

the lake surfaces is not measured directly, but rather computed from a thermodynamic model. The error associated with estimates of evaporation needs to be determined.

Also, a key component of this project task will be the development of a "one stop-shopping" Internet site for all of the basin's relevant water resources data in the context of the lakes' water budgets. This final product will be an invaluable communication tool in conveying this information to the varied constituencies interested in the project.

Several tasks are associated with this project element:

a) Assemble available data and information

Each member of the Project Management Team will be responsible for assembling existing data that its agency collects and houses. Examples of available data and information include the following:

- ▶ Climatology, meteorology, modeling and associated tools, water levels and lake basin data. These data are important because accurate historical hydrological data are required for simulation, forecasting and water resource studies on the Laurentian Great Lakes and their basins. Revised daily and monthly data for over-land and over-lake precipitation and air temperature, basin runoff, lake evaporation, net basin supplies, connecting channel flows, diversion flows, beginning-of-month lake levels, and changes in storage are available at the Great Lakes Environmental Research Laboratory (GLERL). Also, software for computing additional derived quantities is available. All hydro-meteorological data are uncorrected for gage errors or systematic measurement biases and are averaged spatially and temporally without regard to their relative quality. Responsible agencies include the National Oceanic and Atmospheric Administration (NOAA); Environment Canada (EC) and the Canadian Department of Fisheries and Oceans (DFO).
- ▶ Streamflow, ground water. The U.S. Geological Survey (USGS) collects continuous streamflow data at about 300 locations in the Great Lakes watershed. All of these data are available in publications and most data are available via the Internet. It will be straightforward for the USGS to compile these data for the watershed. Groundwater discharging from aquifers directly to the Great Lakes is not measured by any agency. However, discharge has been estimated in a number of site-specific studies and these estimated have been recently compiled and published by the USGS. The USGS will lead this effort, assisted by EC and the DFO.
- ▶ Connecting channel outflow determinations. The flows in the Great Lakes connecting channels --the St. Marys, St. Clair, Detroit, Niagara, and St. Lawrence Rivers -- are required for all Great Lakes basin-wide studies as well as many studies for the individual lakes. The outflows for the St. Marys and St. Lawrence Rivers are the outflows through the regulatory control structures and are provided by the Lake Superior and St. Lawrence River Boards of Control. The flows in the St. Clair and Detroit Rivers are computed using stage-fall-discharge equations and unsteady flow models and are coordinated by the binational Coordinating Committee on the Great Lakes Basic Hydraulic and Hydrologic Data. The Niagara River flows are provided by the International Niagara River Board of Control and by the use of discharge equations developed by the Coordinating Committee. Leading this effort for the project will be the U.S. Army Corp of Engineers (USACE), assisted by NOAA, EC and the DFO.

In addition to working with the agencies identified above as members of the project team, the project will draw on the work and expertise of the Coordinating Committee. This is an ad-hoc body of U.S. and Canadian federal agencies that meets regularly to reach agreement upon past and present hydraulic, hydrologic, hydro-meteorologic and related physical data concerning the Great Lakes. These data are used by the participating agencies in each country in pursuing studies and programs requiring internationally coordinated data. The Coordinating Committee promotes common methods and procedures used by agencies in each country to measure, collect and store the pertinent data, particularly those needed to support the water quantity and water quality management objectives of the International Joint Commission. The Coordinating Committee has managed the update of the International Great Lakes Datum, 1985. The participating agencies include the USACE, NOAA, the USGS, EC and the DFO. It is anticipated that the agencies supporting this proposal will use the Coordinating Committee arrangements to further integrate information to support Project Element Two and the Inventory of Water Withdrawal and Use (Project Element Three). The Coordinating Committees' current initiatives involving the Online Hydro-meteorologic Station Directory and the GLIN Hydrology pages also will be leveraged throughout this proposal.

b) Characterize and interpret data and information

After available data and information have been compiled, the Project Management Team will characterize the availability of data spatially, temporally, and with respect to data needs for quantifying the Great Lakes water balance. Characterizing the data in terms of spatial and temporal availability will be relatively straightforward, given the aforementioned data assembly effort.

Characterizing and interpreting the data and information with respect to quantifying the Great Lakes water balance is more problematic and will be a substantial part of the Project Management Team's effort for Project Element 2. This effort requires identifying and quantifying errors associated with terms in the water balance equation, including lake outflows, tributary inflows, precipitation on the lake surface, evaporation from the lake surface, and direct groundwater discharge to the lake. Methods are available for formally quantifying the errors associated with some of these terms. For instance, errors associated with tributary inflows and lake outflows can be estimated. On the other hand, errors associated with estimated groundwater discharge cannot be quantified. One can only determine that the maximum amount of groundwater discharge must be equal to or less than the amount available from errors in the estimates of all the other water-balance terms.

Final interpretation of data and information for a status assessment will include a description of the quantity and quality of all data and information relevant to the Great Lakes water balance. Particular attention will be paid to data gaps and their influence on errors in water-balance estimates so that states, provinces and their partners can use study results in the context of water management decisions.

c) Develop communications tools

Using the Great Lakes Information Network (GLIN), the Great Lakes GIS Online project, and the Online Hydro-meteorological Station Directory, the Great Lakes Commission will take the lead on developing and expanding communication tools for the project. The centerpiece of this effort will be the development of a Great Lakes Water Use web site that consolidates and greatly expands existing online information. For example:

- ▶ The status assessment of water resources will be displayed via clickable maps, a GIS map/data interface and web-based pointers to allow users to access available data.
- ▶ Results of the water use inventory will be displayed in tabular, chart, graph and narrative format. Data and data sources will be able to be retrieved via clickable maps on the basis of jurisdiction, lake basin, and/or use category. The narrative portion of the inventory will characterize and assess all data sources.
- ▶ The GLIN hydrology pages, unveiled in September 1997, provide one-stop-shopping for current Great Lakes water level and flow information. Highlights of the site include forecasted and historical levels; interactive maps with real-time water levels data from the gauging stations; datums; and news from the agencies and organizations that collect the data and manage lake levels. The GLIN hydrology pages were created under guidance from the binational Coordinating Committee.
- ▶ The Great Lakes GIS Online project extends the regional GLIN by providing Internet-based access to a variety of spatial data covering the Great Lakes basin. The project features a library of completed maps for specific subjects, such as Great Lakes geographic data sets and online mapping tools for analyzing and depicting aspects of the Great Lakes region. The Great Lakes GIS Online project will provide a solid foundation for interagency spatial data sharing and collaboration across the binational region.
- ▶ The Online Hydro-meteorological Station Directory will use web technology and GIS-based mapping tools to depict current and historical river and weather gauging stations in the Great Lakes region. Station locations will be depicted on a regional map which can be viewed over the Internet, and each location will be linked directly to tables of information about periods of operation, types of data collected and responsible agencies.

d) Display and deliver project results

Presently, data and information associated with water resources, uses and ecological impacts are not organized and displayed in a consistent, systematic manner. Hence, the evaluation of the characteristics of various data and information sources will be a comprehensive one. Once the communication tools and strategy have been developed, project results will be accessible by using a variety of means, including clickable maps and web-based pointers to allow users to access available data.

Clickable maps will allow a visitor to quickly view relevant water resources data for a specific location (e.g., lake, river, watershed). This map/data interface can be further explored through a GIS interface that will allow visitors to "map" the specific data that interests them. For example, a GIS mapping tool can enable a user to create a map showing all water level gauging stations on the Great Lakes. By clicking on a gauging station on the map, real-time data would be immediately available, as well as metadata about the gaging station, its precise location and related variables (e.g., current weather conditions or a photo at that location).

A collection of web-based pointers, or links, on a single web site will provide immediate, convenient access to relevant water resources data. To ease navigation, the available data will be organized by topic (e.g., streamflow or water levels), agency/organization (e.g., NOAA or USGS) and location (e.g., lake, state/province, watershed). A search function may also be incorporated on the site to further enhance the profile of these data sources, their use and application.

The data/information associated with ecological impacts will be displayed primarily in narrative format, drawing from available data sets, reports and other system-wide and site specific analyses. The literature search provided for in Project Element Four will determine whether the data/information is sufficiently detailed to permit display via maps and other visual tools.

In sum, the project will yield a Web site and final report that 1) inventories, integrates and displays status assessment, use and ecological impacts data and information; 2) characterizes and assesses the source of such data and information; and 3) identifies inventory gaps, needs, and associated actions to address them.

As noted on the task and activity (Attachment B) the four primary tasks associated with Project Element Two will be pursued throughout the eight project quarters, with interim products available as noted.

Project Element Three: Inventory of Water Withdrawal and Use

Using the Great Lakes Commission's existing Great Lakes Regional Water Use Data Base as a foundation, the Project Management Team will access the latest available water use data as it relates to withdrawals, in-stream uses, diversions and consumptive use. This data will be characterized on the basis of established criteria (e.g., reliability, estimated vs. measured, comprehensiveness) and presented by jurisdiction, lake basin and category of use.

The upgrading/redesign of the Commission's water use data base is needed to accommodate and display the outcome of the inventory and characterization work. For example, it will allow status assessment (Project Element Two) and ecological impact (Project Element Four) outcomes to be incorporated into the data base for ease of reference. It will also help state and provincial officials identify fundamental data/information gaps and needs that must to be addressed irrespective of the type of decision support system ultimately selected.

Project activities will include an evaluation/prospective redesign of the existing data base to enhance value as a decision support tool, software upgrading, and improving access and use by decision makers and other stakeholders. The inventory will be made available in electronic and hard copy, with the former accessible on the Internet (GLIN). It will be incorporated into the Great Lakes Water Use web site discussed in Project Element Two.

The Great Lakes Regional Water Use Data Base provides a common base of data and information on water use in the Great Lakes basin as called for in the Great Lakes Charter of 1985. Housed at Great Lakes Commission offices, the database uses a modified Microsoft Access® software package using Visual Basic for applications. Routine database operations are performed by a customized program prepared in 1987 by Acres International, Ltd. and revised in 1999/2000 by Eastern Michigan University's Center for Environmental Information, Technology and Application. This program includes standard data entry, retrieval and report generation options.

The concept of a regional water use data system to collect and maintain consistent and uniform data on withdrawals, diversions and consumptive uses of water has long been of interest to Great Lakes researchers and program managers. Prior to the establishment of the Great Lakes Regional Water Use Data Base in 1988, the Great Lakes states and provinces had for many years maintained a variety of independent water use data collection, storage and retrieval systems.

In their ongoing efforts relating to the requirements of a Regional Water Use Data Base, the states and provinces have benefitted from several projects and studies undertaken to document individual state and provincial programs, and provide guidance on how to establish a consistent approach to managing the water resources of the Great Lakes basin. For example:

- ▶ The Great Lakes Commission formed a Water Data Collection Task Force in early 1985 to evaluate regional data collection efforts. Through a survey, the Task Force determined the extent of withdrawal, return flow and water consumption data in the Great Lakes states and provinces, along with the assessment, comparability and compatibility of the data. The results are published in an October 1985 report titled *Survey and Preliminary Evaluation of the Existing Water Use Data Collection Systems in the Great Lakes State and Provinces*. This report was authored by the Great Lakes Commission.
- ▶ The USGS, in an extensive 1985-86 study undertaken with input from the Council of Great Lakes Governors' Water Resources Management Committee, examined and compared Great Lakes state and provincial data for nine water use categories. The December 1986 report titled *Water Use Data Collection Programs and Regional Data Base in the Great Lakes-St. Lawrence River Basin States and Provinces* (U.S. Geological Survey Open File Report 86-546, December 1986) influenced the design of the Regional Water Use Data Base.
- ▶ The International Joint Commission (IJC) (through Phase I and Phase II of the Reference on Great Lakes water levels and the recently completed report of the Reference on water export, use and diversion), the USACE, the NOAA Water Levels Section, and EC have all conducted studies and/or collected data pertinent to and supportive of the proposed work.
- ▶ In February 1999, the Great Lakes Commission convened a two day workshop with the technical work group of the Water Resources Management Committee to test a model version of the updated Great Lakes Regional Water Use Data Base. The workshop provided an opportunity for the state/provincial members to provide extensive input on the upgrades to the system and to advise how the database might be improved and enhanced as a decision support tool. Upgrades and modifications to the new database are planned and will be expedited and enhanced under Project Element Three of this proposed project.

In its recent report to the federal governments titled *Protection of the Water of the Great Lakes*, the IJC finds that "sound management of the water resources of the Great Lakes requires sound data about these resources. Although the Great Lakes Charter provides a structure for the collection, analysis and distribution of these data, progress in the data management area has been slow" (page 45, conclusion #21). Also, the report recommends that "federal, state and provincial governments should move quickly to respond to water use data deficiencies by: a) allocating sufficient staff and financial resources to upgrade the timeliness, precision and accuracy of water use data; b) working much closer together to ensure consistency in water use monitoring, estimation techniques, and reporting; and, c) emphasizing and supporting the development and maintenance of a common base of data and information regarding the use and management of the water resources of the Great Lakes Basin, establishing systematic arrangements for the exchange of water data and information and undertaking coordinated research efforts to provide improved information for future water planning and management decisions" (page 49, recommendation #6).

Project Element Three activities will address these and other unmet needs through an updated, enhanced and detailed inventory of Great Lakes water withdrawals, consumptive uses and diversions.

The upgraded Great Lakes Regional Water Use Data Base will serve as a common base of data and information on water use in the Great Lakes Basin as described in the Great Lakes Charter. The database will report on the set of annual data on withdrawals and consumptive uses of Great Lakes water organized by ten water-use categories, six sub-basins and ten jurisdictions as specified by the state/provincial Water Resources Management Committee (WRMC).

The database will include a set of data records, each comprised of a complete set of 17 individual data elements. The data base will store complete data for each of 660 possible combinations of water-use category, withdrawal/ discharge type, basin and jurisdiction.

There will be nine categories of use for the Great Lakes Regional Water Use Data Base. The definitions of these categories were initially developed by the WRMC and later refined by a technical working group of the WRMC. These categories include public supply; self-supply-domestic; self-supply-irrigation; self-supply-livestock; self-supply-industrial; fossil fuel power; nuclear power; hydroelectric power; and other, which includes withdrawals for fish/wildlife purposes, low flow augmentation, navigation and recreation, among others. Each water-use category will include three types of withdrawal/discharge records: Great Lakes Surface Water (GLSW); Other Surface Water (OSW); and Groundwater (GW).

The six drainage basins (Lake Superior; Lake Michigan; Lake Huron; Lake Erie; Lake Ontario; and the St. Lawrence River) will be numerically coded in the data base. All states and provinces will submit water use data to the data base repository by basin of withdrawal. There will be 22 possible combinations of the six basins and ten jurisdictions. Each jurisdiction's set of sub-basin records will be comprised of nine sets of water-use category records. Each set of water-use category records will be comprised of three sets of withdrawal/discharge type records.

Data submitted to the Regional Water Use Data Base will be provided in one of two units: million gallons per day (U.S.) (mgd) and million litres per day (mld). Each jurisdiction will be required to select one of these on a consistent basis for all data submissions. The database records corresponding to the jurisdictions will be maintained in the selected units. There will also be two measures of the quality of data provided for each record: level of accuracy and level of aggregation. The accuracy level indicates whether the withdrawals are 100 percent measured; more than 50 percent measured; or estimated. The level of aggregation indicates whether the withdrawal data originate from site-specific sources or from higher level aggregate sources such as county or census databases.

Augmenting the withdrawal, consumptive use and diversion data will be new database components that incorporate outcomes associated with Project Element Two (Status Assessment of Water Resources) and Four (Inventory of Information on Ecological Impacts). Further, this project activity will include the redesign of the existing database report to ensure ease of reference and flexibility of use as a primary reference for a decision support system.

The proposed inventory will be a much-expanded version of the annual reports produced by the Great Lakes Commission as the repository for the Regional Water Use Data Base. It will be available in hard copy form and electronically via (GLIN). In addition to providing all of the information detailed above, the inventory will include a description of the status of state/provincial data collection and reporting programs, as well as a needs assessment detailing emerging issues and areas that the state and provincial water resources managers view as priorities. This needs assessment will draw on an earlier assessment conducted by the Great Lakes Commission and will include issues such as possible additional upgrades to the database; improving access and use of the data by decision makers and stakeholders; using the data for trend analysis; and, using the data to support proactive water resources management at

the state/provincial and regional levels (e.g., water conservation, demand management, water use forecasting).

Tasks associated with this project element will proceed in the following sequence: needs assessment; data base redesign; software upgrading; enhancements (e.g., status assessment, ecological impacts information); data base population; refinement and testing; state/provincial approval; and recommendations and process for institutionalizing inventory/reporting activity. These tasks will be initiated in the first project quarter and completed in the seventh, with interim products in the intervening quarters.

Project Element Four: Inventory of Information on Ecological Impacts

In conjunction with the Project Management Team and Advisory Committee, the Project Secretariat will prepare a descriptive inventory of the scientific literature addressing the ecological impacts of current and prospective water use. The review will be followed by analysis and discussion, with a focus on how results might be reflected in inventory components and accommodated (quantitatively or qualitatively) in any type of decision support system the states and provinces ultimately adopt.

The Great Lakes Commission views this as a critically important component of the project. Significant uncertainties exist with regard to cumulative ecological impact, yet documentation of such impacts must be an integral component of any decision support system.

The Great Lakes hydrological system is dynamic and highly complex. Levels and flows within the system are constantly fluctuating as they adapt to both natural and human-induced factors. Given both the fragility and intensive use of the system, even modest fluctuations (short and long-term) can have pronounced social, cultural, economic and environmental impacts. These impacts can be either positive or negative, depending on the nature and direction of the fluctuation, location within the system and the affected user groups.

While natural factors (e.g., climate conditions and events) are primarily responsible for historic fluctuations in levels and flows, human interventions (e.g., withdrawals, consumptive use, diversion, dredging, shoreline alteration) also significantly impact ecological, social, cultural and economic characteristics of the system and its associated uses and user groups. These interventions are inherently cumulative: the impact of localized, small scale activities may be difficult to quantify on an individual basis but, collectively, can significantly alter the levels and flow regime and associated ecological conditions. The cumulative nature of these impacts becomes more pronounced as one proceeds downstream through the Great Lakes-St. Lawrence system. Impacted sectors include hydropower, municipal water supply, shipping, shoreline interests, recreational boating, fisheries, wetlands, water quality, Native Americans/First Nations and others (e.g., water based tourism, agriculture, public perception/reaction).

The cumulative impacts associated with past and current change due to human activity – primarily withdrawals consumptive use, diversion, dredging and chemical/shoreline alterations – have been documented to varying degrees. Impacted sectors include municipal water supply, shipping, shoreline interests, recreational boating, fisheries, wetlands, water quality, Native Americans/First Nations and others (e.g., water based tourism, agriculture, public perception/reaction).

U.S. and Canadian experts convened in 1999 by the Great Lakes Commission agreed that the ecological and economic impacts of most water withdrawals, diversions and consumptive uses to date have not been quantified with any degree of precision. Impact assessments have predominately been linear interpolations of past experience. Assessments of water removal proposals, where pursued, have been

hampered by a lack of relevant data and information and typically have not addressed the cumulative impact considerations on a system wide basis. Further, it has been difficult to verify causal relationships in light of other confounding factors affecting the physical, chemical and biological characteristics of the basin's water resources.

Experts generally agree that water use demands and conflicts (intra and interbasin) will increase, and enhanced understanding of ecological impacts (local and systemize) will be key to formulating scientifically sound and legally defensible water use decisions that respect ecological, social and economic considerations. To confirm this initial belief and to increase confidence in the breadth and depth of current ecological impacts information, an initial "experts workshop" will be convened in the early stages of the project as a means to assess and better understand the state of current knowledge and provide guidance to project staff and collaborators undertaking the literature search and inventory of models. We will then hold a follow-up workshop that will yield recommendations as to how scientific understanding and modeling capabilities can be incorporated into inventory and support system development.

While the Project will focus on ecological impacts as a matter of priority, economic impacts will also be inventoried and characterized as relevant data and information becomes available. Impact analyses are presently more site specific and anecdotal than they are regional and systematic. In many cases, such analyses assess both ecological and economic impacts. In some cases, economic parameters are used to benchmark ecological damage.

In summary, the proposed project will address this critical unmet need through a four step project element featuring a literature search and analysis; an investigation of existing models; an experts workshop; and the development of findings and recommendations as to how ecological impacts might be reflected in inventory components and accommodated (qualitatively and quantitatively) in a decision support system.

- a) **Literature Search and Analysis:** The Project Secretariat will prepare a descriptive inventory of the scientific literature addressing the ecological impacts of current and prospective water use. The search will constitute expansion of a Great Lakes Commission/consultant generated report (1999) on the *Cumulative Impacts in the Great Lakes-St. Lawrence River Ecosystem from Factors Affecting Water Levels and Flows*. Database searches (e.g., Water Resources Abstracts, Aquatic Sciences and Fisheries Abstracts, BIOSIS, NTIS) will be complemented by reports and materials acquired from relevant sources including the IJC, which has contributed substantially to the impact assessment literature through water use references. A subset of relevant citations will be abstracted and categorized. The resultant report will present recommendations as to how the search outcomes might be incorporated into the water use inventory and associated decision support system.
- b) **Inventory of Existing Models:** Complementing the literature search will be a descriptive inventory of models that may contribute to a better understanding of ecological impacts. This will include hydrologic (watershed); hydraulic (hydrodynamic); sediment transport; contaminant transport and other impact assessment models which reside in various agencies including USACE (Waterways Experiment Station, Institute of Water Research); NOAA; USGS; U.S. Department of Agriculture; U.S. Environmental Protection Agency; and EC. The descriptive inventory will build upon model characterization/assessment activities of the Great Lakes Commission over the past two years. The outcome will be an evaluation of model applicability to ecological impact, and will address such matters as model sensitivity, precision, data requirements and spatial capabilities. This outcome will allow the policy/management community to determine model applicability to a decision support system.

- c) **Experts Workshop:** Following the completion of draft reports for the two tasks, the Project Secretariat will convene an “experts workshop” bringing together U.S. and Canadian researchers/scientists with policy/management officials from the states, provinces and relevant federal agencies. The objective is to determine how scientific understanding and modeling capabilities can be practically and pragmatically incorporated into water use inventory and decision support system development.
- d) **Synthesis Report Incorporating Ecological Impacts Into Inventory Efforts and Decision making Procedures:** This project element includes a synthesis report that addresses literature search, model assessment and expert workshop outcomes and relates such outcomes to policy and management needs. Once endorsed by the states and provinces through the Project Management and Advisory Committees, synthesis report recommendations will be incorporated into inventory and larger decision support system development processes.

The four tasks will be initiated in the first quarter and completed by the sixth. The experts workshop will be convened in the fifth quarter, and the synthesis report will be prepared in the sixth quarter. All will have interim products available to the states and provinces and other collaborators prior to formal completion.

Project Element Five: Project Synthesis and Next Steps

The Great Lakes Commission and its collaborators recognize that the proposed work is an essential **first** step leading to a fully operational water resources management decision support system for the Great Lakes. As such, work products associated with the four preceding project elements must be synthesized and presented in a manner that will ensure immediate use and benefit to the Great Lakes states and provinces and other relevant agencies. Toward that end, several tasks will be pursued in project quarters 6-8. Each is summarized below:

- a) **Preliminary Findings/Recommendations:** The Project Secretariat will prepare (for Project Management and Advisory Team approval) a comprehensive series of findings and recommendations associated with each of the project elements and their products. These statements will 1) identify remaining gaps and unmet needs associated with the status assessment, water withdrawal/use and ecological impacts inventories; 2) propose a strategy and timeline for addressing them; 3) provide detailed guidance to ensure that the status assessment and inventories are updated on a regular basis; 4) offer guidance to policy makers and managers as to how the project outcomes can be used and applied; and 5) offer suggestions concerning additional technical and policy work that can build upon these products as a fully operational decision support system is instituted.
- b) **Workshop – Implementing Products, Identifying Next Steps:** The aforementioned preliminary findings and recommendations will provide the basis for a workshop, in the seventh project quarter, that provides a bridge between the technical products and their policy/management applications. At this workshop, Project Management and Advisory Team members will be joined by other state and provincial officials (and federal officials, as appropriate) responsible for water resource management/policy in their respective jurisdictions. The objective is to “ground truth” products to ensure their relevance in an applied setting; provide necessary training; discuss and agree on mechanisms to promote implementation; review and refine the preliminary findings and recommendations as a means to prepare for upcoming activities directed at achieving a fully operational decision support system; and address institutionalization of project activities over the long term.

- c) **Refined Web Site Release:** The Great Lakes Water Use Web Site, to be populated and released in preliminary form in the third project quarter, will be updated and refined for its “final” release in the seventh project quarter. (The preceding workshop will be used to receive feedback on the earlier design and content.) The refined web site will be directed at the needs of the project’s primary clients (states and provinces), but will be of interest to, and readily accessible by, all levels of government, citizen organizations, business/industry groups and other interested parties. In addition to synthesizing project outcomes, it will feature comprehensive information on the status of Great Lakes water resources; access to all available withdrawal and consumptive use data; access to all available ecological impacts data; and extensive linkage to all other relevant web sites within and beyond the Great Lakes region. It will be designed with flexibility in mind; and will accommodate any additional features of a water resources decision support system that might be developed in follow up to the project. The Great Lakes Commission will have lead responsibility for design and maintenance in consultation with the Project Management Team and Advisory Committee.
- d) **Final Products and Project Report:** The Great Lakes Protection Fund will receive, in the eighth and final quarter, a complete project report addressing all the aforementioned items. The Project Secretariat and Project Management Team will be available, at the Protection Fund’s request, to formally present the products and discuss ongoing and upcoming tasks yielding a fully operational water resources decision support system for the Great Lakes.

Project Five tasks will be completed between the sixth and eighth project quarters:

C. Dissemination Plan

The Great Lakes Commission and its many collaborators will implement a multi-faceted dissemination plan that will maximize access to and application of status assessment and inventory data and information. The plan is comprised of four primary dissemination pathways:

- 1) **Internet:** A Great Lakes Water Use Web Site will be a centerpiece of project activity. It will be designed and initially populated in the third project quarter and released in its “final” detailed form during the seventh project quarter. The site will be extensively linked through, and prominently highlighted on the Commission-managed Great Lakes Information Network (GLIN). As the region’s preeminent “gateway” to Great Lakes information on the Internet, GLIN is approaching 1,000,000 visits per month. Commission analysis of GLIN usage confirms that all targeted groups in the Great Lakes-St. Lawrence region regularly access GLIN and rely upon it for data and information. Complementing the site will be regular announcements of project activity and interim products on the Great Lakes Commission web site, and on “GLIN Announce,” a list serve for more than 400 policymakers and opinion leaders in the Great Lake-St. Lawrence region.
- 2) **Conventional “Hard Copy” Dissemination:** This dissemination effort will take place at two levels. First, the Great Lakes Commission’s *ADVISOR* newsletter will be used as a means to disseminate project update information/announcements to more than 3,500 policymakers, managers, researchers and other interested parties. Over the course of the project, two special inserts will be prepared to publicize the effort and its interim/final products. Second, hard copy versions of various products (status assessment, inventories) will be published and publicized and made available to all interested parties.
- 3) **Media Relations:** The Great Lakes Commission maintains a detailed database of all media outlets in the Great Lakes region and is capable of targeting sectors of that larger community for information of special interest. Subject to the review and approval of the Project Management

Team, press releases/media advisories will be periodically released and, if warranted, a press teleconference or "in-person" event will be organized to showcase project outcomes. Any such activity, however, will be preceded by consultation with the Great Lakes Protection Fund.

- 4) **Meetings and Conferences:** The Semiannual and Annual Meetings of the Great Lakes Commission will be used to report on progress, receive feedback and release interim and final reports. This will be a convenient and cost effective dissemination vehicle given that the great majority of Project Management Team and Advisory Committee members are regular attendees at such meetings. The Project Secretariat will also solicit/accept opportunities to present interim and final products at other conferences where Great Lakes interests are represented. Among many others, this may include the annual International Association for Great Lakes Research Conference, annual meetings of the Council of Great Lakes Governors, periodic meetings of various non-governmental environmental groups, association meetings, and technical sessions where project staff and participants can benefit from interaction with interested parties.

Recognizing that the states and provinces are primary clients for the project, the Great Lakes Commission and its collaborators welcome any and all opportunities to brief them, individually or collectively, at any time.

3. BUDGET AND GRANTS AND CONTRACTS

The total project budget for this two-year grant is \$876,476 with \$745,000 being provided by the Great Lakes Protection Fund and \$131,476 being provided as in-kind match by the Great Lakes Commission. Out of this budget, a sum of \$175,000 has been allocated over the two-year period for prospective use by state and provincial collaborators. These funds will be available only on a dollar-for-dollar match basis, and contingent upon a jurisdiction's ability to demonstrate that 1) they are needed to ensure full participation in project elements and 2) they will help build and sustain jurisdictional water use reporting capacity over the long term. Baseline data assembly/reporting requirements associated with the Great Lakes Charter and any extant state/provincial laws will not be eligible for this support. The Project Management Team will establish a protocol for application and disbursement, which the Project Secretariat will manage. Any unused funds will be available for other project activities as determined by the project secretariat.

Modest additional funding has been allocated toward consultant costs in support of Project Elements 2-4. While most project activities will be accomplished by project staff and collaborators, it is anticipated that some support may be required for software design for the inventory of water withdrawals and use and presenting project materials online and in hard copy.

4. PROJECT ELEMENT TIMELINE

Project Elements/Tasks	Quarters							
	1	2	3	4	5	6	7	8
1) Detailed Project Description and Infrastructure								
a) Scoping	X							
b) Committee Selection	X							
c) Project Team	X	X	X	X	X	X	X	X
d) Advisory Committee Meetings		X	—	X	—	X	—	X
2) Status Assessment of Water Resources								
a) Assemble available data and information	X	—	—	X	—	—	—	X

b)	Characterize and interpret data and information	X	—	—	X	—	—	—	X
c)	Develop communications tools			X	—	X	—	—	X
d)	Display and deliver project results			X	—	—	X	—	X
3) Inventory of Water Withdrawal and Use									
a)	Needs Assessment	X	X						
b)	Data Base Redesign	X	—	X					
c)	Software Upgrading	X	—	X					
d)	Data Base Population		X	—	X	—	—	—	X
e)	Refinement and Testing				X	X			
f)	State/Provincial Approval					X	—	—	X
g)	Recommendations To Institutionalize					X			
h)	Subcommittee Meetings		X	—	—	X	—	X	—
4) Inventory of Information on Ecological Impacts									
a)	Literature Search and Analysis	X	—	—	X				
b)	Inventory of Existing Models	X	—	—	X				
c)	Experts Workshop					X			
d)	Synthesis Report				X	—	X		
5) Project Synthesis and Next Steps									
a)	Preliminary Findings/Recommendations						X		
b)	Workshop - Implementing Products, Identifying Next Steps							X	
c)	Refined Web Site Release								X
d)	Final Products and Project Report								X

5. BACKGROUND OF PROJECT SECRETARIAT

The Great Lakes Commission will serve as project coordinator, fiscal agent and lead organizer for the proposed project. The Commission is uniquely and ideally suited to serve in this role. It is an established interstate compact agency, founded in state and federal legislation, and dedicated to coordinating and fostering a regional approach to Great Lakes management. Recently, the provinces of Ontario and Québec joined the Commission as Associate Members. The organization's goal, as specified in the Great Lakes Basin Compact of 1955 (P.L. 90-419) is "to promote the orderly, integrated, and comprehensive development, use and conservation of the water resources of the Great Lakes Basin." This goal is pursued through information clearinghouse, policy coordination and regional promotion efforts. The organization is governed by delegations from each Great Lakes state and newly appointed delegations from Ontario and Québec. Membership consists of governors'/premiers' appointees, state/provincial legislators and state/provincial agency officials.

The Commission's legal standing as an interstate compact agency provides it with tax exempt and non-profit status, making it an eligible recipient of grants, contracts and donations from any public or private sector source. The Commission is in sound financial condition, enjoying continued growth in revenues and staffing resources over the past decade. This positive condition, documented in the attached audit statements, will ensure that the Great Lakes Commission is in a position to bring its own resources to the project to augment Great Lakes Protection Fund support. Further, the Commission's strong connections and positive relationship with the larger Great Lakes community will ensure that maximum support from other entities is realized.

The Great Lakes Commission is unique in that it has a legislative mandate (via state and U.S. federal law) to serve its members on an array of resource management, environmental protection, transportation and sustainable economic development issues. Over its 45 year history, the Commission has developed and maintained an extensive network involving state, provincial, regional and federal agencies; governors' and premiers' offices; regional research and policy institutes; universities; and environmental, conservation, citizen and industry interest groups. Over this time, the Commission has pioneered regional coordination efforts, demonstrated economic and environmental effectiveness and benefits for its members and has successfully promoted the region's varied interests.

The Commission's interest in water resources management issues is explicitly stated in the Great Lakes Basin Compact. Among others, Article VI (B) mandates the Commission to "recommend methods for the orderly, efficient and balanced development use and conservation of the water resources of the Basin" and Article VI (G) calls for the Commission to "recommend uniform or other laws, ordinances or regulations relating to the development, use and conservation of the Basin's water resources...." More specifically, the Compact in Article VII, commits Great Lakes Commission signatories to consider Commission recommendations on "stabilization of lake levels" (Article A) and "diversion of waters from and into the Basin" (Article H) among others.

Recent years have demonstrated the organization's commitment to these mandates. The Commission was significantly involved in the myriad activities leading up to the signing of the Great Lakes Charter in 1985; participated on and provided secretariat support to the Water Resources Management Committee (1986 to present); and houses the Regional Water Use Data Base. The Commission has also had extensive involvement in the last two IJC water resources references; the Levels Reference Study for the Great Lakes-St. Lawrence River Basin (1990-1993) and the recent reference on water use, diversion and removal of Great Lakes water (1999-2000) which culminated in a final report to the Governments of the United States and Canada titled *Protection of the Waters of the Great Lakes*. Dr. Michael J. Donahue, Commission executive director, served as a member of the Study Team, and Commission staff authored/contributed to numerous sections of the final report.

Over its history, the Great Lakes Commission has pioneered the concept of the inseparability of environmental protection and economic development goals in the Great Lakes region. This notion is reflected in Great Lakes Basin Compact language and all program and project activity undertaken by the Commission.

Existing staff capabilities, coupled with an extensive commissioner and advisor network and a strong binational partnership and collaborative infrastructure, will provide the expertise to undertake this project, ensure follow-through and, in general, fully meet the goals and expectations of the Great Lakes Protection Fund.

6. PROJECT PERSONNEL

Overall project oversight and coordination will be provided by the Great Lakes Commission staff under the direction of Dr. Michael J. Donahue, Executive Director and Thomas Crane, Program Manager, Resource Management, who will serve as member and alternate member on the project management team. Thomas Rayburn, Program Manager, Resource Management will provide day-to-day coordination activities. Other project personnel will include program specialists and support from administrative and secretarial staff.

Brief statements on each Project Management Team members (and alternates) are presented below. The labor contributions identified are limited to the Team member's own time; this will be augmented substantially by additional staff support to be quantified during the project scoping process. Also, please

note that three state/provincial representatives will be added to the Project Management Team during the scoping process as well.

Great Lakes Commission:

Dr. Michael J. Donahue has been the executive director of the Great Lakes Commission since 1987. He will provide project oversight and contribute to all aspects of project research, design and conduct. Dr. Donahue has twenty years of experience in water resources policy, planning and management issues. He has authored many papers and given numerous presentations on a variety of water resources management related topics. Dr. Donahue holds Ph.D. degree in Urban, Technological and Environmental Planning from the University of Michigan. He is an Adjunct Assistant Professor in the University of Michigan's School of Natural Resources and Environment where he designs and teaches courses in regional water resources policy and management. Dr. Donahue's contribution to the project will be approximately 400 hours (.10 FTE).

Thomas R. Crane was hired as the Commission's Natural Resources Management Specialist in 1986 and appointed as Program Manager for Resource Management and Environmental Quality in 1990. Mr. Crane will provide project management services to this project. Mr. Crane has served as Secretariat to the Water Resources Management Committee since 1986 and has managed the Regional Water Use Data Base since it became operational in 1988. Mr. Crane has provided lead staff support to Great Lakes Commission task forces on Lake Levels, Flooding and Shoreline Erosion, and Drought Management. Mr. Crane holds a master's degree in water resources management from the University of Michigan. Mr. Crane's contribution to the project will be roughly 1360 hours over the life of the project (.33 FTE). (Alternate member.)

Council of Great Lakes Governors. The Council of Great Lakes Governors is a private, non-profit organization devoted to working cooperatively on public policy issues common to its eight member states: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. Since its establishment in 1983, the Council has served as a vehicle for actively addressing the many issues that arise as a result of the Great Lakes Governors collective responsibility for both the world's largest source of freshwater and the industrial heartland of North America. The key Council staff person supporting this project will be **Jeffrey Edstrom**, Senior Policy Director. Mr. Edstrom leads the Council's water quantity initiatives, supports implementation activities associated with the Great Lakes Charter and served on the IJC's study team for its recent reference on water diversion, export and consumptive use. Mr Edstrom's in-kind contribution to this project will be approximately 400 hours (.10 FTE) over the life of the project.

U.S. Geological Survey (USGS). The USGS is an agency within the U.S. Department of the Interior with a mission to provide reliable scientific information to: describe and understand the earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect quality of life. It is the nation's largest earth-science agency and has the principal responsibility within the U.S. federal government for providing hydrologic information and for appraising the Nation's water resources. The USGS manages water information at offices located throughout the United States. Although all offices are tied together through a nationwide computer network, each collects data and conducts studies in a particular area. The key USGS staff person representing the water resources division will be **Jim Nicholas**, District Chief for the Water Resources Division in Michigan. Mr. Nicholas has a wealth of experience in hydrology and hydraulics studies and is also the Michigan state representative for USGS representing the water, biology, geology and mapping divisions. Mr. Nicholas' in-kind contribution to this project will be approximately 250 hours (.06 FTE). Representing the Biological Resources Division will be **Dr. John Gannon**. Dr. Gannon is a renowned limnologist and fisheries biologist with extensive Great Lakes experience. Dr. Gannon's in-kind

contribution to this effort will be approximately 125 hours (.03 FTE). Further, USGS has committed 8.0 FTEs (\$400,000) as an in-kind contribution to the project.

National Oceanic and Atmospheric Administration (NOAA)/Great Lakes Environmental Research Laboratory (GLERL). GLERL, located in Ann Arbor, Mich., is a U.S. Department of Commerce (DOC) facility operated by the NOAA. GLERL conducts integrated, interdisciplinary environmental research in support of resource management and environmental services in coastal and estuarine waters, with a special emphasis on the Great Lakes. The laboratory performs field, analytical, and laboratory investigations to improve understanding and prediction of coastal and estuarine processes, and the interdependencies with the atmosphere and sediments. It places special emphasis on a systems approach to problem-oriented research to develop environmental service tools. Assistance is also provided to resource managers and others who wish to apply the information, tools and services developed. The key GLERL staff person supporting this project will be **Dr. Frank Quinn**, renowned international expert on hydrology and hydraulics of large lakes and river basins, Great Lakes levels and flows, hydrologic modeling, water balance studies, and climate change studies. GLERL's in-kind contribution to this effort, (e.g., involvement from Dr. Quinn and other staff) will be approximately 400 hours over the life of the project (.10 FTE)

U.S. Army Corps of Engineers (USACE) - Detroit District. The main mission of the USACE-Detroit District is to investigate, plan, design, construct, operate and maintain Congressionally authorized water resource projects related to navigation, flood control, beach erosion and other activities. The District operates and maintains the world famous Soo Locks plus 102 harbors on Lakes Superior, Michigan, Huron, St. Clair and the state of Michigan portion of Lake Erie. The Detroit District manages the Great Lakes Water Control Data System, making it the Corps center for hydrometeorologic and water level data collection and dissemination for the Great Lakes system (water level forecast). The key staff person for USACE will be **Roger Gauthier**, supervisory hydrologist for the Great Lakes Hydraulics and Hydrology Branch. Mr. Gauthier's in-kind contribution to the effort will be roughly 250 hours over the life of the project (.06 FTE).

Environment Canada - Canada Centre for Inland Waters (CCIW). The CCIW is one of the world's leading centres for water research, generating environmental information and knowledge about the Great Lakes. The organizations within the CCIW are concerned with environmental research and development, as well as monitoring, resource management, charting, and coastal and harbour engineering. The key staff person for CCIW on this project will be **Doug Cuthbert**, Chief of the Conservation and Management Branch. Mr. Cuthbert is a renowned member of the Great Lakes scientific research community having extensive knowledge and background in areas related to levels and flows, climate change studies, hydrology and hydraulics. Mr. Cuthbert's in-kind contribution to this project will be approximately 200 hours (.05 FTE).