

ASSESSMENT REPORT: DRAFT GUIDANCE MODULES

October 2006

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to providing guidance for the Source Protection technical studies, the province is proposing to consider these Draft Guidance Modules in developing regulations, rules, and in particular guidance materials related to source protection if the Clean Water Act receives Royal Assent. If you have comments on the draft guidance materials, please provide them through the following email address: source.protection@ene.gov.on.ca.

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ASSESSMENT REPORT: Draft Appendix 1

Appendix 1: Information Management

1.0 INTRODUCTION

Information management plays an integral role in each of the assessment modules as well as an overarching function providing a context for the management of data and information. The information management components have been organized into an information management framework comprised of four primary components: policies and procedures, data management, technology, and governance.

The objective of the framework is to establish an information support model for source water protection. **Figure 1** illustrates the components of the framework and the dependency on the assessment processes described in the other modules and the associated information requirements.

The vision is to ensure that:

“Information to support Source Water Protection Planning is available, discoverable, and accessible – and managed effectively and efficiently in a collaborative inter-agency environment.”

The responsibility for information management will be teams of representatives from the watershed community (e.g., municipalities, conservation authorities, water users, land owners, and the provincial government). The teams will work together at the local level with team representation dependent on local needs. The success of information management is dependent on collaboration between these parties. The collaborative environment will foster the creation of consistent, standardized output products, and will support specific processes described in detail in the other guidance modules.

A sustained effort is required to manage and maintain the information base as it evolves, and to enhance and expand the data holdings to ensure the investments in information management meet the initial planning cycle and future cycles as well. This effort must be conducted under a philosophy of ‘continuous improvement’ both at the local and provincial levels. This approach will increase accuracy and reduce uncertainty in the data over time.

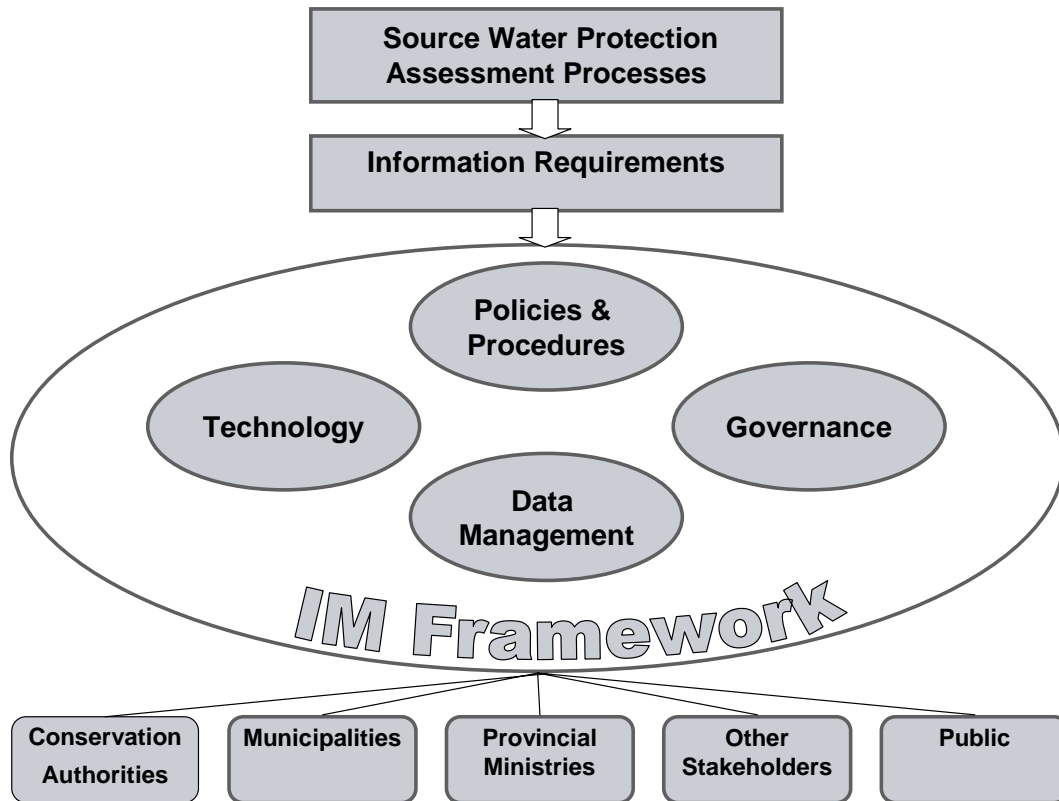


Figure 1: Information management framework.

Although information management tasks occur throughout each of the individual modules, this appendix concentrates on the description of overarching tasks and generic processes required. Given the magnitude of the associated information management tasks and the many individuals involved, a combination of standards, guidance, and best management practices will be employed.

Please refer to the individual modules for a description of the input and output data requirements as well as any direction on the selection and use of analytical and modelling tools. Appendix 2 describes model selection and application with references to both input and output requirements. The two documents, “*Assessment Report Outputs: Data Specifications*” (OMNR 2006) and “*Source Water Protection Mapping Symbolology and Standards*” (OMNR 2006) provide further details with respect to standards and guidelines for data and output products.

2.0 INFORMATION REQUIREMENTS

The information management framework depends on clearly identified data and information requirements. The information requirements have been captured in the Data Matrix Version (1.1.13) along with the sources and metadata descriptions for the data sets. The requirements have been compiled from a number of source documents, including the Technical Experts Committee (TEC) recommendations to the government, the Trent Coalition watershed pilot, and the terms of reference from the municipal groundwater studies. The requirements were further enhanced to reflect the understanding of the individual processes described in the guidance modules.

Local organizations must assess their particular situation with respect to existing data to better understand the effort required to compile the required information. Additional refinements will be required at the local level (conservation authorities and municipalities) to better reflect local conditions, data availability, and model selection. The data matrix provides a starting point for this assessment.

The information required to facilitate source water protection may currently be stored digitally or on paper, in both structured and unstructured formats. The information could include

- Textual records (e.g., letters, messages, memoranda, minutes, email)
- Publications (e.g., monographs, journals, books, brochures, reports)
- Tabular and geospatial databases
- Images, photographs, graphics, or maps

The analytical processes described in the guidance modules will rely heavily on both spatial (geo-referenced) and temporal (monitoring) data. The teams will need to be able to make specific linkages of data to land parcels, or an aggregation of parcels, in order to complete the necessary risk assessments and to allow risk management to proceed at the property level.

3.0 FRAMEWORK COMPONENTS

The information management framework is comprised of four components: policies and procedures, data management, technology, and governance. Each of these components is discussed in the following section.

3.1 Policies and Procedures

The planning and implementation of source water protection will be an open and transparent process. The process will be based on several guiding principles. These principles set the context for proper management of the data across organizations. In addition to the principles, formal data sharing procedures are required to ensure timely access to data and the protection of privacy.

Principles

The following principles are critical to the success of meeting the framework's vision. The importance of information management must be recognized by all participating organizations, and the appropriate information management processes must be built into the assessment processes. The following guiding principles will apply:

1. **Information is accessible:** Information will be easily obtained and easy to use. Accessibility ensures that the right information is available to the right people at the right time, in the right format, with the right context to make it meaningful and useful. It must be delivered using the most appropriate medium. Accessible information facilitates communication, productivity and the efficient use of information resources.
2. **Information is business-driven:** Only relevant, timely and accurate information will meet the needs of clients, employees, stakeholders and partners. Activities related to information should be planned and integrated into the organization's business plans. Information management strategies, policies, procedures and standards should meet the organization's business objectives, mission, vision and needs. Information and the decisions about its management must support timely and effective decision-making.
3. **Information is shared:** Information is a resource and a reusable asset designed to be shared. It will be available for common use within the limits imposed by legislation. Information-sharing within and between organizations focuses on the common resources with the aim of eliminating the collection of information more than once. The result minimizes cost and maximizes efficiencies within an agreed framework.
4. **Accountability for information:** The parties' responsibilities for information and its management are well defined and understood. Leadership, responsibilities and accountability of information management throughout its lifecycle should be expressed in policies and structures that facilitate performance measurement and evaluation at every level. Delegation of responsibility should be appropriate to the capabilities and availability of staff and organizations.
5. **Information can be integrated:** Information assets are managed in an integrated manner, regardless of the medium in which they are held. Information needs to be integrated among various business areas to foster public trust in the decisions. Understanding the different formats of information, how they relate to each other, and how they are used in decision-making is essential. Common standards for handling integration will make

managers confident that supporting technology is compatible throughout the information network.

6. **Lifecycle approach:** The information management lifecycle is the sequence of operational activities that information holdings go through during their existence, including planning, collection/creation, use/analysis, dissemination, maintenance, archiving/disposal, and evaluation.
7. **Information is an asset:** Information will be managed to optimize and protect its value and the investment made to avoid unplanned redundancy. Information is required for all organizational decisions and plan development. Lack of appropriate information can lead to poor decisions and planning. The more that information is used, the more valuable it becomes to the organization. Maintenance strategies must be developed and implemented to prevent information from losing its value over time. Information must also be protected from unauthorized access, use and disclosure. Backing up and archiving information will prevent its loss from accidents and technical failures.

These principles form the core values for effective information management across multiple organizations.

Data exchange/sharing agreements

Data exchange/sharing agreements are fundamental to enable a collaborative environment. The agreements follow from the 'Information is shared' principle above and represents the legal agreement that enables the fair exchange of data among all parties to the agreement.

A data exchange is similar to a data-sharing agreement, however, it is more streamlined, flexible, and open to numerous organizations. Member organizations in a data exchange have access to data holdings of other members. The Ontario Geospatial Data Exchange (OGDE) was developed as a data-sharing mechanism by Land Information Ontario. The OGDE enables data-sharing among provincial and federal governments, municipalities, conservation authorities, universities, and some non-governmental organizations. OGDE members may use other members' data for internal, non-commercial use and may not re-distribute data. Some restrictions may apply to specific data sets, enabling access only to a limited set of users.

The OGDE is the recommended instrument to share data across participating organizations and to provide an overarching agreement that ensures data accessibility and the timely flow of information. The exchange process will allow for the movement of provincial data to planning authorities, the transfer of data among local planning authorities, and the transfer of critical data and information back to provincial authoritative databases.

The OGDE provides specific benefits to the participants of source water protection. These benefits include protection of intellectual property rights and copyrights, release of liability for use of the data, recognition of individual investments and the ability to protect privacy through the Freedom of Information and Protection of Privacy Act (FIPPA).

Privacy protection is one of the greatest concerns for the participating agencies. The planning process will involve the use of both sensitive and private data in arriving at the individual assessments at the property level or broader aggregation. These assessments and the sensitive data upon which they are based must remain internal and not be distributed publicly. In certain situations, private data from one organization may be required to be used within another organization to conduct the risk assessment. In such situations, it is essential that this confidential data be shared for the purposes of the assessment and risk management mitigation only.

Where municipalities or other organizations not currently signatories to the OGDE require access to provincial or local data, local data sharing agreements must be put in place. In these situations, OGDE memberships will be encouraged. The development of individual data sharing agreements can cause delays in data access. Membership in the OGDE will minimize these data access delays. Recent modifications to the agreement waive any financial support for participating in the exchange.

The data access and exchange protocols are essential components of the exchange. These protocols include availability (who has access to the data), dissemination and publication protocols (how is the data disseminated and published to the warehouse), and any sensitivity restrictions that apply to the data. A Data Access Protocol has been developed for access to provincial data by conservation authorities. This protocol will be extended to additional stakeholder groups as appropriate.

Consultants cannot be members of OGDE. However, consultants working for an OGDE member are considered agents of the member organization, and may be granted access to data under this membership. For consultants and other stakeholders ineligible for OGDE membership, access must be considered within the extended exchanges to ensure all relevant participants have access to the critical data sets for source water protection.

3.2 Data Management

Many datasets lack maintenance protocols and many agencies' holdings are not catalogued (and therefore unknown to others). While central data warehouses have been established through LIO and provincial data improvement projects

have been undertaken, significant amounts of data remain unavailable, difficult to access or have quality concerns. Inter-agency data sharing is often ad hoc and sporadic rather than formal and consistent.

Given these complexities, the nature of the scientific process and magnitude of data required, data management is crucial for the success of source water protection. Proper investment in data management will provide benefits to the current planning cycle but also position the local organizations to benefit from future planning cycles as well as other water management activities.

This section describes the components of data management: the information management lifecycle, data and information standards, and metadata. Although data standards and metadata are considered within the lifecycle, they have been highlighted on their own due to their importance in the identification of data accessibility and the need for consistency in the delivery of output products from source water protection.

Information Management Lifecycle

Information assets must be managed using a lifecycle approach that includes planning, collection/creation, use/analysis, dissemination, maintenance, archiving/disposal, and evaluation of information. The team will use a generic data management process to support each of the individual modules under which the detailed data management activities will be conducted. The following section highlights the generic process to follow in managing data through its life cycle.

Provincial information requirements (Data Matrix Version 1.1.13) will be used as a starting point for the assessment of existing and potential data sources. Detailed investigations are required at the local level to ensure that the data are available at the right scale and in sufficient detail for the specific purpose (e.g., water budget numerical models);

Following this preliminary assessment, local data technicians will compile existing spatial, temporal and tabular data for their jurisdiction sourced from multiple organizations. Where data models and/or standards exist, these should be used to ensure consistency within and across source protection regions;

A gap analysis will then be conducted by matching the existing spatial and tabular data against the specific requirements for each of the modules. Temporal monitoring data must be assessed for its ability to support source water protection from three perspectives:

- geo-spatial and temporal extent;
- water quality parameters (chemical and pathogenic); and
- water quantity parameters (use, levels, flows and climate).

Where gaps exist in any of these areas, the team needs to develop options to ensure that the best available information is brought forward. For many of the monitoring programs run provincially, standards already exist for collection methodologies and data storage. The team should feed specific actions regarding gaps or issues for any of the individual monitoring networks back to the provincial government program area that is mandated to manage these monitoring activities.

Where gaps exist in spatial, temporal or tabular data, planning will be required at the local level to fill the gaps either by additional data collection or using proxy data sets in the short term (e.g. using land cover until Southern Ontario Land Resources Information System data is available). In cases where local efforts can not reasonably satisfy gaps in information, local teams should make these gaps known to the province.

Under certain circumstances, these improvement outputs may need to be deferred to later phases of the planning process, especially where enhancements to the monitoring networks are required. Ultimately, the team must ensure that appropriate data and information exist, or will exist in the future, to support the implementation of source water protection. This will ensure that continuous improvement is made to the information base to improve accuracy and reduce uncertainty.

Based on the availability of data and the specific requirements of the module, analytical modeling software will be selected. The analytical processes will be conducted, producing outputs (informational products and data) for submission to the provincial government within the specified provincial standards (see standards subsection). The team should note that the model selection for any of the analytical processes will have a direct impact on the input and output data requirements. The team must consider what specific activities are required to convert data to a usable input format and to convert output data to the required formats for submission.

The analytical processes described in the other guidance modules will rely heavily on both spatial (geo-referenced) and temporal (monitoring) data to produce the required outputs. Specific referencing of data to land parcels or other larger aggregations of parcels will be required for the risk assessment processes. This highlights the importance of accurate geo-referenced information in meeting source water protection outputs. This requirement is especially important in the case of threats. It will ensure that the threats identification, risk assessment, and subsequent risk management activities accurately identify the location of threats to drinking water sources.

Summary worksheets are required as a deliverable for each vulnerable area within a source protection area. The worksheets provide a tracking and reporting mechanism for various stages of decision-making that lead to the categorization

of drinking water threats in vulnerable areas. The tracking and reporting in the worksheet is dependent on the ability to pull data from a number of standardized data sets (refer to Appendix 3 for a more detailed explanation).

In addition to the short term filling of gaps, longer term processes will be initiated by the province for priority data sets. The data management plans will identify data management roles and responsibilities by organization, metadata, data standards, data collection methodologies, data maintenance processes, data distribution and updating authoritative databases.. For example, the mandate for managing water wells is a provincial responsibility. A data management plan must be established for the water well records. It would include a process to ensure the flow of new records to the planning participants, and the return of improvements to existing records or the identification of previously unrecorded wells to the provincial government.

Data and Information Standards

A standard is an endorsement by one or more organizations of certain expectations and requirements. Standards can be *de facto*, which means they already exist within one or more organizations and can easily be formally adopted. Otherwise – where no standards exist – a consensus process will be followed to create the standard through a collaborative approach. Standards are required for: data collection/creation methodologies, data storage (including format and content), data analysis, data exchange, analytical models, and cartographic output products. In the development and adoption of these data standards, consideration will be given to data types, content classifications, measurement types, physical locations, feature types, common tables (e.g., pick lists), etc.

Establishing standards for data and information products is one of the most critical aspects of the information management framework. Data standards for both input and output datasets can ensure consistent standardized deliverables within and across the regions of source water protection. Standards also allow for the efficient use of automated systems, facilitate data transfer between agencies and enable managers to compile data at watershed region or provincial levels.

The outcome-based approach reflected in the Assessment Report will require standardized outputs of both data and information. This approach will allow some local flexibility in reaching the outcomes. Standards will be developed for the specific output data and information products. Standards for input data will be developed and/or promoted where warranted.

Some provincial ministries have established data models, standards and supporting applications to management information. These standards should be adopted for source water protection where appropriate. They include:

- Natural Resources and Values Information System (NRVIS) – Ministry of Natural Resources;
- Environet – Ministry of the Environment;
- Earth Resources and Mineral Exploration (ERMES) – Ministry of Northern Development and Mines.

In addition to these existing data standards, provincial efforts are working toward standard data models for surface water features (ArcHydro) and boreholes. ArcHydro has been implemented throughout many of the conservation authorities. A project to develop a provincial borehole data model has been initiated with the model to be completed early in 2007.

The standards discussed above are generally input data sets for the assessment process. Data standards will be prescribed for a fixed set of source water protection outputs. These data sets include threats, issues, intake protection zones, well head protection areas, significant recharge areas, highly vulnerable aquifers, future water supplies, water budgets, risk assessments. These standards and associated specifications are described in detail in the document "**Assessment Report Outputs: Data Specifications**"(OMNR 2006).

For instance the threats data standard will have a set of tables describing the threat and associated attributes including standard lookup tables for a set list of chemicals, allowing toxicity and persistence values to be automatically selected when a land use activity (threat) is identified. Similarly, hazard scoring for pathogens has been set as a fixed value for a specific pathogen depending on whether the occurrence was within groundwater or surface water.

In addition to the standards associated with the specific themes, the data specifications document also describes projection (Universal Transverse Mercator), datum (NAD 83 NTV2) and file format (geodatabase) standards. The adoption of these standards at the initial data compilation stage reduces effort required later for data conversion and ensures consistency with output data requirements.

The provincial government conducts many ongoing monitoring programs relevant to source water protection. These monitoring programs have existing standards for both data collection and management processes. These include:

- Provincial Water Quality Monitoring Network;
- Provincial Groundwater Monitoring Network;
- drinking water testing programs (both municipal and private);
- climate monitoring network;
- surface water levels and flows network.

Both the provincial and federal governments conduct monitoring programs associated with the Great Lakes. These programs contain established

methodologies and associated standards for the collection and storage of data that should be adopted by local planning participants. Variations in these standards may occur at the local level, although any deviation from the provincial standards must be evaluated. In the future, additional geographic and parameter coverage may be required to ensure the appropriate inputs for analytical processes and performance measurement are available.

Data exchange formats will also be critical. The Standardized NRVIS Interchange Format has been developed to allow complex provincial data structures to be extracted and shared with outside agencies utilizing different operating environment and GIS software. Other mechanisms and formats for exchange of data are currently being considered for use within the source water protection process. Geodatabases, shapefiles, coverages, Access databases and other formats will be distributed where appropriate to minimize import efforts at the local level.

Standards, guidelines and best management practices for the production of output products (maps and other images) have been developed and can be found in the document “**Source Water Protection Mapping Symbology and Standards**” (OMNR 2006). The standards cover legends, symbology, map surrounds, etc. required for the submission and public viewing of output products. Each guidance module prepared for the Assessment Report identifies specific output products that should follow the intent of this document.

Metadata

As data is created or enhanced, metadata must be recorded for the data set or informational output. Metadata is defined as a high-level description, catalogue or directory of a specific data or information holding. The catalogue addresses the fundamental requirement that data and information products be discoverable to stakeholders. The catalogue increases the value of data assets by making their existence more widely known and documenting ownership, data lineage, projections, resolution, etc.

The Ontario Land Information Directory (OLID) is a provincial metadata tool developed by LIO that utilizes the GO-ITS 72.00 standard. OLID is the recommended standard metadata software system for source water protection. As an alternative, agencies may adopt equivalent metadata software tools that support the GO-ITS 72.00 standard or alternatively the Federal Geographic Data Committee (FGDC) or International Organization for Standardization (ISO) standards. Verification from the province of compatibility with OLID is required.

3.3 Technology

Technology will be an important consideration for source water protection on two fronts: from a provincial coordination and distribution perspective and a local data management, analysis and reporting perspective to support the assessment, planning and implementation phases. The following sections describe the provincial and local environments required in the short term to deliver the first planning cycle. These environments will continue to evolve over the planning lifecycle enabling opportunities for more sophisticated interoperability between organizations.

Provincial Technology Environment

Source water protection will involve many participating organizations and a large number and variety of data sets. Consequently, the process requires a mechanism to enable discovery, distribution and data standardization. The province has established the Ontario Land Information Infrastructure (OLII) through Land Information Ontario (LIO). This infrastructure includes the Ontario Land Information Warehouse (OLIW) and associated data subscription and publication systems. The data warehouse provides for the consolidation of data related to water quality and quantity, water use, land use, geology, hydrogeology, natural heritage and other geo-technical data. The benefits of a central data repository include: easier access to data, better awareness of data, opportunities for data collaboration, availability of wide area datasets spanning jurisdictional boundaries to more meaningful physical and ecological extents, and greater use of common data standards.

The warehouse enables an environment where individual agencies manage their respective databases and contribute (publish) them to the central repository. These databases are broadly available to other OGDE members, either as a single request or through an ongoing subscription service within the restrictions applied by the data owner.

The data warehouse can distribute provincial data and coordinate the exchange of data between local agencies. The warehouse will move data from provincial sources to local planning agencies and from the agencies to the province. This flow back of information will allow the province to maintain authoritative databases that can be used in the future by all organizations involved in source water protection. This process will also ensure that source water protection is aligned with other mandated provincial programs.

This infrastructure also provides data discovery through metadata (OLID) and visualization services. These services help users to locate and view data online.

Advancements in the OLII have recently made it possible to use web services that are based on Open Geospatial Consortium standards, including web map services and web feature services. These services extend the notion of a single

warehouse to one of a more distributed environment, such that data is managed closer to its source.

Local Technology Environments

Local agencies need to establish local data storage and analysis environments in order to support the assessment, planning, and implementation phases of source water protection. Local technology environments will be driven largely by the level and type of analysis at the local level. Participating agencies will need to establish the necessary technology, including analytical software, geographic information systems, database management systems, internet servers, analytical software and communication/consultation capabilities.

The model selection process (see Appendix 2) will directly influence the establishment of functionality requirements (e.g., 3D- versus 2D-modeling, event-driven versus continuous, etc.) of the software, application and database needs. The guidance modules streamline the selection of the specific models to a limited list of preferred models, nevertheless, variations in software solutions can significantly impact software/hardware requirements. For instance, the selection of groundwater methodologies to conduct vulnerability identification, and the selection of a Time-of-Travel method versus a Surface-to-Well Advection Times will affect data availability, input formats, processing times and software.

Local agencies will need to align existing business information systems with the new functionality required for source protection. This alignment has potential to influence how the local environments are established so that they can utilize existing systems and associated data.

3.4 Governance

A governance model has been established to oversee implementation of the information management framework. The model will be used to resolve technical issues and foster the development of data standards and collaboration partnerships. The model will provide for a provincial government coordinating function and a multi-agency technical committee.

As part of its coordinating function, the provincial government will help source water protection stakeholders implement the information management framework. This role includes providing assistance to source water protection stakeholders regarding their roles in implementing the framework, data collection, data improvement, data distribution, facilitating the development of standards, managing data exchanges, and provision of provincial infrastructure and tools.

The collaborative information management environment envisioned in the framework involves multiple organizations working together. To facilitate this

collaboration, a multi-agency technical committee, the Conservation Ontario Provincial Information Management Working Group, has been established to address a wide range of information management issues faced by provincial ministries, conservation authorities, and municipalities.

The COPIM working group meets on a monthly basis to build consensus and ensure the cooperation of numerous organizations. Its mandate is to:

- Provide a mechanism for addressing and resolving technical issues;
- Feedback on provincial direction and projects;
- Consensus building for the development of data standards;
- Communications and liaison with participating organizations.

Working groups will be established as required to resolve specific issues and/or determine specific deliverables. The working group members will require sufficient knowledge and expertise to actively participate in the development of solutions and products. Additional expertise will be brought in as required.

In addition, the governing board of the Ontario Geospatial Data Exchange will be used to resolve any major issues resulting from the data exchange agreement. The governing board includes members from the provincial government, conservation authorities and municipalities, non-government organizations, and universities.

4.0 Data Submission to Province

Upon completion of the assessment report for each source water protection area, the output products and data sets listed in the individual modules will be submitted to the province. The submitted products and data will conform to the standards identified in the companion documents. The conformance with the standards will ensure that consistent products are produced across all watersheds.

This submission of data will ensure that these specific data sets are used to enhance the provincial databases, and to ensure the data is aligned with other provincial government programs.

References

Assessment Report Outputs: Data Specifications, Ministry of Natural Resources, Water Resources Information, Version 1.0, March 2006.

Source Water Protection Mapping Symbology and Standards, Ministry of Natural Resources, Water Resources Information, Version 1.0, August 2006.