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Great Lakes Water Quality Board. Surveillance Work Group

GREAT LAKES INTERNATIONAL SURVEILLANCE PLAN (GLISP)

VOLUME II

BY

THE SURVEILLANCE WORK GROUP

OF THE

GREAT LAKES WATER QUALITY BOARD

INTERNATIONAL JOINT COMMISSION

WINDSOR, ONTARIO

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ORGANIZATION OF VOLUME II

Volume II of the Great Lakes International Surveillance Plan consists of several parts, each bound separately. This part contains the Preface and the Conceptual Framework. The other components, under separate cover, are:

- Lake Michigan Surveillance Plan
- Lake Huron Surveillance Plan
- Lake Erie Surveillance Plan
- Niagara River Surveillance Plan
- Lake Ontario Surveillance Plan
- St. Lawrence River Surveillance Plan

To be prepared at a later date are the Lake Superior Surveillance Plan and the Upper Connecting Channels Surveillance Plan.

any defensible measurement scheme must involve large numbers of samples. If the known spatial and temporal variabilities in the system are to be accommodated, as they must be, the number of samples necessary to provide a confident representation of real conditions becomes large indeed. At a more basic level, the size of the lakes is an obstacle to easy solutions. Scale-related physical factors make prediction of the distribution of materials within the lakes particularly difficult.

The factor of time is closely related to the physical size of the lakes and introduces a number of complications at both the purely scientific level and at the level of scientific-sociological interactions. It is an important consideration because the long residence time of water in the lakes means that certain types of undesirable materials will take a long time to flush from the system once they are introduced. The full effect of certain types of environmental insult may not become evident until decades have passed. Time has been a neglected dimension in ecological studies and management considerations in the Great Lakes.

Although severe pollution of the Great Lakes is popularly conceived as a relatively recent phenomenon, this impression is grossly mistaken. Documented pollution episodes involving direct threats to human health occurred at least as early as 1870. Many valued fish stocks were severely affected, and in some cases destroyed, by the beginning of the present century. Graphic accounts of gross pollution of the lower lakes during the 1920s and 1930s describe conditions which would be considered completely intolerable today. An appreciation of the effects of these conditions upon some segment of society's aesthetic values, and indirectly upon their livelihood, can be obtained by comparison of the trends in real value of shoreline property in areas suffering various levels of effect. Indeed, perhaps the greatest real advance towards realistic solutions of problems in the Great Lakes has been the emergence of an appreciation of the importance of time scale.

Given these considerations, it is indeed unfortunate that both individuals and society find it difficult to deal with problems which operate on long time scales. The focus on any particular issue seems to operate between the lower bound of one term of political office and the upper bound of a lifetime.

Considering the ponderous course from problem discovery to public awareness to eventual corrective action and evaluation of results, one might conjecture that the lower bound is always exceeded and the upper is likely to be. In addition, there have been wide fluctuations in public awareness of problems in the Great Lakes and institutional willingness to apply resources to their solution. Any surveillance scheme must have longevity incorporated as a basic principle. Many, if not most, effective management actions which have been taken were predicated on the existence of a long-term record of change in some property of the system. In many cases the records available were not intended as a surveillance tool, and in many cases they are seriously flawed. Nonetheless, any type of consistent long-term record is highly valuable. Moreover, great improvements in utility could be made by increasing the quality of such records. History has shown that this means adoption of the best available methods of the day. All too often potentially valuable records have been rendered less useful by blind adherence to some prescribed standard method long after it was superseded by better techniques. The corollary of this is that voucher samples should be preserved, if at all possible, for future verification and, if necessary, reinterpretation.

This Plan has been developed by the Surveillance Work Group as the minimum monitoring and surveillance activities necessary and sufficient to meet the requirements of the Great Lakes Water Quality Agreement. The Plan which follows identifies the level of activity required to ensure that the goals and objectives established are met.

2.0 CONCEPTUAL FRAMEWORK

The primary objective of the Surveillance Plan is to provide the Parties of the 1978 Canada-United States Great Lakes Water Quality Agreement with an assessment of progress in meeting Agreement objectives, and to provide guidance in the development of future programs for the enhancement and protection of the Lake Huron ecosystem.

The Great Lakes International Surveillance Plan (GLISP), released by the Water Quality Board in 1980, called for both an annual surveillance and monitoring component for each lake and connecting channel, plus a periodic intensive component which would focus on a particular lake or channel. The annual program was designed principally to assess changes and trends, detect emerging problems, and establish compliance with water quality objectives. The intensive program was designed to provide for a comprehensive, integrated state-of-the-lake assessment.

Because of the size of the lakes, long-term changes in water quality occur slowly. Therefore, the programs under GLISP were to follow a nine-year cycle, the first of which was concluded with the intensive survey conducted on Lake Superior in 1983.

Since the development of GLISP, the review of accumulated data has identified a need to modify the surveillance strategies in order to more effectively address current Great Lakes water quality issues and problems. This need for modification also reflects the changes in program emphasis toward toxic substances, especially accumulation in sediment and fish, and in the thinking of the Water Quality Board and the International Joint Commission communities as a whole towards surveillance, i.e. that surveillance and monitoring must embrace the ecosystem approach.

The specific requirements for surveillance and monitoring activities are outlined in Annexes 11 and 12 and the Supplement to Annex 3 of the Agreement. The purposes of these activities are:

1. Compliance -

   To assess the degree to which jurisdictional control requirements are being met.

2. Achievement of general and specific objectives given in Annex 1 of the Agreement -

   To provide definitive information on the location, severity, areal or volume extent, frequency, and duration of non-achievement of the objectives, as a basis for determining the need for more stringent control requirements.

3. Evaluation of water quality trends -

   To provide information for measuring local and whole lake response to control measures using trend analyses and cause/effect relationships, and to provide information which will assist in the development and application of predictive techniques for assessing impact of new developments and pollution sources. The results of water quality evaluations will be used for:

   Assessing the effectiveness of remedial and preventative measures and identifying the need for improved pollution control.

   Assessing enforcement and management strategies, and identifying the need for further technology development and research activities.

   This in order to obtain guidance for the development of future programs for the protection and enhancement of the Great Lakes ecosystem.

4. Identification of emerging problems -

   To determine the presence of new or hitherto undetected problems in the Great Lakes Basin ecosystem, leading to the development and implementation of appropriate pollution control measures.

Annex 12 states in part that monitoring and research should be established at a level sufficient to identify:

1. Temporal and spatial trends in concentration of persistent toxic substances and other substances known to be present in biota and sediment of the Great Lakes,

2. The impact of persistent toxic substances on the health of humans and the quality and health of living aquatic systems,

3. Sources of input of persistent toxic substances, and

4. The presence of previously unidentified persistent toxic substances.

The Agreement calls for the development and implementation of a joint surveillance and monitoring program specifically to include baseline data collection, sample analysis, evaluation, and quality assurance programs (including standard sampling and analytical methodology, inter-laboratory comparisons, and compatible data management) to allow assessments of:

1. Inputs from tributaries, point source discharges, atmosphere, and connecting channels

2. Whole lake data including that for nearshore areas (such as harbours and embayments, general shoreline and Cladophora growth areas), open waters of the lakes, fish contaminants, and wildlife contaminants and

3. Outflows including connecting channels, water intakes, and outlets.

The Supplement to Annex 3 also requires the Parties "to develop and implement surveillance and monitoring measures to determine the progress of the phosphorus load reduction plans for the Lower Lakes.... These measures will include an inventory of areas treated, watershed modelling, and improved measurement of tributary loadings to the Lower Lakes for the purpose of providing improved non-point source loading estimates...."

The International Joint Commission, the Great Lakes Fishery Commission, and the 12 associated state, provincial, and federal Great Lakes resource agencies are committed to the ecosystem approach for the resolution of water quality and other major Great Lakes issues. This means that surveillance must become holistic. The ideal product from such a holistic program on the Great Lakes will be a coherent annual assessment of the health of the system.

The ecosystem approach requires a change in focus, rather than a change in methodology. No major change is anticipated in the basic sampling and analysis techniques. What is required is coordination at the planning, implementation, and reporting levels in order to link appropriate surveillance components. This will entail selection of common sampling sites, sampling schedules, and data collection targets, and will necessitate compatible data recording and storage. The summarization process will also require use of common due dates and use of standard terms to link water quality and the status of the ecosystem.

The Great Lakes ecosystem consists of the physical habitat and the associated biota. To properly manage the lake, in order to attain the Agreement objectives, it is essential to recognize that habitat and the lakes are synonymous and, when biota (including humans) are added to that habitat, the lakewide ecosystem is presented.

A large number of integrated factors determine the habitat and changes therein. The individual chapters of this Plan are designed to measure certain of these factors and changes, i.e. they serve as building blocks to reach a goal or goals.

Collectively, the various surveillance components are also some of the major components of the habitat (ecosystem). Habitat and its quality and quantity provide the common linkage for the components of this Surveillance Plan. The quality of the habitat, including the quality of human life dependent on it, can be described directly by the water quality and the abundance and variety of the associated biota. While the common questions asked are oriented towards human safety and health, i.e. is the water safe to drink or swim in, are the fish safe to eat, more subtle concerns about

ecosystem integrity must also be the focus of these surveillance plans. While human health considerations are addressed by the plans, for example the sport fish contaminant components and the beach surveillance components, the level of discussion in each of the plans varies. Lake Ontario, the Niagara & St. Lawrence Rivers have more emphasis on human health than the plans for the upper lakes. This reflects the level of impact to those regions and the resulting level of concern from human activity, particularly the impacts of toxic substances. Furthermore, the plans are primarily oriented toward protecting the aquatic ecosystem and, therefore, do not include for example the various drinking water monitoring programs established by the jurisdictions. Finally, the basic premise is accepted that if those components of the biota intimately and directly associated with the waters of the Great Lakes are protected, then humans will also be protected and that those components of the biota will also indicate impact sooner than human populations from degraded water quality.

In preparing this ecosystem surveillance plan with its emphasis on anthropogenic stresses, the following questions were considered:

1. What is the present condition of the ecosystem?
2. What was the historic condition of the ecosystem?
3. Have the objectives of the Great Lakes Water Quality Agreement been altered?

This Surveillance Plan has been developed to help answer these questions.

At the outset, this Plan represents an attempt to integrate the necessary components, with the aim of achieving greatly improved data quality and comparability over the whole of the Great Lakes. The first requirement for the ongoing program is that plans be established to complete this process of linking the components from water quality programs through the various levels of the food chain. Historical data series should not be abandoned, simply to satisfy the need for coordination and ways must be found to phase over to an ecosystem perspective with minimal loss of comparability with past data.

The second requirement is creation of an evaluation process which will measure progress towards the ideal program.

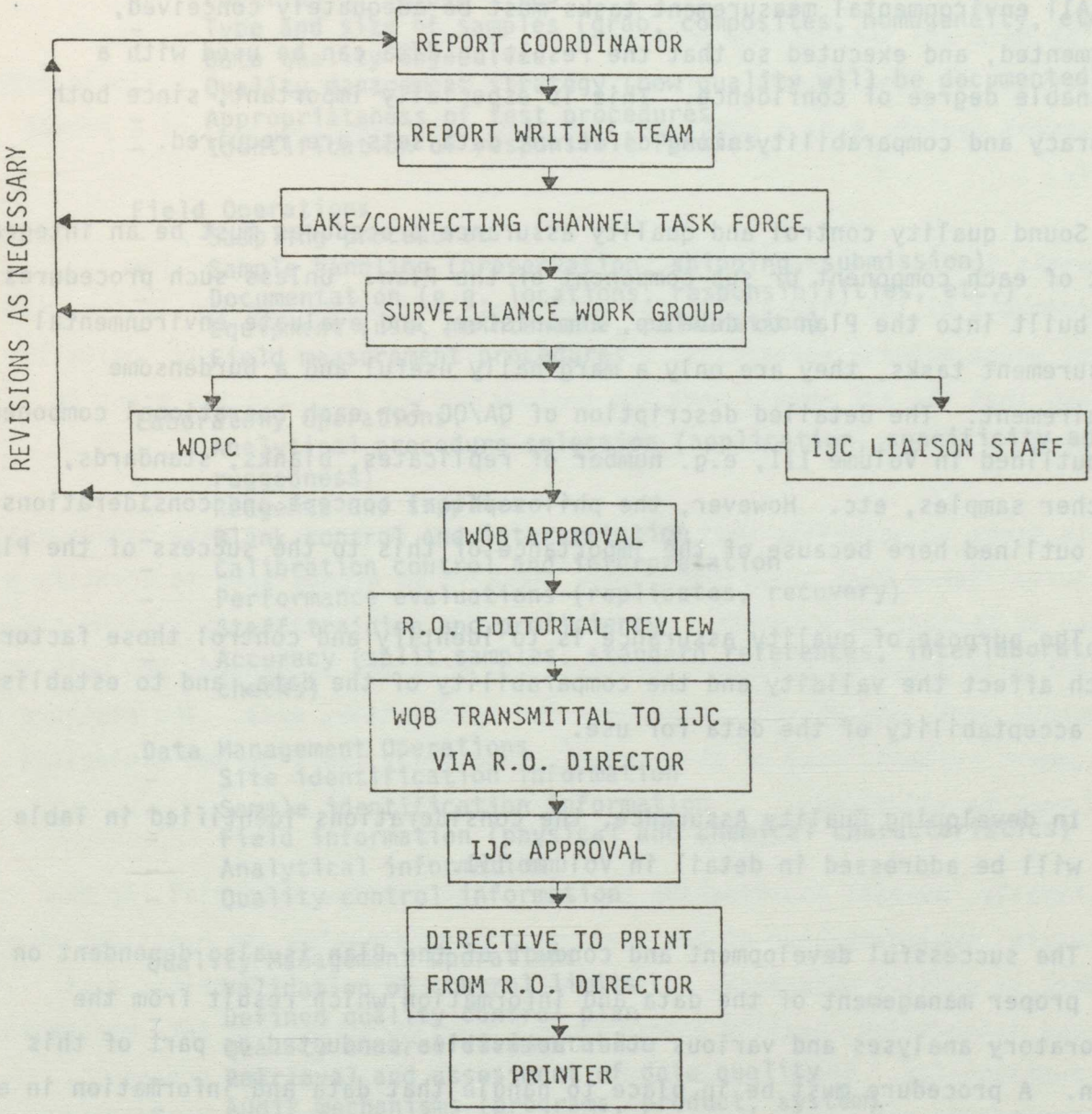
The third requirement is some assurance of program continuity and the intent of this Plan is to make surveillance efforts more effective in an ecosystem sense.

The data derived from the conduct of this Plan will be used to prepare periodic reports on the status of each of the Great Lakes. The reports will address the issues identified, in terms of the specific considerations presented in each chapter or program element of the Plan. The reports will be prepared under the auspices of the Lake Task Forces and the Surveillance Work Group of the International Joint Commission's Great Lakes Water Quality Board, as shown in Figure 2.1.

The Plan proposes that certain activities be conducted on an ongoing basis, others annually, and still other activities less frequently. Therefore, the content of each report will reflect the activities conducted during the reporting period. The Surveillance Work Group proposes a regular reporting schedule of work activities and elements at 12-to-18 month intervals for input to the Water Quality Board's biennial reports to the International Joint Commission regarding Great Lakes water quality. Periodic state-of-the-lake reports will also be prepared at three-to-five year intervals, as appropriate.

It should also be emphasized that the plans are not seen as fixed or static documents, and that they will continue to evolve as further information becomes available. Current activities underway are, a review of the sampling design for the Straits of Mackinac and development of monitoring techniques for areas of concern. The latter will allow the development of detailed monitoring for each area of concern that will also be part of the remedial action plans for the areas of concern. Similarly, habitat monitoring is under development in cooperation with the Habitat Advisory Board of the Great Lakes Fishery Commission. The individual Lake and Connecting Channels Task Forces will be responsible for reviewing the plans and updating them as necessary through the Surveillance Work Group.

FIGURE 2.1


REPORT COORDINATOR
REPORT WRITING TEAM
LAKE/CONNECTING CHANNEL TASK FORCE
SURVEILLANCE WORK GROUP
WQPC
IJC LIAISON STAFF
WQB APPROVAL
R.O. EDITORIAL REVIEW
WQB TRANSMITTAL TO IJC VIA R.O. DIRECTOR
IJC APPROVAL
DIRECTIVE TO PRINT FROM R.O. DIRECTOR
PRINTER
REVISIONS AS NECESSARY

A key ingredient to the success of the Surveillance Plan is that the data generated within each program element must be internally consistent, comparable, and valid. In addition, the data must also be comparable among program elements.

All environmental measurement tasks must be adequately conceived, documented, and executed so that the resulting data can be used with a definable degree of confidence. This is especially important, since both accuracy and comparability among different data sets are required.

Sound quality control and quality assurance procedures must be an integral part of each component or sub-component of the Plan. Unless such procedures are built into the Plan to develop, administer, and evaluate environmental measurement tasks, they are only a marginally useful and a burdensome requirement. The detailed description of QA/QC for each operational component is outlined in Volume III, e.g. number of replicates, blanks, standards, voucher samples, etc. However, the philosophical concept and considerations are outlined here because of the importance of this to the success of the Plan.

The purpose of quality assurance is to identify and control those factors which affect the validity and the comparability of the data, and to establish the acceptability of the data for use.

In developing Quality Assurance, the considerations identified in Table 2.1 will be addressed in detail in Volume III.

The successful development and conduct of the Plan is also dependent on the proper management of the data and information which result from the laboratory analyses and various other activities conducted as part of this Plan. A procedure must be in place to handle that data and information in a timely and coordinated fashion, and the QA/QC mechanism must ensure that data handling, data reporting, and statistical analyses are comparable for use in preparation of periodic reports on the status of the lakes.

To ensure that the reports address the identified issues in the most forthright manner, the right data must be available at the right time and in

TABLE 2.1

Project Plans
- Project objectives and design
- Number of samples
- Location of sample sites
- Type and size of samples (grab, composites, homogeneity, etc.)
- Data quality objectives
- Quality management strategy (how quality will be documented)
- Appropriateness of test procedures
- Identification of responsible Parties

Field Operations
- Sampling procedures
- Sample handling (preservation, shipping, submission)
- Documentation (e.g. locations, responsibilities, etc.)
- Equipment (use, maintenance, calibration)
- Field measurement procedures

Laboratory Operations
- Analytical procedure selection (application, specificity and ruggedness)
- Reagents and supplies
- Blank control and interpretation
- Calibration control and interpretation
- Performance evaluations (replicates, recovery)
- Staff training and proficiency
- Accuracy (split samples, standard references, interlaboratory checks)

Data Management Operations
- Site identification information
- Sample identification information
- Field information (physical and chemical characteristics)
- Analytical information
- Quality control information

Quality Management Operations
- Validation of control limits
- Defined quality control plan
- Quality control documentation
- Retrieval and assessment of data quality
- Audit mechanisms (programs, product, system)

External Validations
- Split samples
- Interlaboratory comparision studies

the right format. These requirements dictate a particular end product of the data handling exercise, which means that consideration must be given to the models, graphs, tables, and other particulars regarding the presentation of the information. These requirements, in turn, dictate how data must be entered into the data management system.

The data and information requirements, which are necessary for the development of good reports, strongly imply the desirability of a single data management system, e.g. a computer, operated under the auspices of a single entity.

Since there is a need to manage these data, in order to meet the requirements of the Plan and of the Agreement, and since the IJC is the only entity whose mandate encompasses the entire Great Lakes Basin, it logically follows that the IJC should have the responsibility for, and the means to manage data in the most cost efficient manner.

In order to establish what the Plan requires in terms of data management, the Surveillance Work Group feels that there is an urgent need to identify a person or persons to assemble information about what management systems are presently in place in the jurisidctions, how data are exchanged, how well the exchanges work, and present procedures for reformatting data. The plethora of management systems, many of them manual, especially for fish and biological data must be addressed.

Finally, overall coordination and oversight is also essential for the successful implementation of the Plan, as is coordination and oversight of all aspects of quality assurance. Effective coordination and oversight must address integration, quality assurance and data validity, and data management and availability. These are essential, in order to allow for proper interpretation and use of data. Further, mechanisms for such coordination and oversight must be in place before the activities called for in the Plan go forward. This will be the responsibility of an appointed quality assurance coordinator employed by the Parties in cooperation with the IJC Regional Office staff in Windsor.