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Upper Great Lakes Water Quality Studies: Preliminary Study Plan

International Joint Commission. Upper Great Lakes Reference Group

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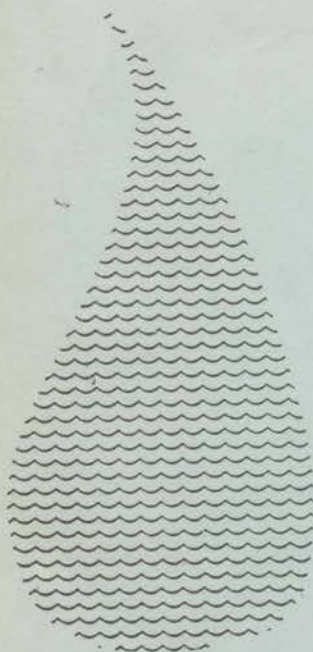
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Upper Great Lakes

Water Quality Studies

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PRELIMINARY STUDY PLAN



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JUN 25 1973

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By IJC Upper Great Lakes Reference Group

April, 1973

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PRELIMINARY STUDY PLAN

IJC UPPER GREAT LAKES REFERENCE GROUP

UPPER GREAT LAKES WATER QUALITY STUDIES

PRELIMINARY STUDY PLAN

Subsequently, the Water Quality Board, established by the IJC, instructed the International Upper Lakes Reference Group, also established by the IJC, to provide a preliminary study plan, with a schedule and costs appropriate for the questions posed in the Upper Lakes Reference, Study.

(1) Are the waters of Lake Superior and Lake Huron being polluted to either side of the boundary to an extent (a) which is causing or is likely to cause injury to the life or property on the other side of the boundary; or (b) which is causing, or likely to cause, a degradation of existing levels of water quality in any part of the lake or in downstream portions of the Great Lakes system?

(2) If the foregoing questions are answered in the affirmative, to what extent, by what causes, and in what localities is such pollution taking place?

(3) If the Commission should find that pollution of the character just referred to is taking place, what remedial measures would, in its judgment, be most practicable to restore and protect the quality of the waters, and what would be the probable cost?

(4) In the event that the Commission should find that little or no pollution of the character referred to is taking place at the present time, what remedial measures would, in its judgment, be most practicable to ensure that such pollution does not occur in the future, and what would be the probable cost?

By

IJC UPPER GREAT LAKES REFERENCE GROUP

April, 1973

PRELIMINARY STUDY PLAN

IJC UPPER GREAT LAKES REFERENCE GROUP

On April 15, 1972, the United States and Canada signed an Agreement concerning Great Lakes Water Quality which included among other items a Reference to the International Joint Commission to study pollution problems of Lake Huron and Lake Superior.

Subsequently, the Water Quality Board, established by the IJC, instructed the International Upper Lakes Reference Group, also established by the IJC, to provide a preliminary study plan, with a schedule and costs appropriate for the questions posed in the Upper Lakes Reference, namely:

(1) Are the waters of Lake Superior and Lake Huron being polluted on either side of the boundary to an extent (a) which is causing or is likely to cause injury to health or property on the other side of the boundary; or (b) which is causing, or likely to cause, a degradation of existing levels of water quality in these two lakes or in downstream portions of the Great Lakes System?

(2) If the foregoing questions are answered in the affirmative, to what extent, by what causes, and in what localities is such pollution taking place?

(3) If the Commission should find that pollution of the character just referred to is taking place, what remedial measures would, in its judgment, be most practicable to restore and protect the quality of the waters, and what would be the probable cost?

(4) In the event that the Commission should find that little or no pollution of the character referred to is taking place at the present time, what preventive measures would, in its judgment, be most practicable to ensure that such pollution does not occur in the future and what would be the probable cost?

The date given by the Water Quality Board for submission to it of the final report was December 31, 1975.

This document contains a proposed Study Plan which should be considered as preliminary and subject to intensive review and implementation in the immediate future.

In the brief time available to prepare this Study Plan, the Reference Group has consulted with scientists and engineers within the government bodies which are most likely to participate in the study. From these sources, most of the study proposals and virtually all of the cost estimates have been obtained. Some major promises were adopted in the preparation of this Study Plan. First, the Canada-U.S. Agreement makes specific reference to the "non-degradation" of the waters in the Upper Great Lakes. Consequently,

it is considered to be highly important to establish baseline levels of concentrations and distributions of materials in each of these lakes. Secondly, the Study Group has strongly recognized that the Upper Great Lakes differ markedly from the Lower Great Lakes in that the more serious existing and potential pollution problems exist in the waters of embayments and the coastal waters adjacent to point sources. For this reason, considerations of each lake merely as a whole would cause the most serious pollution problems to be overlooked.

The Study Plan includes several distinct items of attention. These particular items, and the order in which they appear, are not based solely on the science of the problems being investigated, but rather on the basis of practicalities, such as program management and costing. In many cases, specific proposals by study groups which provide details of these items have been reviewed by the Reference Group. In all cases, the Reference Group has identified a costing source and potential study participants.

I Background Information on the Basin and its Population

The proposed water quality study of the Upper Lakes will require preparation of background summaries of the characteristics of basin and atmospheric properties which are influential. This broadly includes: basin geology, hydrology, climate, population characteristics, land use and development, and water uses.

Although much of this requirement is straight-forward, physical and social scientists involved in various aspects of this Study defined later should provide certain specific summary requirements.

This aspect of the Study should be undertaken in conjunction with the same task of the Land Drainage Reference Group.

II Surveys of the Main Bodies of the Upper Lakes

In order to enable assessment to be made of the existence and movements of pollutants in the main bodies of Lake Huron and Lake Superior, and to provide bases for non-degradation criteria, collections of chemical, physical, biological and geological data are recommended.

A broad range of chemical data is required, similar to that collected for the Lower Lakes in the previous IJC study, but with increased emphasis on pesticides, PCBs, mercury and phenols, especially near the coastal regions. Data on the sediments are needed to ascertain the existence and pathways of certain pollutants (e.g. mercury), and the history of pollution occurrence. Temperature data are needed in order to evaluate the role of thermal structure in the occurrence and movements of pollutants in various parts of the lakes, and those limnological processes which encourage productivity.

Biological and microbiological data for the lower stages of production are needed to assess trophic levels, influences of pollutants on populations, pollution pathways, and the occurrence and nature of bacteria populations. Information on fish populations and the occurrence of pollutants in fish is also required, but has not yet been introduced into the Study Plan.

Excluding the fisheries aspects, data of the above types have been recently collected in all lakes by the Department of the Environment, Canada. A variety of data also exists from previous years, collected by several U. S. and Canadian agencies. These collections are almost adequate for Lake Huron, except in the case of certain items (Hg, PCB, pesticides, phenols) which should be sampled, especially in the coastal regions. Considerable additional sampling of all types is needed for Lake Superior and Georgian Bay, and for both lakes in winter months.

Accordingly, it is recommended that the following "main lake" surveys be done:

1. 6 or 7 surveys of Lake Superior; chemical, biological, and physical (C, B, P) during 1973.
2. 4 surveys of Georgian Bay (C, B, P) during 1974.
3. 2 winter surveys (C, B, P) of Lake Superior and two of Lake Huron, winter of 1973-1974.
4. 2 "special" surveys of Lake Huron during 1974 to collect data itemized above, at about 20 stations, emphasizing nearshore regions.
5. A geological survey of the sediments of Lake Superior, during 1973.

In order to provide information on the transboundary movements of pollutants, a review of past current meter data and a study of a data collection of the U. S. Environmental Protection Agency will be included. Further studies during 1974 would be proposed, if needed. Two proposed additional circulation studies, one in western Lake Superior and one in southern Lake Huron, to examine transboundary movements in regions of known interest are proposed by DOE, Canada and should be considered. These are not included in the cost summary.

Thermal and water color surveys using remote sensing techniques from aircraft and satellites are recommended, both to obtain basic data and to evaluate possible uses of these techniques for surveillance.

III Sources and Characteristics of Material Inputs

In order to determine the net effects of materials inputs to lakes, materials budgets should be calculated. The loadings of materials from municipalities, industries and tributaries should be monitored more intensively and with a high degree of accuracy. A list of recommended items for tributary inputs is included in Appendix A. This list should be applied at least once for each municipal and industrial discharge direct to the lakes. The atmosphere as a source of materials will also be included in the study.

Movement of materials between lakes is an important materials budget consideration. Particular attention should be paid to interlake transport between Lake Michigan and Lake Huron, and between Georgian Bay and Lake Huron. Studies on the former are proposed by the U. S. Lake Survey and on the latter by DOE, Canada.

A close working relationship must be developed with the implementation of the Land Drainage Reference Group studies, in order to enable the Upper Lakes study to benefit from those studies in determinations of the nature and quantities of inputs from land drainage.

IV Geographic and Water Resources Relationships

Materials budget data collections such as outline above will hopefully be sufficient to determine an assessment of present conditions of loading to and deterioration of the Upper Great Lakes. In order to realistically assess future problems and permit recommendations on programs to alleviate anticipated problems, assessments of trends in conditions which cause pollution problems must be made. These will include studies of the interrelationships between population, water uses, and the effects of these upon materials inputs to the lakes. Studies on the future trends which will influence these interrelationships are considered to be an important part of this study. The influences of human and other activities on the land drainage influences on these lakes will be provided in consultation with the Land Drainage Reference Group.

V Coastal and Local Effects Studies

The Reference Group has recognized that high priority must be given to the coastal regions of the Upper Lakes as the majority of presently identifiable water quality problems exist in the bay, and coastal waters adjacent to sources of inputs. Consequently, studies in coastal regions are required to identify the occurrence and extent of water quality impairment and delineate the sources contributing to this impairment in order to determine what and where remedial and preventative measures should be taken for the protection of the local and lake wide quality. Environmental

response studies at major waste sources will define their zone of influence and provide the basis for establishment of limits on "mixing zones" and "localized areas" as required by the Agreement. Recommendations will be made as to abatement actions necessary to eliminate problems and maintain non-degradation criteria.

A major program for studies of this nature on Ontario near-shore waters of Lakes Huron and Superior and in the St. Marys River has been proposed by the Ontario Ministry of the Environment. Specific studies are planned by the Province for the examination of the impact of major waste sources at some twelve locations in the Upper Lakes.

Specific studies at point source locations have also been proposed by each of the States of Michigan and Wisconsin. In addition, the federal U.S. Environmental Protection Agency is sponsoring and proposes to undertake studies in embayments containing known pollution problems. The Department of the Environment, Canada, has proposed a "process" oriented study, which would be undertaken at a known problem source, but which would be directed towards improving the understanding of the differing ways specific pollutants enter, mix with and affect the lake system, so that the Study directors can better assess future trends in degradation and better define criteria for mixing zones and localized areas.

The Reference Group has been advised that, in the case of the Reserve Mining operations which has received considerable public attention, considerable data are available which will be examined as to its sufficiency.

Included in the costs shown later, for this study item, are those related to studies of transboundary movements of pollutants in the St. Marys River region.

VI Main Lake Effects Studies

Section II defined the data collection program which would permit scientific and engineering analyses of the concentrations and distributions of pollutants in the main bodies of the two Upper Great Lakes. This section (VI) is meant to define the interpretations of those data which are considered to be necessary to meet the objectives of the Upper Lakes Reference.

Appropriate scientists should be designated to examine and interpret the limnological, meteorological and related data which are available and will be collected for this study and indeed participate in the detailed criteria for the data collection, and requested to provide information on baseline concentrations of pollutants, assessments of lake conditions and processes which cause or influence pollution problems, and provide recommendations for abatement and other action

which would serve to eliminate existing problems and ensure future non-degradation. Attempts should be made to interpret distribution of properties and data of currents in terms of trans-boundary movement of pollutants, in a realistic manner.

Other Items

The Upper Lakes study report should include a resume of remedial measures available and recommended which would influence the effects of existing and predicted quantities of pollutants. At some time during the Study, the Reference Group may wish to recommend commencement of research and development of remedial measures to meet particular identified needs.

Studies on public perception and attitude are considered to be of value in connection with the overall assessment of public involvement in pollution-problem identification and abatement programs. However, such studies are not deemed to be within the terms of reference of this Group. Similarly, although studies on institutional arrangements have been conducted by the Great Lakes Basin Commission and others are planned by Department of the Environment, Canada, these are also not included as part of this Study Plan.

Appendix B contains a detailed breakdown of costs per fiscal year, with reference to the most probable federal, state or provincial participant. Appendix C shows the amounts of proposed costs to be supplied from ongoing programs, and the additional funding required to support the study.

Recommendations

1. It is recommended that the Water Quality Board act immediately to approve, and establish a procedure for implementing, this Study Plan. As this is a preliminary plan, broad tasks must be assigned to groups of experts for detailed design criteria.
2. The Water Quality Board and the IJC should conduct a review of the membership of the Upper Lakes Reference Group, in consideration of the role it should play in the implementation of the Study Plan. In particular, strengthening in the realm of scientific expertise in water quality - fisheries aspects should be considered.
3. The successful accomplishment of this study will depend upon timely and adequate funding. It is recommended that the Board seek the assistance of the IJC in drawing this fact to the attention of appropriate agencies.

APPENDIX A

Items for routine sampling of tributaries at least monthly, and more frequently during spring runoff:

Microbiological

total coliform
fecal coliform

Physical

flow
temperature
pH
conductivity
turbidity
suspended solids

Others

As needed, or described in agency programs.

Chemical

dissolved oxygen
phenol
total iron
total phosphorus
ammonia
total nitrogen
chloride
alkalinity
silica
manganese
BOD

Items for sampling at least 3 times per year, for background information:

Radiological

gross beta
tritium
strontium
radium

Organics

pesticides
oil
chlorinated hydrocarbons
total organic carbon
polychlorinated biphenols

Others

Cyanide
fluoride
sulphates
COD

Metals

Arsenic
barium
cadmium
chromium
copper
lead
mercury
nickel
selenium
zinc
calcium
magnesium
sodium
potassium

Appendix B: Preliminary Upper Great Lakes Study Plan
SCHEDULES AND COSTS

Study Item	1972/73		1973		1974		1975		1976		CALENDAR TIME STUDY DURATION FISCAL TIME	Source
	MY	\$1000	MY	\$1000	MY	\$1000	MY	\$1000	MY	\$1000		
I												
Background information: hydrology, climate, geology, population, land use, water use			.4	8						2		Canada
			.5	12						1		U.S.A.
				2								Ontario
II												
Main-Lake surveys												
- Lake Superior (C,B,P)	100			100								U.S.A.
			31.5	600	4	98						Canada
- Lake Superior (Geology)			7	125	4.5	90						Canada
- Winter, Huron & Superior				90								U.S.A.
- Lake Huron, special surveys				175		50						U.S.A.
					8	120						Canada
						50						U.S.A.
- Georgian Bay surveys					15	165						Canada
- Remote Sensing			1	40	1	40						Canada
III												
Sources and characteristics of material input.												
- direct discharges	194			194						65		U.S.A.
			62	62		200				12		Ontario
			18	18		62				9		Michigan
			25	25		18				13		Wisconsin
						25						Minnesota
- atmospheric loading			1	30	1	30			.5	15		Canada

1972/73 1973/74 1974/75 1975/76

	1972/73		1973/74		1974/75		1975/76		
	MY	\$1000	MY	\$1000	MY	\$1000	MY	\$1000	
- interlake transport (Michigan-Huron) (Huron-Georgian Bay)		161		169		30			U.S.A. Canada Canada
			.2	50	2	100			
					3.5	58			
IV Relationships between, & trends in, geographic & water resources characteristics.			2	30	.5	12			U.S.A. Canada Ontario
				6.5		42	.5	5	
						6.5		8	
V Local effects (pt. Source Study)		150	12	476	16	460		205	Ontario Canada
		450		285		390	3.7	52	Canada U.S.A.
				520		175			
VI Whole-lake effects, materials balance, and other interpretations of item 2 data			19	347	18.5	340	8.5	120	Canada U.S.A. U.S.A.
			3	75	3	75	2	50	
- transboundary movements				51		47			U.S.A. Ontario U.S.A.
			2	70		50		25	
				50	2	50	1	25	Ontario U.S.A.
VII Peripheral costs for engineering, computers, drafting			7.5	250	8	375	1.5	67	Canada Ontario U.S.A.
								28	
VIII Report writing					1	25	1	35	Ontario U.S.A. Canada
					1	25	1.5	50	
			5.5	1436	6.5	514	4	110	U.S.A.
TOTALS		905	80.6	1725	84.5	1833	16.2	311	Canada Ontario Michigan Wisconsin Minnesota
		150		754.5		716.5		332	
		62		62		62		31	
		18		18		18		9	
		25		25		25		13	

Notes: Ontario costs contain some funds supplied by Canada under cost sharing agreements.

Except for Canada, man-year estimates are incomplete.

Costs are estimates, provision of funds is subject to funding processes.

APPENDIX C
Preliminary Upper Great Lakes Study Plan

Schedule and Costs

Study Item	ongoing funds		additional requirement		Total		Source
	MY	\$1000	MY	\$1000	MY	\$1000	
I Background information: hydrology, climate, geology, population, land use, water use							Canada Ontario U.S.A.
II Main Lake Surveys		100				100	Canada U.S.A.
III Sources and characteristics of material input		62 18 25 355		147* 4* 43*		..209 22 68 161**	Canada Ontario Michigan Wisconsin Minnesota U.S.A.
IV Relationships between, and trends in, geographic and water resources characteristics							Canada Ontario U.S.A.
V Local effects (Point Source Studies)				150		.. 150	Canada Ontario Michigan Wisconsin Minnesota U.S.A.
VI Whole lake effects, materials balance, other interpretations of Item 2 data		450				450*	Canada U.S.A.
VII Peripheral costs for engineering, computers, drafting, etc.							Canada Ontario U.S.A.
VIII Report writing							Canada Ontario U.S.A.

Note: Man-year figures if complete.

*To be funded from U.S. ongoing funds.

**Total reduced by amount of U.S. support to states.

APPENDIX C
Preliminary Upper Great Lakes Study Plan
Schedule and Costs

Study Item	ongoing funds		additional requirement		Total		Source
	MY	\$1000	MY	\$1000	MY	\$1000	
I Background information: hydrology, climate, geology, population, land use, water use	.2	4	.2	4	.4	8	Canada
	.5	12		2	.5	12	Ontario U.S.A.
II Main Lake Surveys	25.5	423	13	302	38.5	725	Canada
	2	365			2	365	U.S.A.
III Sources and characteristics of material input	.2	10	1	70	1.2	80	Canada
		125		75		200	Ontario
		62		147*		209	Michigan
		18		4*		22	Wisconsin
		25		43*		68	Minnesota
		363				169**	U.S.A.
IV Relationships between, and trends in, geographic and water resources characteristics	1	15	1	15	2	30	Canada
				6.5		6.5	Ontario U.S.A.
V Local effects (Point Source Studies)	4.5	75	7.5	210	12	285	Canada
				476		476	Ontario
				65*		65	Michigan
				55*		55	Wisconsin
		520				400**	Minnesota U.S.A.
VI Whole lake effects, materials balance, other interpretations of Item 2 data	5.5	90	13.5	257	19	347	Canada
		126				126	U.S.A.
VII Peripheral costs for engineering, computers, drafting, etc.	4.5	150	3	100	7.5	250	Canada
	2	50		70	2	70	Ontario
						50	U.S.A.
VIII Report writing							Canada
							Ontario
							U.S.A.

Notes: Man-years figures are incomplete. *To be funded from U.S. ongoing funds. **Total reduced by amount of U.S. support to states.

APPENDIX C
 Preliminary Upper Great Lakes Study Plan
 Schedule and Costs

Study Item	ongoing funds		additional requirement		Total		Source	
	MY	\$1000	MY	\$1000	MY	\$1000		
Background information: hydrology, climate, geology, population, land use, water use	I						Canada Ontario U.S.A.	
Main Lake Surveys	II	22	268 100	9.5	205	31.5	473 100	Canada U.S.A.
Sources and characteristics of material input	III	3	48	3.5	140	6.5	188	Canada
			125 62 18 25 30		75		200 62 18 25 30	Ontario Michigan Wisconsin Minnesota U.S.A.
Relationships between, and trends in, geographic and water resources characteristics	IV	1.5	21	1.5	21	3	42	Canada
		0.5	12		6.5	0.5	6.5 12	Ontario U.S.A.
Local effects (Point Source Studies)	V	6.5	120	9.5	270	16	390	Canada
			175		460		460	Ontario Michigan Wisconsin Minnesota U.S.A.
Whole lake effects, materials balance, other interpretations of Item 2 data	VI	5	100 122	13.5	240	18.5	340	Canada
			240		135		122	U.S.A.
Peripheral costs for engineering, computers, drafting, etc.	VII	4.5	240	3.5	135	8	375	Canada
		2	50		50	2	50	Ontario U.S.A.
Report writing	VIII	1	25	1	25	1	25	Canada
			25				25	Ontario U.S.A.

Notes: Man-years figures are incomplete.
 *To be funded from U.S. ongoing funds.
 **Total reduced by amount of U.S. support to states.

Study Item	ongoing funds		additional requirement		Total		Source
	MY	\$1000	MY	\$1000	MY	\$1000	
I Background information: hydrology, climate, geology, population, land use, water use		2		1		2 1	Canada Ontario U.S.A.
II Main Lake Surveys							Canada U.S.A.
III Sources and characteristics of material input	0.5	10 43 31 9 13		5 22	0.5	15 65 31 9 13	Canada Ontario Michigan Wisconsin Minnesota U.S.A.
IV Relationships between, and trends in, geographic and water resources characteristics			0.5	5 8	0.5	5 8	Canada Ontario U.S.A.
V Local effects (Point Source Studies)			3.7	52 205	3.7	52 205	Canada Ontario Michigan Wisconsin Minnesota U.S.A.
VI Whole lake effects, materials balance, other interpretations of Item 2 data	4 2	45 50	4.5	75	8.5 2	120 50	Canada U.S.A.
VII Peripheral costs for engineering, computers, drafting, etc.	0.5 1	38 25	1	29 25	1.5 1	67 25 25	Canada Ontario U.S.A.
VIII Report writing	1	35	1.5	50 28	1.5 1	50 28 35	Canada Ontario U.S.A.

Notes: Man-years figures are incomplete. *To be funded from U.S. ongoing funds. **Total reduced by amount of U.S. support to states.

APPENDIX C

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SUMMARYSCHEDULES AND COSTS

	<u>ONGOING</u>		<u>ADDITIONAL</u>		<u>TOTAL</u>	
	<u>MY</u>	<u>\$ 1000</u>	<u>MY</u>	<u>\$ 1000</u>	<u>MY</u>	<u>\$ 1000</u>
<u>1972/3</u>						
Canada						
Ontario				150		150
Michigan		62		147*		209
Wisconsin		18		4*		22
Minnesota		25		43*		68
U.S.A.		905				711**
TOTAL		1,010		150**		1,160
<u>1973/4</u>						
Canada	41.4	767	39.2	958	80.6	1,725
Ontario		125		629.5		754.5
Michigan		62		212 *		274
Wisconsin		18		59*		77
Minnesota		25		43*		68
U.S.A.	2.5	1,436			2.5	1,122**
TOTAL	43.9	2,433	39.2	1,587.5**		4,020.5
<u>1974/5</u>						
Canada	42.5	797	42	1,036	84.5	1,833
Ontario		125		591.5		716.5
Michigan		62				62
Wisconsin		18				18
Minnesota		25				25
U.S.A.	3.5	514			3.5	514
TOTAL	46.0	1,541	42	1,627.5	88	3,168.5
<u>1975/6</u>						
Canada	5	95	11.2	216	16.2	311
Ontario		43		289		332
Michigan		31				31
Wisconsin		9				9
Minnesota		13				13
U.S.A.	4	110			4	110
TOTAL	9	301	11.2	505	20.2	806

Notes: Man-years figures are incomplete.

*To be funded from U.S. on-going funds.

**Total reduced by amount of U.S. support to states.