Report

OF THE

INTERNATIONAL JOINT COMMISSION

UNITED STATES AND CANADA

ON THE

Pollution Of Boundary Waters

WASHINGTON 1950 OTTAWA

INTERNATIONAL JOINT COMMISSION

UNITED STATES	CANADA
A. O. STANLEY, Chairman	A. G. L. McNAUGHTON, Chairman
ROGER B. McWHORTER	GEORGE SPENCE
EUGENE W. WEBER	J. LUCIEN DANSEREAU
Jesse B. Ellis, *Secretary*	E. M. Sutherland, *Secretary*

Counsel

On behalf of	*On behalf of*
Government of United States	*Government of Canada*
William R. Vallance	Kenneth J. Burbridge

LETTER OF TRANSMITTAL

The following letter was sent to the Secretary of State, Washington, D. C., by the secretary of the United States Section of the International Joint Commission and to the Secretary of State for External Affairs, Ottawa, Canada, by the secretary of the Canadian Section of the International Joint Commission:

October 11, 1950.

Sir,

I have the honor to transmit a copy of Report of the International Joint Commission to the Governments of Canada and the United States in the matter of the pollution of boundary waters dated October 11, 1950.

Under the reference of April 1, 1946 the Commission was directed to investigate and report upon the waters of the St. Clair River, Lake St. Clair and the Detroit River; under date of October 2, 1946, the reference was extended to include the waters of the St. Marys River from Lake Superior to Lake Huron; and on April 2, 1948, the Commission was directed to report on the waters of the Niagara River from Lake Erie to Lake Ontario. Copies of the Reports of the Board of Technical Advisers, covering these two sections of the investigation are enclosed.

I have the honor to be,

Sir,

Your obedient servant,

JESSE B. ELLIS,
Secretary, United States Section

E. M. SUTHERLAND,
Secretary, Canadian Section

Report of

The International Joint Commission

United States and Canada

On The

Pollution Of Boundary Waters

The Secretary of State for the Government of the United States and the Secretary of State for External Affairs for the Government of Canada on April 1, 1946, made the following Reference to the International Joint Commission through identical letters addressed to the United States and Canadian sections of the Commission.

"I have the honor to advise you that the Governments of the United States and Canada have been informed that the waters of the St. Clair River, Lake St. Clair and the Detroit River are being polluted by sewage and industrial wastes emptied into those waters. Having in mind the provisions of Article IV of the Boundary Waters Treaty signed January 11, 1909, that boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other side, the two Governments have agreed upon a joint Reference on the matter to the International Joint Commission, pursuant to the provisions of Article IX of said Treaty. The Commission is requested to inquire into and report to the two Governments upon the following questions:

(1) Are the waters referred to in the preceding paragraph, or any of them, actually being polluted on either side of the boundary to the injury of health or property on the other side of the boundary?

(2) If the foregoing question is 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 measures for remedying the situation would, in its judgment, be most practicable from the economic, sanitary and other points of view?

(4) If the Commission should find that the construction or maintenance of remedial or preventive works is necessary to render the waters sanitary and suitable for domestic and other uses, it should indicate the nature, location and extent of such works, and the probable cost thereof, and by whom and in what proportions such cost should be borne.

For the purpose of assisting the Commission in making the investigation and recommendations provided for in this Reference, the two Governments will, upon request, make available to the Commission the services of engineers and other specially qualified personnel of their governmental agencies, and such information and technical data as may have been acquired by such agencies or as may be acquired by them during the course of the investigation.

The Commission should submit its report and recommendations to the two Governments as soon as practicable."

Extension of the Reference to Include the St. Marys River

The Government of Canada, on October 2, 1946, and the Government of the United States, on October 3, 1946, transmitted supplementary letters to the Commission, extending the scope of the foregoing Reference to include the waters of the St. Marys River from Lake Superior to Lake Huron.

Appointment of Board of Technical Advisers

Upon receipt of the Reference, the Commission, in May 1946, appointed a board of sanitary experts to act as technical advisers to the Commission. In addition to the personnel made available by the two Governments, the Board included representatives of the State of Michigan and the Province of Ontario. Members of the board were:

For the United States

J. K. Hoskins, Chief, Sanitary Engineering Division, and Assistant Surgeon General, U. S. Public Health Service, Washington, D. C. (1946-1947)

L. M. Fisher, Sanitary Engineer Director, U. S. Public Health Service, Washington, D. C. (1947-1949)

L. F. Warrick, Senior Sanitary Engineer, U. S. Public Health Service, Washington, D. C. (1949-1950)

M. LeBosquet, Jr., Sanitary Engineer Director, U. S. Public Health Service, Cincinnati, Ohio.

For Canada

G. H. Ferguson, Chief, Public Health Engineering Division, Department of National Health and Welfare, Ottawa, Ontario.

W. R. Edmonds, Senior Sanitary Engineer, Public Health Engineering Division, Department of National Health and Welfare, Ottawa, Ontario.

For Michigan

J. M. Hepler, Director, Division of Engineering, Michigan Department of Health, Lansing, Michigan.

L. F. Oeming, Sanitary Engineer, Michigan Stream Control Commission, Lansing, Michigan.

For Ontario

A. E. Berry, Director, Division of Sanitary Engineering, Ontario Department of Health, Toronto, Ontario.

A. V. DeLaporte, Chemical Engineer, in charge of Experimental Station, Ontario Department of Health, Toronto, Ontario.

The foregoing Board was requested by the Commission to advise also on the October extension of the Reference to cover the St. Marys River from Lake Superior to Lake Huron.

Extension of Reference to Include the Niagara River Area

The scope of the Reference was again extended on April 2, 1948 to cover the waters of the Niagara River from Lake Erie to Lake Ontario. Inasmuch as this section involved different State representation, the Commission appointed a separate Board of Technical Advisers, as follows:

For the United States

L. M. Fisher, Sanitary Engineer Director, U. S. Public Health Service, Washington, D. C. (1948-1949)

L. F. Warrick, Senior Sanitary Engineer, U. S. Public Health Service, Washington, D. C. (1949-1950)

M. LeBosquet, Jr., Sanitary Engineer Director, U. S. Public Health Service, Cincinnati, Ohio.

For Canada

J. R. Menzies, Chief, Public Health Engineering Division, Department of National Health and Welfare, Ottawa, Ontario.

W. R. Edmonds, Senior Sanitary Engineer, Public Health Engineering Division, Department of National Health and Welfare, Ottawa, Ontario.

For New York

Earl Devendorf, Director, Bureau of Environmental Sanitation, New York State Department of Health, Albany, N. Y.

C. R. Cox, Chief, Water Supply Section, Bureau of Environmental Sanitation, New York State Department of Health, Albany, N. Y.

For Ontario

A. E. Berry, Director, Division of Sanitary Engineering, Ontario Department of Health, Toronto, Ontario.

A. V. DeLaporte, Chemical Engineer, in charge of Experimental Station, Ontario Department of Health, Toronto, Ontario.

DESCRIPTION OF AREA COVERED

This report of the International Joint Commission covers all three of the areas specified in the original Reference and its two extensions. The three areas, for which separate reports were made by the technical advisers, are as follows:

Lake Superior-Lake Huron Section

This section is the relatively small and sparsely settled region adjacent to the St. Marys River, the connecting water between Lake Superior and Lake Huron. The area of principal interest is the vicinity of the adjoining cities of Sault Ste. Marie, Michigan and Sault Ste. Marie, Ontario, with a combined population of 47,000 (estimated in 1948) and where there are several industrial developments, including a steel mill, a pulp and paper mill, a tar and chemical plant, a carbide manufacturing plant and a leather processing plant.

Lake Huron-Lake Erie Section

The waters connecting Lakes Huron and Erie include the St. Clair River, 40 miles in length, Lake St. Clair, a shallow basin of 430 square miles and the Detroit River, 31 miles in length. This is a heavily settled area with a population, estimated in 1948, of 3,487,000, of which 85 percent is urban, concentrated principally in the highly industrialized Detroit-Windsor area. These connecting waters, which have an average flow of 177,000 cubic feet per second at Detroit, constitute one of the world's greatest waterways. They carry a tonnage, principally ore, coal and grain, which exceeds that of any other waterway in the world. The region encompasses one of North America's most important industrial areas. The region is also highly developed for residential and recreational purposes and the use of the waters under reference for domestic supply, sanitation, industry, recreation, and fish and wildlife is vital to the people of the area.

Lake Erie-Lake Ontario Section

The area adjacent to the Niagara River which connects Lakes Erie and Ontario, has a population, estimated in 1949, of 1,125,000 of which 81 percent is urban, concentrated principally at Buffalo, Tonawanda, North Tonawanda, and Niagara Falls, New York, and at Niagara Falls in Ontario. The Niagara River, about 37 miles in length, falls 326 feet from Lake Erie to Lake Ontario. About half of this fall is concentrated at Niagara Falls, midway in the length of the river. The unusually uniform flow, averaging 202,000 cubic feet per second at the outlet of Lake Erie, and the concentrated drop make possible the development of low cost hydro-electric power which has attracted many industries including

electro-chemical, ferro-alloy, abrasive, chlorine and caustic soda, carbide, steel, fertilizer and pulp and paper.

PROCEDURE OF THE INVESTIGATION

The necessary surveys and studies of the pollution problem were organized by the technical advisers and carried out through the cooperation of the appropriate Federal, State and Provincial agencies concerned. Details of the investigation are given in the reports of the technical advisers which are appended and form part of the Commission's report.

It is pertinent to record that the Commission has found this procedure eminently satisfactory. The boards of technical advisers were made up of senior experts who held positions of responsibility in either country on some activity related to the pollution problem. These experts were able, as a result of their familiarity with the problem, to plan the investigation soundly and, through their official administrative connections, were able to bring the full resources of appropriate governmental agencies in both countries to bear directly upon the problem. Circuitous, time-consuming procedures were thus avoided and the investigations were more comprehensive, more efficiently conducted, and more economical than would have been possible by other procedures. The Commission makes this observation for consideration in connection with possible future references and as an expression of appreciation of the excellent cooperation of all those who participated in these investigations, particularly the representatives of the Province of Ontario and the States of Michigan and New York.

As a preliminary to the investigations, the technical advisers had access to reports on the previous comprehensive pollution studies undertaken by the Commission in 1912, the conclusions of which were published in the final report of the Commission in 1918. Data on the physical characteristics, activities and population of the area were assembled and studied. Examinations were made of known and potential sources of pollution including the waste disposal practices of 61 municipalities, 101 industries and the vessels navigating the waters under reference. More than 100,000 laboratory determinations for bacteriological, limnological, physical and chemical characteristics were made from water samples. Hydrometric data, observations of travel of specific contaminants and results of float tests were analyzed to determine transboundary effects.

Numerous conferences were held by the technical advisers with representatives of municipalities and industries, culminating in a series of public hearings before the Commission to obtain information on waste treatment processes in use or proposed, estimates of cost and time required for institution of the necessary pollution control measures and the views of all concerned towards the specific objectives for pollution control which the Commission had adopted. These hearings took place as follows:

Detroit, Michigan	June 28, 29, 30, 1948
Detroit, Michigan	Sept. 8, 9, 10, 1948
Detroit, Michigan	Nov. 15, 16, 1948
Windsor, Ontario	Nov. 17, 18, 19, 20, 1948
Sault Ste. Marie, Ontario	Nov. 22, 1948
Detroit, Michigan	June 28, 29, 1949
Buffalo, New York	Nov. 15, 16, 1949
Niagara Falls, Ontario	Nov. 17, 1949
Buffalo, New York	Dec. 13, 14, 15, 1949

The results of the extensive field surveys and studies are presented in detail in the reports of the technical advisers which form a part of this report. The findings and recommendations which the Commission has arrived at, after consideration of the results of the investigations and of the Commission's public hearings, are outlined below.

NATURE AND EXTENT OF THE POLLUTION PROBLEM

The population of the 61 municipalities in the three regions covered by this report is 3,557,900. Approximately 96 percent is served by sewer systems and 86 percent has primary treatment of the wastes before discharge into the international waters under reference. Only a minor percentage is served by

systems with secondary or biological treatment. Despite the partial treatment afforded the major portion of domestic sewage, the bacterial concentration in these waters is in places three to four times greater, on the average, than it was in 1912. The total discharge of municipal wastes into the boundary waters under reference is about 750 million U. S. gallons (625 million Imperial gallons) daily. About one-fifth of this amount is untreated and practically all of the remainder is only partially treated.

Industrial wastes, which were of little concern in 1912, are now a major problem. The daily discharge into these boundary waters now averages more than 2 billion U. S. gallons (approximately 1¾ billion Imperial gallons). While much of this is condenser and cooling water which has not been adversely affected by its use for industrial purposes, an appreciable volume of harmful pollutants is discharged daily. These include some 13,000 pounds of phenols, 8,000 pounds of cyanides, 25,000 pounds of ammonium compounds and large quantities of oils and suspended solids of all types.

In addition to the toxic effects of some of the pollutants as discussed later, the industrial waste discharge has a biochemical oxygen demand (B.O.D.) equivalent to the oxygen demand of the untreated sanitary wastes from a population of more than 4,000,000. Thus the industrial wastes produce a greater oxygen requirement on the receiving streams than the combined total of the domestic wastes of the area.

The wastes from vessel traffic through these international waters also constitute a pollution problem. The sewage from vessels at the height of the navigation season is the equivalent of the wastes contributed from a population of 1000 in the St. Marys River area and a population of 3900 in the St. Clair-Detroit River area. In addition, disposal of garbage, bilge water and water ballast creates problems in ports and congested areas. Such disposal is particularly objectionable near water intakes and bathing beaches.

A further pollution problem arises in these waters in connection with the dredging of channels for navigation. The dumping of contaminated dredged material in the Detroit River results in a concentration of pollution in a critical section of the river.

Effects of the Pollution

The discharge of untreated and partially treated municipal wastes into these waters has created a serious health menace and has had adverse economic effects as well. The waterways being polluted are used as a source of domestic water supply for a population of 4 million persons. The extra treatment necessary to make the water safe for domestic use adds to the cost of water supplies. Furthermore, the bacterial concentration at water intakes varies widely and a constant threat exists that extremely high concentrations may occur so suddenly and change so quickly that treatment measures cannot be adjusted to meet them. The precautionary measures that can be taken at water supply intakes are incapable of insuring that such "slugs" of polluted water will not enter the water supplies and cause injury to the health of many water users. The only effective remedy lies in preventing the "slugs" from reaching the water intakes.

Bacterial concentrations at bathing beaches are also a health menace and cause economic losses when beaches must be closed during unsafe periods. Waterfront property values are also adversely affected by unsafe or undesirable conditions caused by pollution.

Industrial wastes contain numerous substances which are not susceptible to water treatment measures commonly used. There is danger to health if concentrations of some of these substances should enter water supplies. Objectionable tastes in domestic water have already been experienced in a number of localities. Fish and wildlife are destroyed by a number of industrial pollutants.

In general, the cumulative effect of uncontrolled waste disposal into these boundary waters seriously reduces the capacity of the waters to perform many beneficial and necessary functions vital to the health, recreation and economy of the people of the area.

Transboundary Effects of Pollution

Several methods were employed to determine whether pollution originating on one side of the boundary had adverse effects on the other. In the 1912 investigation, evidence was presented to show that there was a definite crossing of pollution from one side of the boundary to the other. In the

investigations for this report, observations of currents by means of float tests and study of specific cases of reported travel of pollutants from source to an observed destination demonstrated conclusively that pollution from sources on each side of the boundary had adverse effects on the other. The interchange of waters across the boundary is such that any pollution on either side is a matter of concern to both countries.

OBJECTIVES FOR BOUNDARY WATERS QUALITY CONTROL

In order to permit a more accurate evaluation of the nature and extent of pollution, its effects and the remedial measures necessary, the Commission, in the course of the investigation, adopted the following statement of objectives for boundary waters quality control which was developed by the technical advisers:

"The term "boundary waters" as herein used shall include the waters defined in the references to the International Joint Commission dated April 1, 1946, October 2 and 3, 1946, and April 2, 1948 and are as follows:

St. Clair River, Lake St. Clair, the Detroit River, St. Marys River from Lake Superior to Lake Huron, and Niagara River from Lake Erie to Lake Ontario.

These objectives are for the boundary waters in general, and it is anticipated that in certain specific instances, influenced by local conditions, more stringent requirements may be found necessary.

General Objectives

All wastes, including sanitary sewage, storm water, and industrial effluents, shall be in such condition when discharged into any stream that they will not create conditions in the boundary waters which will adversely affect the use of those waters for the following purposes: source of domestic water supply or industrial water supply, navigation, fish and wildlife, bathing, recreation, agriculture and other riparian activities.

In general, adverse conditions are caused by:

(A) Excessive bacterial, physical or chemical contamination.

(B) Unnatural deposits in the stream, interfering with navigation, fish and wildlife, bathing, recreation, or destruction of aesthetic values.

(C) Toxic substances and materials imparting objectionable tastes and odors to waters used for domestic or industrial purposes.

(D) Floating materials, including oils, grease, garbage, sewage solids, or other refuse.

Specific Objectives

In more specific terms, adequate controls of pollution will necessitate the following objectives for:

(A) *Sanitary Sewage, Storm Water, and Wastes from Water Craft*

Sufficient treatment for adequate removal or reduction of solids, bacteria and chemical constituents which may interfere unreasonably with the use of these waters for purposes aforementioned. Adequate protection for these waters, except in certain specific instances influenced by local conditions, should be provided if the coliform M.P.N. median value does not exceed 2,400 per 100 ml. at any point in the waters following initial dilution.

(B) *Industrial Wastes*

(1) CHEMICAL WASTES—PHENOLIC TYPE

Industrial waste effluents from phenolic hydro-carbon and other chemical plants will cause objectionable tastes or odors in drinking or industrial water supplies and may taint the flesh of fish.

Adequate protection should be provided for these waters if the concentration of phenol or phenol equivalents does not exceed an average of 2 p.p.b. and a maximum of 5 p.p.b. at any point in these waters following initial dilution. This quality in the receiving waters will probably be attained if plant effluents are limited to 20 p.p.b. of phenol or phenol equivalents.

Some of the industries producing phenolic wastes are: coke, synthetic resin, oil refining, petroleum cracking, tar, road oil, creosoting, wood distillation, and dye manufacturing plants.

(2) Chemical Wastes—Other Than Phenolic

Adequate protection should be provided if:

(a) The pH of these waters following initial dilution is not less than 6.7 nor more than 8.5. This quality in the receiving waters will probably be attained if plant effluents are adjusted to a pH value within the range of 5.5 and 10.6.

(b) The iron content of these waters following initial dilution does not exceed 0.3 p.p.m. This quality in the receiving waters will probably be attained if plant effluents are limited to 17 p.p.m. of iron in terms of Fe.

(c) The odor-producing substances in the effluent are reduced to a point that following initial dilution with these waters the mixture does not have a threshold odor number in excess of 8 due to such added material.

(d) Unnatural color and turbidity of the wastes are reduced to a point that these waters will not be offensive in appearance or otherwise unattractive for the afore-mentioned purposes.

(e) Oils and floating solids are reduced to a point such that they will not create fire hazards, coat hulls of water craft, injure fish or wildlife or their habitat, or will adversely affect public or private recreational development or other legitimate shore line developments or uses. Protection should be provided for these waters if plant effluents or storm water discharges from premises do not contain oils, as determined by extraction, in excess of 15 p.p.m., or a sufficient amount to create more than a faint iridescence. Some of the industries producing chemical wastes other than phenolic are: oil wells and petroleum refineries, gasoline filling stations and bulk stations, styrene copolymer, synthetic pharmaceutical, synthetic fibre, iron and steel, alkali chemical, rubber fabricating, dye manufacturing, and acid manufacturing plants.

(3) Highly Toxic Wastes

Adequate protection should be provided for these waters if substances highly toxic to human, fish, aquatic, or wildlife are eliminated or reduced to safe limits.

Some of the industries producing highly toxic wastes are: metal plating and finishing plants discharging cyanides, chromium or other toxic wastes; chemical or pharmaceutical plants and coke ovens. Wastes containing toxic concentrations of free halogens are included in this category.

(4) Deoxygenating Wastes

Adequate protection of these waters should result if sufficient treatment is provided for the substantial removal of solids, bacteria, chemical constituents and other substances capable of reducing the dissolved oxygen content of these waters unreasonably. Some of the industries producing these wastes are: tanneries, glue and gelatin plants, alcohol, including breweries and distilleries, wool scouring, pulp and paper, food processing plants such as meat packing and dairy plants, corn products, beet sugar, fish processing and dehydration plants."

Note: The methods of determination of the chemical constituents referred to in the preceding Objectives are as given in "Analytical Methods for Boundary Waters Quality Control," as prepared by the Board of Technical Advisers. Bacterial determinations are to include the presumptive and confirmed tests for the coliform group of bacteria as given in "Standard Methods for the Examination of Water and Sewage," American Public Health Association, New York.

CONSULTATION WITH VARIOUS INTERESTS CONCERNED

Copies of the foregoing "Objectives" were made available to municipalities, industries, and agencies concerned with the pollution problem. Conferences were then held by the technical advisers with representatives of municipalities and industries about their pollution problems and public hearings were held by the Commission to ascertain the view of all interested parties as to:

(a) The suitability of the "Objectives" proposed by the Commission.
(b) The nature and extent of specific pollution problems.
(c) The remedial measures completed, under way, or planned to alleviate pollution.
(d) The problems involved in organizing and financing pollution abatement.

The results of these conferences and hearings are summarized in the attached reports of the technical advisers. Records of the public hearings are on file in the offices of the Commission. In general, these consultations and the records of the hearings indicate clearly that the "Objectives" are reasonable and desirable. In general, all concerned support the proposal to eliminate harmful pollution and, since the announcement of the Commission's "Objectives", considerable progress has been made towards this end, particularly by industries. Many municipalities have plans for treatment of wastes but realization of their plans depends upon overcoming organizational and financial difficulties.

CONCLUSIONS

The conclusions of the Commission are summarized below under each of the questions contained in the Reference from the two Governments.

Question (1) "Are the waters referred to in the preceding paragraph (of the reference), or any of them, actually being polluted on either side of the boundary to the injury of health or property on the other side of the boundary?"

The Commission finds that the waters under reference are being polluted on either side of the boundary to the injury of health and property on the other side of the boundary.

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

The Commission finds that the pollution of the boundary waters under reference is taking place to an extent which is injurious to health and property, principally by reason of domestic sewage and industrial wastes discharged along the shores of boundary waters, on tributaries of the boundary waters, and, to a lesser extent, by sewage and other wastes discharged from vessels engaged in passenger and freight traffic on these waters. There is progressive overall degradation of the waters in the lower St. Marys River, the St. Clair River, the Detroit River and the upper Niagara River. Dredging operations contribute to the diffusion of pollution.

The most serious pollution, principally from untreated or inadequately treated sewage and industrial wastes, occurs throughout the Lake Huron-Lake Erie section; but is heaviest in the upper St. Clair River, along the west shore of Lake St. Clair, in the lower Detroit River and the west end of Lake Erie. Serious pollution from both sewage and industrial wastes is also taking place in the upper St. Marys River, principally at and near Sault Ste. Marie and along the United States side of the east end of Lake Erie and on the upper Niagara River.

Question (3) "If the Commission should find that pollution of the character referred to is taking place, what measures for remedying the situation would, in its judgment, be most practicable from the economic, sanitary and other points of view?"

The Commission is of the opinion that all wastes discharged into the waters under reference should be treated to comply with the "Objectives for Boundary Waters Quality Control" set forth in this report. Specific remedial measures required to meet these objectives are discussed in the accompanying reports of the technical advisers and are summarized in the Commission's finding on the next question.

Question (4) "If the Commission should find that the construction or maintenance of remedial or preventive works is necessary to render the waters sanitary and suitable for domestic and other uses, it should indicate the nature, location and extent of such works, and the probable cost thereof, and by whom and in what proportions such cost should be borne."

Treatment of municipal wastes by sedimentation and disinfection of the effluent is urgently needed and should be undertaken as the initial step by all municipalities where all wastes are not already afforded such primary treatment. This should be followed by a more efficient or secondary treatment where necessary in order to meet the requirements of the "Objectives." Treatment of overflows from sewers in which both storm water and sanitary wastes are combined should be provided during storm periods where needed. The estimated cost of necessary primary treatment measures, in the three areas under reference, is $43,500,000 in the United States and $21,000,000 in Canada. The estimated cost of the secondary treatment needed is $33,000,000 in the United States and $4,000,000 in Canada.

Treatment of industrial wastes is already being provided to a considerable degree but further treatment in a number of ways to meet the wide range of conditions at the various industries is needed in many cases and should be provided as set forth in the accompanying reports. The estimated cost of treatment of industrial wastes in the three areas under reference is $22,650,000 in the United States and $3,450,000 in Canada.

Vessels plying these waters should be equipped with holding tanks for retention and disinfection of sanitary wastes. Measures to control the escape of oil and dumping of all refuse from vessels should be instituted by the appropriate authorities.

Dredged material should be disposed of in such a manner and at such locations as will not result in harmful transfer of polluting substances in the waters under reference.

The Commission considers that the costs of the necessary remedial measures should be borne by the municipalities, industries, vessel owners and others responsible for the pollution.

With respect to pollution originating from sources other than vessels, the Commission finds that there is adequate legal and administrative authority in each country to enforce proper waste disposal objectives. With respect to pollution from vessels, there is existing legislation applicable only to certain aspects of the problem and consideration should therefore be given in each country to the additional legislation necessary for adequate control of pollution from vessels.

One of the principal requirements for enforcement of quality control objectives in these boundary waters is a procedure whereby an official determination that improper waste disposal practices exist can be brought to the attention of the appropriate enforcement authority.

RECOMMENDATIONS

(1) The Commission recommends that the "Objectives for Boundary Waters Quality Control" as set forth in this report be adopted by the two Governments as the criteria to be met in maintaining boundary waters in satisfactory condition, as contemplated in that portion of Article IV of the Boundary Waters Treaty of 1909 wherein it is stated: "It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

(2) The Commission recommends that the remedial measures already known to be necessary as described in the accompanying reports of the technical advisers be put into effect and that additional measures be undertaken as may prove to be necessary in the future to meet the recommended "Objectives".

(3) As a procedure to insure accomplishment of the foregoing, the Commission recommends that it be specifically authorized by the two Governments to establish and maintain continuing supervision over

boundary waters pollution through boards of control appointed by the Commission. In carrying out this supervisory function, the Commission shall notify those responsible for any pollution found objectionable in the light of the objectives recommended above and, in the event that assurance is not received that such pollution will be corrected in a reasonable time, shall make recommendations to the appropriate authority having jurisdiction as to the further action deemed advisable.

Signed at Ottawa, Canada, this 11th day of October, 1950.

A. G. L. McNaughton

A. O. Stanley

George Spence

Roger B. McWhorter

J. Lucien Dansereau

Eugene W. Weber

The reports of the technical advisers referred to in the foregoing report of the Commission are available in the offices of the Commission in Washington and Ottawa.