper 1541-A. *Methods and practices of the Geological Survey*. Online: <http://www.yorku.ca/carmelca/6101E/readings/USGS-River%20Glossary.html#B>