LAKE HURON BASIN

LAKE HURON - MICHIGAN

WATER QUALITY DATA
1965 SURVEY

Clean Water Series LHBO-17-A

U.S. DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
Great Lakes Region

TABLE OF CONTENTS

TABLE OF CONTENTS
(cont'd)

LIST OF TABLES

LIST OF TABLES
(cont'd)

LIST OF TABLES
(cont'd)

LIST OF TABLES
(cont'd)

LIST OF FIGURES

INTRODUCTION

The water quality data contained in this report are the results of field investigations and other studies conducted in 1965 and 1966 to provide information for a water pollution control plan for the Lake Huron Basin. The Lake Huron Basin Study is a part of the Great Lakes-Illinois River Basins Project, directed by the Great Lakes Region, Federal Water Pollution Control Administration (FWPCA) and under authority of Public Law 84-660 (33 U.S.C. 466 et seq.).

> Sec. 3. (a) The Secretary shall, after careful investigation, and in cooperation with other Federal agencies, with State water pollution control agencies and interstate agencies, and with the municipalities and industries involved, prepare or develop comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses. For the purpose of this section, the Secretary is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may adversely affect such waters.

Total water quality planning begins in the headwaters of the individual river basins and continues downstream through the major tributaries to and including the Great Lakes. The extent and complexity of the Great Lakes and tributaries are shown on Figures 1, 2, and 3.

Water quality standards for interstate waters (Lake Huron) have been adopted by the State of Michigan and approved by the Secretary of the Interior. Intrastate standards for Michigan are being implemented by the Michigan Water Resources Commission. These standards will form a basis for long-range plan for controlling pollution and maintaining water quality for Lake Huron and its tributaries.

ACKNOWLEDGMENTS

The principal agencies taking an active part in providing assistance in the preparation of the report are as follows:

State Agencies - Michigan Water Resources Commission
Michigan Department of Public Health

Federal Agencies - U.S. Department of Commerce
Weather Bureau
Office of Business Economics
Bureau of Census

U.S. Department of the Interior
Bureau of Commercial Fisheries
Bureau of Sport Fisheries and Wildlife
Bureau of Outdoor Recreation
Geological Survey

For further information, contact the following:

Lake Huron Basin Office
Federal Water Pollution Control Administration
U.S. Naval Air Station
Grosse Ile, Michigan 48138

Michigan Water Resources Commission
Stevens T. Mason Building
Lansing, Michigan 48926

Michigan Department of Public Health
3500 N. Logan
Lansing, Michigan 48914

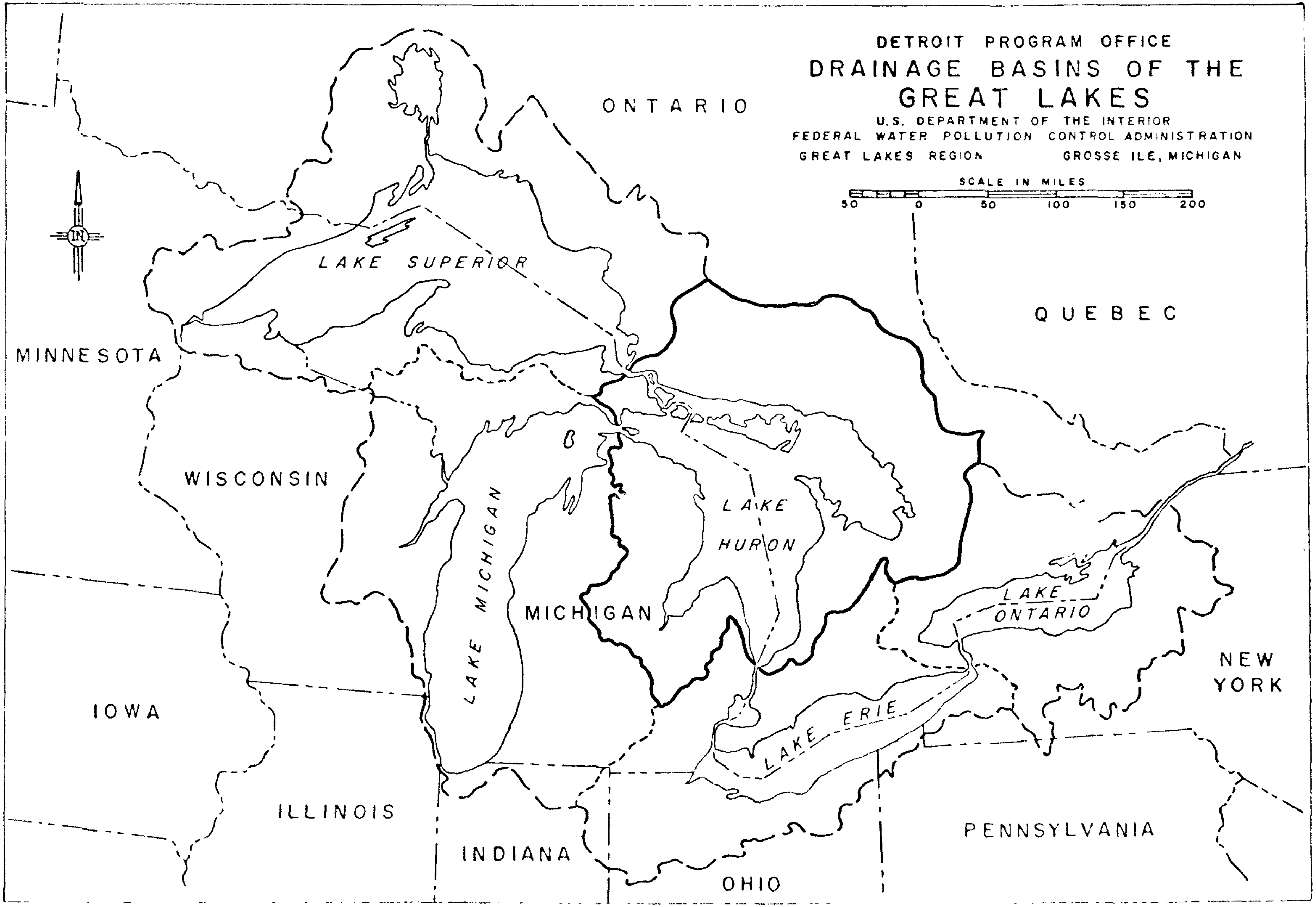
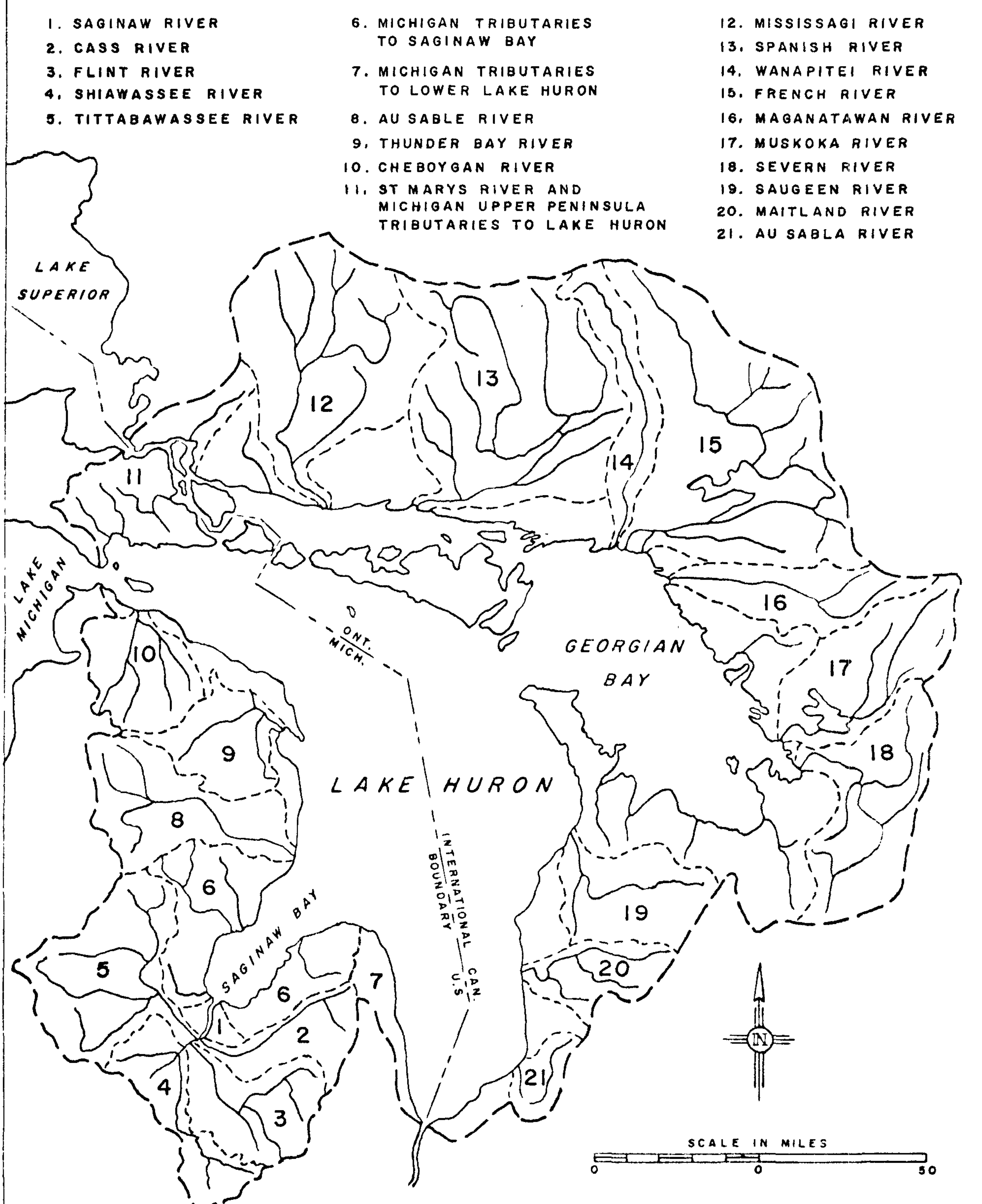

DETROIT PROGRAM OFFICE
DRAINAGE BASINS OF THE GREAT LAKES
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
SCALE IN MILES
50 0 50 100 150 200
ONTARIO
QUEBEC
MINNESOTA
WISCONSIN
MICHIGAN
IOWA
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
IN

FIGURE 1

FIGURE 1



DETROIT PROGRAM OFFICE

LAKE HURON BASIN

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

GENERAL DESCRIPTION

Area Description

Lake Huron, second largest of the Great Lakes and fifth largest lake in the world, has a water surface area of 23,000 square miles and a drainage basin area of 72,600 square miles. Of these totals, 9,100 square miles of water surface area and 25,300 square miles of drainage basin area are in Michigan. It has a length of 200 miles and a width of 100 miles. The greatest recorded depth in the lake is 750 feet at a point 23 miles southwest of the entrance to Georgian Bay. The lake has an average depth of 195 feet and a volume of 850 cubic miles (about 1 quadrillion gallons). Bottom irregularity characterizes all the deepwater portion of the basin with depths in a number of locations ranging from 200 to more than 600 feet in a distance of several miles. The low water datum measured at Harbor Beach is 576.8 feet above the mean water level of the Gulf of St. Lawrence at Father Point, Quebec (IGLD)*. The United States shoreline (mainland only) is 564 miles.

The major sources of flow to the lake are Lake Superior (via the St. Marys River) and Lake Michigan (via the Straits of Mackinac). The major tributaries to the lake (not including Georgian Bay and North Channel) are Cheboygan, Thunder Bay, Au Sable, and Saginaw Rivers in the United States and the Saugeen River in Canada. The major Canadian tributaries to North Channel and Georgian Bay are the Mississagi, Spanish, Wanapitei, French, Maganatawan, Muskoka,

*IGLD - International Great Lakes Datum

and Severn Rivers.

Forest cover varies across the basin. In the southern part of the U.S. portion of the basin are many birch, beech, maple, and hemlock; oak and hickory cover the southern part of the basin on the Canadian side. Northward on both sides of the border, the predominant tree types change to spruce, fir, and white, Norway, and jack pines.

Extending from the western side of Lake Huron in a southwesterly direction is Saginaw Bay. This shallow arm of the lake is 26 miles wide at the entrance, and the minimum width is 13 miles between Sand Point and Point Lookout. The bay is 51 miles long from the mouth of the Saginaw River to a line joining Pointe Aux Barques and Au Sable Point which are on opposite sides of the entrance. There are two outlying islands in the bay - Charity and Little Charity Islands - both are small.

Georgian Bay and North Channel are extensions of the lake on the northeast and north sides, respectively and are Canadian waters. They are nearly landlocked by the Bruce (Saugeen) Peninsula, and Drummond, Cockburn, Manitoulin, and Fitzwilliam Islands.

Georgian Bay is 115 miles long in a northwest-southeast direction and 50 miles wide. It contains over 20,000 islands - largest of which are Fitzwilliam, Lonely, Parry, and Christian. The coastline is very irregular and has many inlets and capes. The largest passage between Georgian Bay and Lake Huron is the channel between Fitzwilliam Island and the tip of Bruce Peninsula. It is possible for small boats to proceed directly to Lake Ontario from Georgian Bay by means of the

Trent Canal system which was opened in 1918. The depth of the water over most of the bay ranges from 100 to 300 feet and the maximum recorded depth is 540 feet near the entrance to Lake Huron. The major tributaries to Georgian Bay are Wanapitei, French, Maganatawan, Muskoka, and Severn Rivers. The Mississagi and Spanish Rivers are tributary to North Channel.

Table 1 lists the location and size of the major drainage areas to Lake Huron.

Climate

A wide variety of climatic conditions are encountered in the Great Lakes area. Because of its mid-continental, mid-latitude position and a length of 1,297 miles, the area lies in the path of storms which periodically travel from the western and southwestern regions of the continent. The area experiences storm periods throughout the year, with a tendency for severe storms to occur in the fall. The climate is modified to a degree by the moderating influences of the lakes.

The Lake Huron Basin is subject to considerable variations in climate from north to south because of its great length. From Port Huron in the southern portion to the Thunder Bay Basin, the mean yearly temperature is 44°F, while mean summer and winter temperatures are 60°F and 25°F, respectively. The average annual precipitation is 31 inches. In the Upper Peninsula and the St. Marys River region, the average temperature is about 10°F lower than the southern part of the lake. Cold air masses tend to be warmed by the large masses of warmer water in the Great Lakes. This lake effect modifies temperatures close to the Lake Huron shoreline, with the result that warmer winter and cooler summer temperatures are recorded. Table 2 shows the variations of temperature and precipitation during 1965 at various locations inside and outside of the Lake Huron Basin.

Hydrology

The major source of flow to Lake Huron is from the upper lakes - Lake Superior via the St. Marys River, and Lake Michigan via the Straits of Mackinac. The other main source of water is surface runoff from United States and Canadian streams. Contributions from ground water and evaporation-precipitation relationships of the lake have not been precisely determined but are assumed to be minor (less than 10 percent of the outflow).

The long-term average flow from Lake Superior is 73,000 cubic feet per second (cfs). Outward flow from Lake Michigan to Lake Huron is variously estimated between 40,000 and 55,000 cfs. In this report, computations are based on an outflow of 40,000 cfs from Lake Michigan. The long-term average flow in the St. Clair River at Port Huron is 176,000 cfs. The annual runoff from the Lake Huron drainage basin is 47,000 cfs. An estimate of 10,200 cfs is made for the Michigan portion of the drainage basin (exclusive of that drainage to the St. Marys River).

Table 3 summarizes the available surface water records for the Michigan portion of the basin as published by the U.S. Geological Survey. The gaging stations listed are nearest the mouth on the main river or major tributaries. Multiple gages listed for Cheboygan, Thunder Bay, Au Gres, and Saginaw River tributaries were weighed in proportion to their gaged area to obtain the yields and flows for the river basin. In areas such as the Upper Peninsula and Southern Lake Huron shoreline where no long-term gages exist, the records of adjacent basins were utilized to obtain a yield factor.

The yield is highest in the northeastern Michigan area, although major tributaries to Thunder Bay and Cheboygan Rivers indicate a lower yield than the main stream. The Rifle River has the highest yield, both for the period of record and for the water year 1965. This yield is high throughout all gaged areas of the Rifle River Basin. With this exception, all basins in the Southern Lake Huron Basin, including that of the Saginaw River, have a much lower yield than the northeastern area. The yield for the water year 1965 was slightly above average for the northern portion of the Lake Huron drainage area. In the basins (Shiawassee, Flint, and Cass Rivers, and the Southern Lake Huron tributaries area) to the south and east of the Tittabawassee River Basin, the yield for the water year 1965 was significantly lower than in the northern part of the basin.

Table 4 is a summary of the average flows of the Michigan drainage to Lake Huron. The flows have been grouped according to major basin and area, with the exception of the Saginaw River tributaries, which are considered as a single entity. The total average annual flow is 11,000 cfs, including the Upper Peninsula drainage to the St. Marys River. Of this total, 35 percent is discharged from the Saginaw River, The northeastern Michigan drainage amounts to 57 percent of the total, with the Au Sable alone accounting for 15 percent of the total Michigan flow.

The major Canadian tributary areas to Lake Huron are the French (7,328 sq. mi.), Spanish (5,417 sq. mi.), Mississagi (3,602 sq. mi,), and Severn (1,582 sq. mi.) Rivers. Total Canadian drainage to Lake Huron is 33,000 square miles, with the major tributaries amounting to 22,300 square miles.

Average annual flow to Lake Huron from the Canadian drainage basin is 36,000 cfs. Table 5 lists the hydrologic characteristics of the major Canadian streams. The yield of Canadian tributaries is significantly higher than that of U.S. tributaries. Table 6 summarizes the water balance for the Lake Huron Basin. Sampling stations for the Lake Huron Basin are listed in Table 7 and shown on Figure 3.

Lake Currents

A number of factors determine the direction, velocity, and persistence of surface currents in the Great Lakes. The more important of these are: direction and velocity of winds, barometric pressure differentials over the lake surface, temperatures, depth and mass of water, bottom and shoreline configuration. Although a number of these factors vary daily, fundamental patterns of surface and subsurface currents exist in each of the lakes.

A great deal remains to be known about the velocity and duration of current patterns in Lake Huron. Existing data on the lake appears to indicate that although a general surface current pattern exists, it is variable. This is brought out in recent studies by Ayers, Anderson, Chandler, and Lauff in the 1956 joint publication of the Ontario Department of Lands and Forests and the University of Michigan. Hough (1958) regards the surface current pattern demonstrated by Harrington (1895) to be a "fair representation of the average circulation of the lake during the summer months."

The FWPCA conducted extensive current studies of Lake Huron during 1965. The data collected are in the process of being analyzed and are not avialable for this report.

In general, circulation patterns in the upper and lower portions of the lake have a counterclockwise direction. In the upper lake, water from the Straits of Mackinac and the St. Marys River meet offshore from Presque Isle. Part of the water mass moves along the shoreline to enter Saginaw Bay, another portion swings eastward above Presque Isle to form a large counterclockwise moving series of currents in the north central portion of the lake. Part of this large flow pattern is directed into Georgian Bay and another portion moves southeastward towards Kincardin and along the Saugeen Peninsula. The surface currents eventually assume a counterclockwise direction to form a second large circular pattern in the lake. A series of currents travel in a southerly direction from the vicinity of Presque Isle to the southern portion of the lake and its outlet. These are gradually deflected by the Canadian land mass so that the currents move in a northerly direction, some to merge with the large counterclockwise pattern found off the Saugeen Peninsula. Figure 4 shows the average summer surface currents of Lake Huron.

In the area of the outflow to the St. Clair River the flow is accompanied by clockwise eddies near the lower shoreline and by strong currents moving towards the St. Clair River.

The currents in Saginaw Bay have been extensively studied. In general, there is a substantial outward movement of Saginaw Bay water. The more contaminated flow of the Saginaw River tends to flow in the deeper channel unless upset by wind induced surface currents. Computed flushing times of the Bay are 113 days at peak river flow and 186 days under average river flow. Seiches caused by substantial winds or barometric changes raise or lower the water level at the mouth of the Saginaw River by four ft. in less than as many hours.

The changing of water temperatures on an annual basis causes vertical currents and upwelling or sinking. Because of the great depth and formation of a thermocline, vertical mixing is restricted during the summer. Major windstorms may result in mixing below the thermocline. Thermal bars are assumed to exist at the mouth of major tributaries during the spring. These result in containment of tributary flow as a distinct body, with limited dispersion to the main water mass of the lake.

TABLE 1. MAJOR DRAINAGE AREAS TO LAKE HURON

Location	Drainage Area (sq. mi.)	
MICHIGAN		
Upper Peninsula Tributaries to St. Marys River	808	
Upper Peninisula Tributaries to Lake Huron	590	
Subtotal		1,398
Cheboygan River Basin	1,550	
Miscellaneous Cheboygan-Thunder Bay	650	
Thunder Bay River Basin	1,120	
Miscellaneous Thunder Bay-Au Sable	180	
Au Sable River Basin	2,035	
Subtotal		5,535
West Saginaw Bay	1,300	
East Saginaw Bay	701	
Southern Lake Huron Tributaries	500	
Subtotal		2,501
Saginaw River Basin		
Saginaw River	246	
Tittabawassee River	2,482	
Shiawassee River	1,201	
Flint River	1,404	
Cass River	889	
Subtotal		6,222
Total		15,656
ONTARIO		
Mississagi River	3,602	
Spanish River	5,417	
French River	7,328	
Magnatawan River	1,663	
Muskoka River	1,967	
Severn River	2,390	
Nottawasaga River	1,145	
Minor Tributaries	791	
Saugeen River	1,582	
Maitland River	981	

TABLE 1. MAJOR DRAINAGE AREAS TO LAKE HURON (Cont'd)

Location	Drainage Area (sq. mi.)	
Au Sable River	431	
Islands and Miscellaneous	6,100	
Total		33,400
GRAND TOTAL		49,056

TABLE 2. AVERAGE TEMPERATURE AND TOTAL PRECIPITATION
Lake Huron Basin - 1965

Location		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Sault Ste. Marie	P	2.86	2.32	.93	1.33	4.42	3.71	5.46	3.91	7.12	3.21	5.08	2.61	42.96
	T	12.0	12.9	22.3	36.0	51.8	57.3	59.1	60.6	53.1	43.2	32.3	26.8	39.0
Cheboygan	P	1.50	1.06	1.29	2.59	3.30	1.81	1.42	3.52	6.25	1.83	4.00	1.52	30.09
	T	18.7	19.0	24.7	37.6	54.9	61.7	64.3	64.7	57.9	48.5	36.4	30.9	43.3
Boyne Falls*	P	2.26	1.32	1.55	3.37	3.62	1.02	1.74	3.04	6.97	2.84	4.30	2.42	34.45
	T	18.8	20.0	24.6	39.9	59.2	61.7	64.5	64.2	58.2	47.1	36.2	30.3	43.7
Alpena Airport	P	2.79	1.86	1.25	3.43	4.24	2.95	1.04	3.65	4.64	1.37	2.70	1.93	31.85
	T	16.3	17.9	22.4	35.9	54.9	59.2	61.9	62.0	56.2	44.8	34.3	29.1	41.2
Lake City Exp. Farm*	P	2.13	1.18	1.22	2.87	3.57	4.09	.93	5.11	6.43	2.62	1.74	1.46	33.35
	T	17.4	20.1	23.4	38.6	58.2	62.0	64.4	65.0	57.6	46.8	36.2	29.6	43.3
Saginaw FAA	P	2.79	3.02	2.50	3.51	2.80	2.49	1.01	4.80	4.84	1.52	2.66	4.67	36.61
	T	20.7	22.8	26.5	41.2	60.7	64.8	68.3	67.6	61.7	49.6	40.3	33.0	46.4
Detroit Metro*	P	3.63	2.54	3.59	3.30	1.15	2.28	2.38	6.94	1.91	3.89	1.49	6.00	39.10
	T	24.7	25.9	30.1	45.1	62.4	66.8	69.2	68.0	63.3	48.2	40.5	35.0	48.3

* Not located in the Lake Huron Basin.

P - Precipitation in inches
T - Temperature in degrees Farenheit

TABLE 3. FLOW CHARACTERISTICS AT MAJOR MICHIGAN GAGING STATIONS
Lake Huron Basin - 1965

Area	Area Gaged (sq. mi.)	Period of Record (Year)	Average Annual Flows: Flow (cfs) POR	Flow (cfs) 1965	Yield (cfsm) POR	Yield (cfsm) 1965	Average Drought Yield (cfsm) Ten Year Recurrence: one-day	ten-day	thirty-day
Cheboygan River Basin	865	1943	769	797	.889	.921	.139	.289	.393
	597	1943	416	435	.697	.729	.025	.067	.120
Thunder Bay River Basin	588	1945	431	440	.733	.748	.280	.320	.356
	184	1945	102	111	.554	.603	.011	.014	.019
Au Sable River Basin	1100	1953	906	884	.824	.804	.455	.527	.582
Saginaw River Basin Tributaries									
Tittabawassee	2400	1936	1519	1758	.633	.732	.083	.104	.129
Shiawassee	637	1940	401	285	.630	.447	.058	.063	.075
Flint	1120	1940	678	510	.605	.445	.038	.048	.062
Cass	848	1940	447	365	.527	.430	.022	.028	.035
Southern Lake Huron Tributaries									
E. Branch Au Gres	169	1951	91.7	94.6	.543	.560	.055	.062	.078
Au Gres	84	1951	62.1	59.5	.739	.708	.321	.345	.369
Rifle	320	1937	300	295	.938	.922	.369	.382	.409
Kawkawlin	101	1951	52.9	56.9	.524	.563	0	0	0

TABLE 3. FLOW CHARACTERISTICS AT MAJOR MICHIGAN GAGING STATIONS (Cont'd)
Lake Huron Basin - 1965

Area	Area Gaged (sq. mi.)	Period of Record (year)	Average Annual Flows: Flow (cfs) POR	Average Annual Flows: Flow (cfs) 1965	Average Annual Flows: Yield (cfsm) POR	Average Annual Flows: Yield (cfsm) 1965	Average Drought Yield (cfsm) Ten Year Recurrence: one-day	Average Drought Yield (cfsm) Ten Year Recurrence: ten-day	Average Drought Yield (cfsm) Ten Year Recurrence: thirty-day
Southern Lake Huron Tributaries (Cont'd)									
Pigeon	55	1953	25.9	18.4	.471	.335	.016	.018	.027

Period of Record (POR) - Continuous record since year of installation.

TABLE 4. SUMMARY OF MICHIGAN AVERAGE FLOWS
Lake Huron Basin

	Total Drainage Area (sq. mi.)	Gaged Drainage Area (sq. mi.)	Average Yield POR* (cfsm)	Total Area Flow (cfsm)
Upper Peninsula	1398	-	.900**	1260
Cheboygan	1550	1462	.810	1260
Thunder Bay	1120	722	.738	827
Au Sable	2035	1100	.824	1680
Miscellaneous	830	-	.787**	653
Subtotal	6933	3284	-	5680
Saginaw Basin Tributaries				
Tittabawassee	2482	2400	.633	1571
Shiawassee	1201	637	.630	757
Flint	1404	1120	.605	849
Cass	889	848	.527	469
Saginaw	246	-	.608**	150
Subtotal	6222	5005	-	3796
Southern Lake Huron Tributaries Area				
Saginaw Bay West	1300	674	.752	978
Saginaw Bay East	701	55	.471	330
Southern Nearshore	500	-	.500**	250
Total	15,656	9018	-	11,034

* POR - Period of Record

** Based on Yield of adjacent basins

TABLE 5. ONTARIO HYDROLOGIC VALUES
Lake Huron Basin

River	Gaged Drainage Area (sq. mi.)	Average of Gaged Discharge (cfsm)	Average Yield (cfsm)	Remarks
Mississagi	3,590	4,640*	1.29*	At Mississagi Chute
Spanish	4,660	4,490	.96	At Espanola
Vermilion	1,570	1,640	1.04	At Lorne Falls (tributary to Spanish River)
Wanapitei	1,220	1,290	1.06	Near Wanup
French	5,370	5,530*	1.03*	At Dry Pine Bay
North Magnatawan	135	197	1.46	Near Burts Falls
Muskoka	1,800	2,490	1.38	Below Bala
Severn	2,260	1,880	.83	At Swift Rapids
Nottawasaga	456	336	.74	Near Baxter
Sauble	358	429	1.20	At Sauble Falls
Sydenham	70	96	1.37	Near Owen Sound
Beaver	225	161*	.72*	Near Clarksburg
Bighead	113	139	1.23	Near Meaford
Saugeen	1,570	1,950	1.24	Near Port Elgin
Maitland	680	816	1.20	Near Donnybrook

* Water Year 1961-1962

TABLE 5. ONTARIO HYDROLOGIC VALUES (Cont'd)
Lake Huron Basin

River	Gaged Drainage Area (sq. mi.)	Average of Gaged Discharge (cfsm)	Average Yield (cfsm)	Remarks
Au Sable	334	324	.97	Near Spring-back

Total Ontario Gaged 24,411 sq. mi.

Drainage to Lake Huron Basin

Total Drainage Area 33,400 sq. mi.

Total Area Flow 36,000 cfsm

TABLE 6. LAKE HURON WATER BALANCE
Lake Huron Basin

Drainage Area		Area Flow (cfs)
Lake Superior (St. Marys) Inflo		73,000
Lake Michigan (Straits of Mackinac) Inflo		40,000
Canadian Rivers Inflo		36,000
Michigan Rivers Inflo		11,000
Precipitation (minus evaporation) Inflo and ground water		17,000
	Total Inflo	177,000
Lake Huron	Total Outflo	177,000

TABLE 7. LAKE HURON BASIN SAMPLING STATIONS

Area or Tributary	Station	Location
Deepwater Ranges		
Straits of Mackinac	H814	10.0 miles - 77° from Round Island Passage Light
Cheboygan	H530	Midway between Poe Reef Light and buoy #2
	H532	10.0 miles - 57° from Poe Reef Light group
	H534	10.0 miles - 228° from Detour Reef Light
	H536	At Detour Reef Light
Presque Isle	H420	1.5 miles - 20° from Presque Isle Light
	H422	10.0 miles - 20° from Presque Isle Light
	H424	19.6 miles - 20° from Presque Isle Light
	H426	29.5 miles - 20° from Presque Isle Light
	H428	At Mississagi Strait Light, Ontario
	H432	At entrance to False Detour Channel
North Channel	H808	3.5 miles - 15° from Cape Robert Light
	H809	7.5 miles - 338° from Cape Robert Light
	H810	5.0 miles - 275° from Mississagi Isle Light buoy
	H812	5.0 miles - 177° from Bigsby Island

TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Deepwater Ranges (Cont'd)		
Georgian Bay	H380	59.0 miles - 71° from flashing buoy in Thunder Bay
	H382	Entrance buoy to Georgian Bay
	H384	2.0 miles - 0° from Tobermory Light
	H386	37.0 miles - 64° from Tobermory Light
	H388	30.5 miles - 18° from Owen Sound radiobeacon
Alpena	H370	4.9 miles - 214° from Thunder Bay Light
	H372	10.0 miles - 71° from bell buoy in Thunder Bay
	H374	23.5 miles - 71° from bell buoy in Thunder Bay
	H376	38.0 miles - 71° from bell buoy in Thunder Bay
	H378	52.0 miles - 71° from bell buoy in Thunder Bay
Oscoda	H320	10.0 miles - 85° from Au Sable breakwater light
	H321	19.1 miles - 85° from Au Sable breakwater light
	H322	29.7 miles - 85° from Au Sable breakwater light
	H324	49.2 miles - 85° from Au Sable breakwater light
	H326	68.7 miles - 85° from Au Sable breakwater light

TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Deepwater Ranges (Cont'd)		
Oscoda (Cont'd)	H328	85.7 miles - 85° from Au Sable breakwater light
	H330	93.7 miles - 85° from Au Sable breakwater light
Mouth of Saginaw Bay	H200	5.0 miles - 118° from buoy #2, Tawas Point
	H202	10.0 miles - 118° from buoy #2, Tawas Point
	H204	16.3 miles - 118° from buoy #2, Tawas Point
	H206	21.3 miles - 118° from buoy #2, Tawas Point
Point Aux Barques	H250	2.3 miles - 56° from Pte. Aux Barques light
	H252	6.8 miles - 11° from Pte. Aux
	H254	17.0 miles - 3° from Pte. Aux Barques light
Harbor Beach	H130	9.5 miles - 100° from Harbor Beach Light
	H132	21.4 miles - 100° from Harbor Beach Light
	H133	27.7 miles - 100° from Harbor Beach Light
	H134	44.5 miles - 100° from Harbor Beach Light
	H136	1.0 miles - 280° from west end of breakwater at Goderich, Ontario

TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Deepwater Ranges (Cont'd)		
Port Huron	H100	1.9 miles - 270° from Lake Huron Lightship
	H102	100 feet - 90° from Lake Huron Lightship
	H104	1500 feet - 90° from Lake Huron Lightship
	H106	5.7 miles - 90° from Lake Huron Lightship
	H108	8.5 miles - 90° from Lake Huron Lightship
	H110	11.4 miles - 90° from Lake Huron Lightship
Nearshore Ranges		
Straits of Mackinac	H500	3800 feet from Mackinaw City shoreline under the Mackinac Bridge
	H502	1.9 miles from Mackinaw City shoreline under center section of Mackinac Bridge
	H504	5000 feet from Point St. Ignace shoreline under Mackinac Bridge
	H506	Midway between east ends of State Ferry Dock, on Graham Point, St. Ignace
	H508	1.2 miles - 86° from east end of State Ferry Dock
	H510	2.3 miles from east end of State Ferry Dock Graham Point, near Mackinac Island light

TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Nearshore Ranges (Cont'd)		
Straits of Mackinac (Cont'd)	H512	Midchannel between Round Island Passage Light and buoy #5
	H514	6.1 miles - 68° from north end of State Ferry Dock
	H516	2.8 miles - 68° from north end of State Ferry Dock
	H518	At end of State Ferry Dock
Cheboygan	Y500	West State Street bridge at center on upstream side
	H525	50 feet north of Crib Light Bell in Cheboygan Channel
	H526	1.5 miles - 349° from Crib Light Bell
	H527	2.9 miles - 349° from Crib Light Bell
	H528	4.2 miles - 349° from Crib Light Bell
	MWRC Che	.25 mile from the mouth of the River
Rogers City	H400	3000 feet - 0° from landing light in Rogers City
	H401	300 feet - 102° from landing light in Rogers City
	H402	5350 feet - 102° from landing light in Rogers City
	H403	At breakwater light in Calcite

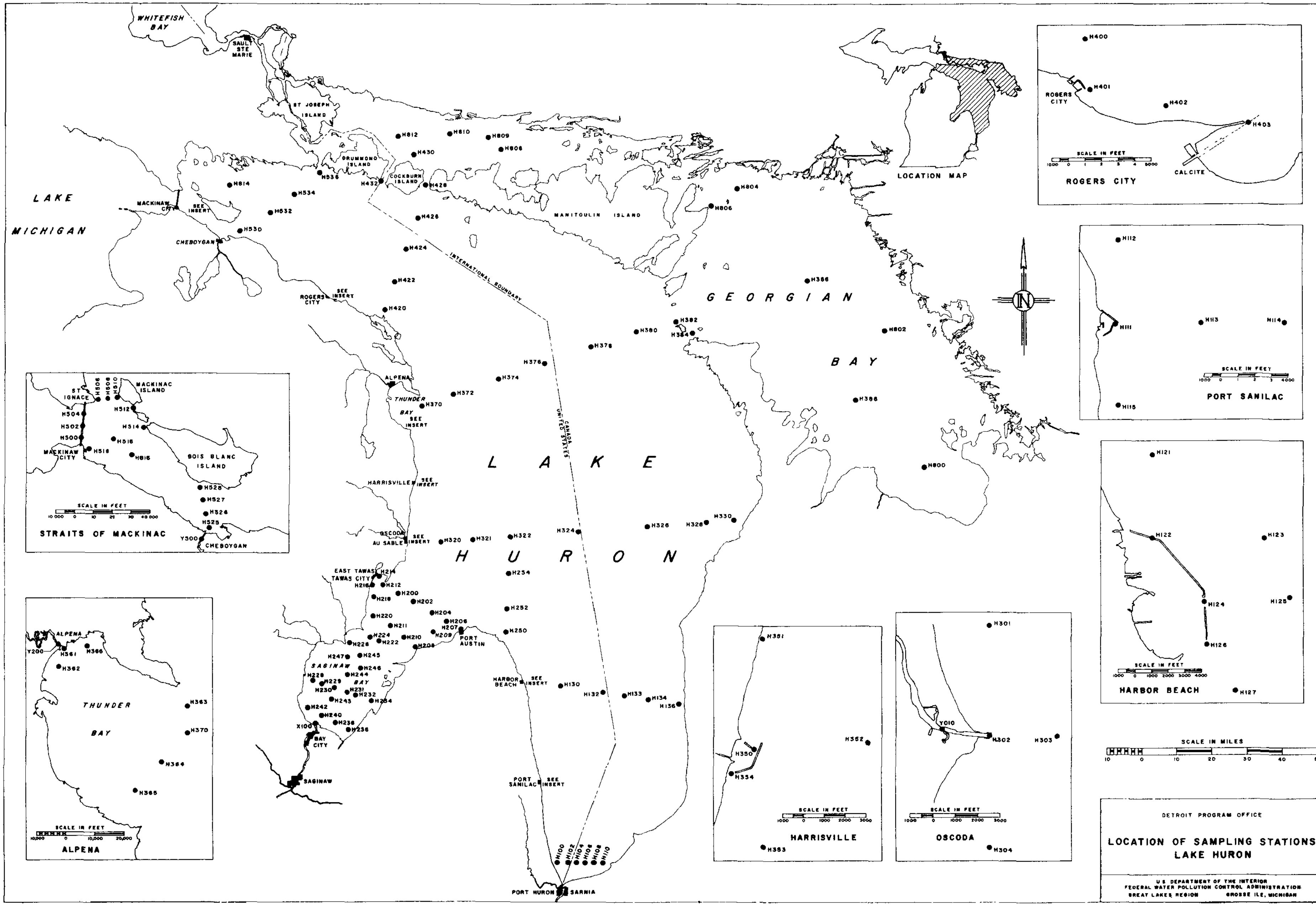
TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Nearshore Ranges (Cont'd)		
Alpena	H361	Midway between end of breakwater and Alpena Light
	H362	1.3 miles - 186^{o} from Alpena Light
	H363	1.6 miles - 150^{o} from south end of North Point
	H364	2.7 miles - 231^{o} from bell buoy
	H365	5.3 miles - 231^{o} from bell buoy
	H366	1.5 miles - 84^{o} from Alpena Light
Harrisville Harbor	H350	Midway between south edge of north breakwater and main breakwater in entrance to harbor
	H351	5000 feet - 0^{o} from breakwater light
	H352	5000 feet - 90^{o} from breakwater light
	H353	5000 feet - 180^{o} from breakwater light
	H354	10 feet from southwest end of main breakwater
Oscoda	H301	5000 feet - 0^{o} from end of breakwater light
	H302	Midway between the breakwater lights
	H303	3000 feet - 90^{o} from end of breakwater light
	H304	5000 feet - 180^{o} from end of breakwater light

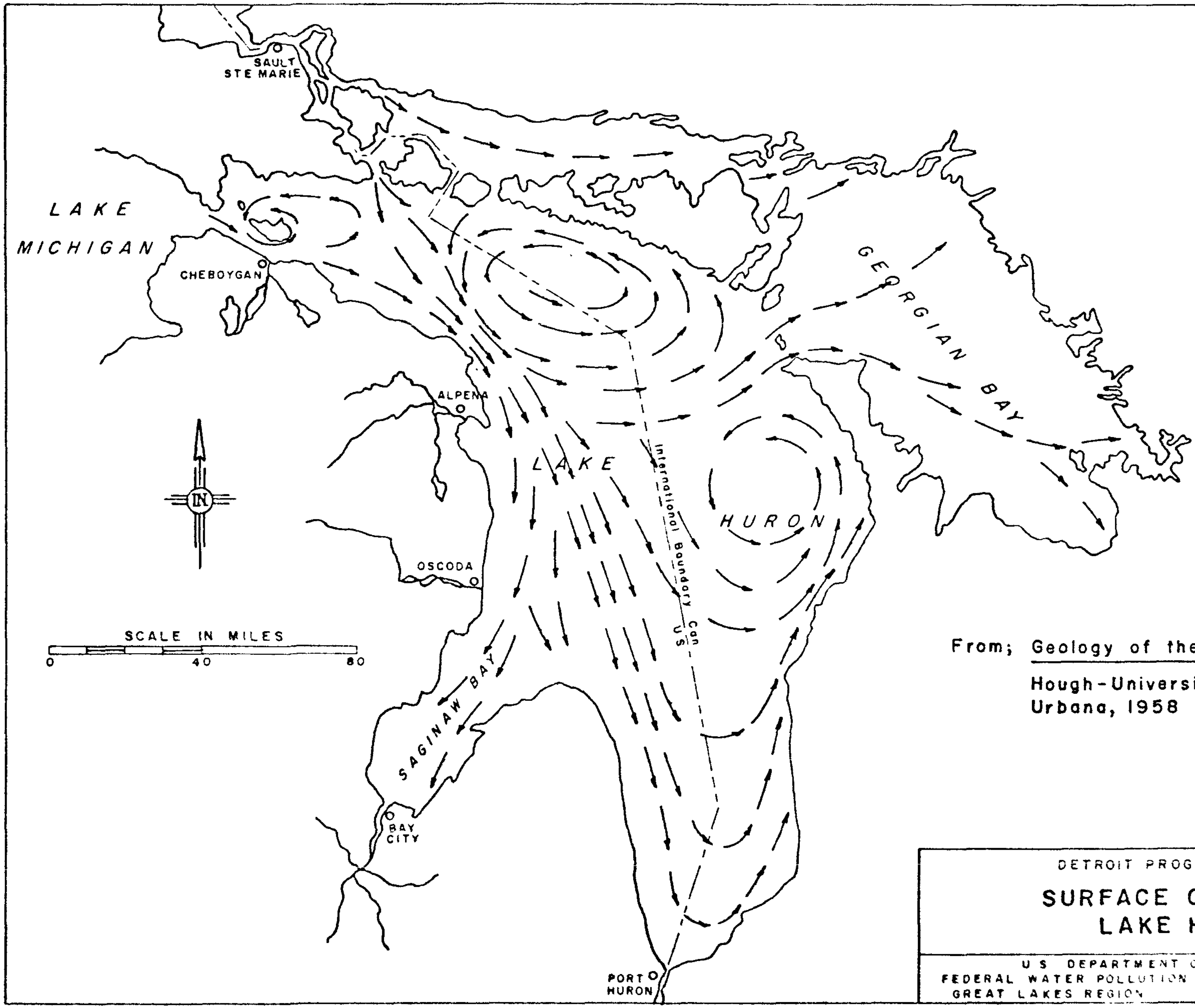
TABLE 7. LAKE HURON BASIN SAMPLING STATIONS (Cont'd)

Area or Tributary	Station	Location
Nearshore Ranges (Cont'd)		
Oscoda (Cont'd)	Y010	US 23 bridge at center on downstream side
	MWRC-AuS	.2 mile from mouth of river on US 23 on south edge of Oscoda
Harbor Beach	H121	5000 feet - 0^{o} from north entrance to breakwater
	H122	Middle of north entrance of breakwater
	H123	5000 feet - 45^{o} from Harbor Beach Light
	H124	Midway between Harbor Beach Light and South Pier Light
	H125	5000 feet - 90^{o} from east entrance to harbor
	H126	300 feet - 180^{o} from south edge of breakwater
	H127	1.1 miles - 150^{o} from east entrance to harbor
Port Sanilac	H111	In entrance to harbor, midway between north and south breakwaters
	H112	5000 feet - 0^{o} from north breakwater light
	H113	5000 feet - 90^{o} from north breakwater light
	H114	1.9 miles - 90^{o} from north breakwater light
	H115	5000 feet - 180^{o} from north breakwater light

Figure 3



DETROIT PROGRAM OFFICE
LOCATION OF SAMPLING STATIONS
LAKE HURON
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION
GROSSE ILE, MICHIGAN
SCALE IN MILES
LAKE HURON
GEORGIAN BAY
LAKE MICHIGAN
WHITEFISH BAY
SAULT STE MARIE
ST JOSEPH ISLAND
DRUMMOND ISLAND
COCKBURN ISLAND
MANITOULIN ISLAND
INTERNATIONAL BOUNDARY
CANADA
UNITED STATES
MACKINAW CITY
CHEBOYGAN
ROGERS CITY
ALPENA
THUNDER BAY
HARRISVILLE
OSCODA
AU SABLE
EAST TAWAS
TAWAS CITY
SAGINAW BAY
BAY CITY
SAGINAW
PORT AUSTIN
HARBOR BEACH
PORT SANILAC
PORT HURON
SARNIA
SEE INSERT
LOCATION MAP
ROGERS CITY
CALCITE
PORT SANILAC
HARBOR BEACH
HARRISVILLE
OSCODA
STRAITS OF MACKINAC
ST IGNACE
MACKINAC ISLAND
BOIS BLANC ISLAND
ALPENA
SCALE IN FEET



From; Geology of the Great Lakes

Hough-University of Illinois Press, Urbana, 1958

DETROIT PROGRAM OFFICE

SURFACE CURRENTS
LAKE HURON

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

FIGURE 4

WATER USE

Municipal Water Supply

The Michigan portion of the Lake Huron Basin had a total population of 1.2 million in 1960. In 1965, 715,000 permanent residents were served by public water supply systems. Thirty percent of the supply was from ground water sources and 70 percent was from surface water. Fifty percent of the latter was served directly with supplies from Lake Huron, including the St. Marys River and Saginaw Bay. The total amount of water used in the basin was 140 MGD, with 40 MGD from ground sources and 75 MGD directly from Lake Huron.

Projected populations to be served are 1,370,000 in 1990 and 2,550,000 in 2020. Demand is projected to be 300 MGD in 1990 and 580 MGD by 2020. Not included in these projections is the planned use by the Detroit Metropolitan Water Services of Lake Huron north of Port Huron for a water source. The capacity of this pipeline and water treatment plant will be 400 MGD in 1969 and 1,200 MGD by 1990. This system will also serve the Flint metropolitan area.

Table 8 lists the present municipal water supplies and the population served by these systems. Table 9 lists the present and projected populations served by public water systems in the Lake Huron Basin. Table 10 lists the present and projected water demands for municipal, industrial, and total needs. These have been grouped by river basin and area.

Industrial Water Supply

There are numerous industries in the Lake Huron Basin that obtain water from municipal systems. Many industries have individual sources, particularly for cooling or major process use. At present, not many of these industries obtain their water directly from Lake Huron, although most of the industrial water demand, particularly for cooling waters, is supplied by surface sources.

In 1965, a total of 49 industries in the Lake Huron Basin had an average demand of 860 MGD. Twelve percent of these industries used ground water sources, with a total demand of 10.6 MGD and 37 percent used surface waters, with a total demand of 830 MGD. Projected water use is expected to be 2,000 MGD in 1990 and 3,800 MGD in 2020. Not included in these demands are the requirements for extra-basin industries.

Table 10 lists the present and projected industrial water demands by basin and area. Table 11 lists the present water demands by basin and area for process, cooling, and total needs.

Water-Related Recreation

The Lake Huron Basin offers some of the finest water-oriented outdoor recreation in the State. Even in the populous and industrialized areas of the Saginaw River Basin, recreation areas have been established and are maintained. Fishing, hunting, camping, skiing, boating, swimming, and touring are popular. Much of the northeastern Michigan area is in public ownership in the national and State forests.

The shoreline of the lake and the lake itself are extensively used for recreation; including duck hunting and fishing in Saginaw, Thunder, and Tawas Bays and other nearshore waters. The fishing activity may be expected to increase when the Coho salmon, scheduled for planting in Lake Huron streams, reach maturity in the lake and begin their annual migrations back to the streams. Summer camping is combined with swimming at shoreline parks such as Tawas State Park. Numerous marinas and harbors of refuge have been constructed with Federal, State, local and private funds. Boating ranges from weekend cruising and sailing in numerous small craft to the annual cup races such as the Detroit to Mackinac regatta. A more detailed description of basin recreation is contained in the Bureau of Outdoor Recreation publication "Water Oriented Outdoor Recreation - Lake Huron Basin (1967)."

Commercial Shipping

The Lake Huron Basin has been an important waterway, but the construction of the Soo Locks and the opening of the St. Lawrence Seaway has increased the navigation traffic to and through Lake Huron. The additional shipping and larger vessels emphasized the need for deeper channels and improved docking facilities, and better and more harbor sites.

Lake Huron has only a few natural harbors which have been improved and manmade harbors have been developed. Table 12 lists the major Michigan port sites as well as total tonnage and major commodities by basins. Of the 34,567,248 total tons, the port of Calcite (Thunder Bay River Basin) handled 14,266,112 tons (41.3 percent) of the limestone (14,189,407), coal and lignite (69,343), and asphalt, tar, and pitches (7,362). The next largest port area was the Saginaw River where 7,243,288 tons were handled. Table 13 shows a breakdown of total freight tonnage through the major water systems.

Commercial Fishing

The commercial fishing industry has always been an important part of Michigan economy, beginning in recent times with the fur companies of the seventeenth and eighteenth centuries. In the Lake Huron Basin, this early fishery developed in the St. Marys River and Straits of Mackinac areas, spreading by the 1830's to Saginaw Bay and numerous ports along the Lake Huron shore. The westward expansion, made practical by the Erie Canal and later the railroads, resulted in an ever increasing demand for fishery products. Commercial production rose steadily between the mid 1800's and the turn of the century, reaching a peak in 1902 when over 20 million pounds were landed. Annual harvests remained relatively stable through the 1920's, with Lake Huron ranking third in commercial fisheries landings, behind Lakes Erie and Michigan.

Sea lamprey predation, general economic conditions, availability of more preferrable protein sources, and a decline in the unit value of the fishery products resulted in a decline of the total production. The decline of the traditional high valued species lake trout, whitefish, and suckers, caused by lamprey predation, and in some areas by taste and odor problems created by pollution, has been responsible to a large degree for the reduction in active United States commercial fishermen operating on the lake.

Saginaw Bay remains the most active fishing area, accounting for 68 percent of the total landings in 1966. Major ports of the bay fishery include Bayport, Tawas City, Sebewaing, and the Standish area. Alpena, Cheboygan, Oscoda, Rogers City, and Harbor Beach are the major ports on the open lake. In all, some 30 Lake Huron shoreline communities recorded commercial fish landings in 1966.

Although pollution and the introduction of destructive species such as the sea lamprey and alewife has most assuredly resulted in the decline of commercial fishing, fishery techniques - harvesting, processing, and marketing - used by United States fishery have not kept pace, for various reasons, with other technological advances. Much of the total fishery population in the lake is underutilized. Advances such as the use of fish protein concentrate, more appealing fresh-water fish specialty items, and return of the lake trout or Coho salmon, will result in a more profitable fishery and increase the value of this resource in Lake Huron. Commercial fishing in the tributary areas has not in the past been of importance, principally because of sports fishing's greater impact. Such items as harvesting surplus Coho salmon or fish farm ponds may provide an inland commercial fishery resource.

Potential demand for commercial fishery products from the Great Lakes is expected to increase fourfold by 2020. Water quality is expected to be a constraint in achieving this level of production, even with advances in harvesting, processing, and marketing. Although population densities throughout most of the basin will remain relatively low, with the exception of the Saginaw Bay tributary area, man's activities in the basin will have a significant effect on the total aquatic environment. Pesticide residues have already been found in adult fish, fry, and eggs. Although applications of pesticides may be low, in terms of the concentrations in the waters affected, the concentration effect of the fish food chain yields levels capable of damaging the fish population. The increase in power requirements will create heat loads sufficient to cause localized areas with temperature considerably above the ambient level of the lake. Fish and other aquatic life are extremely sensitive to even minor changes in the environment and will be affected long before gross pollution becomes apparent.

The Bureau of Commercial Fisheries publication "Report on Commercial Fisheries Resources of the Lake Huron Basin (1968)" details the many aspects of commercial fisheries history, problems, and potential.

TABLE 8. MUNICIPAL WATER SUPPLIES
Lake Huron Basin - Michigan 1965

Area	Number of Communities				Population Served*			
	Surface	Shallow**	Deep***	Total	Surface	Shallow**	Deep***	Total
Upper Peninsula	1	-	-	1	18,722	-	-	18,722
Cheboygan River Basin	-	-	2	2	-	-	7,247	7,247
Thunder Bay River Basin	1	-	1	2	16,000	-	445	16,445
Au Sable River Basin	-	2	3	5	-	2,715	3,660	6,375
Total	2	2	6	10	34,722	2,715	11,352	48,789
Saginaw River Basin Tributaries								
Saginaw River	10	-	1	11	196,166	-	1,874	198,040
Tittabawassee River	2	2	12	16	36,757	16,375	21,614	74,746
Shiawassee River	-	-	13	13	-	-	53,734	53,734
Flint River	2	-	17	19	200,701	-	71,750	272,451
Cass River	1	-	11	12	1,728	-	17,505	19,233
Total	15	2	54	71	435,352	16,375	166,477	618,204
Southern Lake Huron Tributaries Total	13	1	14	28	12,283	2,025	12,940	27,248
Lake Huron Basin Total	30	5	74	109	482,357	21,115	190,769	694,241

* Based on 1960 census of communities.
** Wells less than 50 feet deep.
*** Wells greater than 50 feet deep.

TABLE 9. PROJECTED POPULATION
Michigan Municipal Water Supply Systems
Lake Huron Basin

Area	1965	1990	2020
Upper Peninsula	24,500	34,000	45,000
Cheboygan River Basin	8,325	10,050	13,250
Thunder Bay River Basin	20,500	39,000	69,000
Au Sable River Basin	7,525	14,250	23,750
Total	60,850	97,300	151,000
Saginaw River Basin			
Saginaw River	198,000	340,000	570,000
Tittabawassee River	75,000	150,000	300,000
Shiawassee River	54,000	85,000	120,000
Flint River	280,000	620,000	1,300,000
Cass River	20,000	28,500	40,100
Total	627,000	1,223,500	2,330,100
Southern Lake Huron*			
Total	26,750	47,500	67,500
Lake Huron Basin Total*	714,600	1,368,300	2,548,600

* Exclusive of Detroit Metropolitan Water Services System; population not in the Lake Huron Basin.

TABLE 10. PROJECTED WATER USE
(Million Gallons Per Day)
Lake Huron Basin - Michigan

Area	Municipal*			Industrial*			Total		
	1965	1990	2020	1965	1990	2020	1965	1990	2020
Upper Peninsula	3.7	6.2	9.5	-	3.0	7.5	3.7	9.2	17.0
Cheboygan River Basin	1.4	2.8	5.3	1.0	4.8	11.1	2.4	7.6	16.4
Thunder Bay River Basin	3.3	6.8	14.4	3.3	10.6	25.0	6.6	17.4	39.4
Au Sable River Basin	0.8	1.7	3.5	-	2.0	5.0	0.8	3.7	8.5
Total	9.2	17.5	32.7	4.3	20.4	48.6	13.5	37.9	81.3
Saginaw River Basin									
Saginaw River	60	120	210	600	1320	2270	660	1440	2480
Tittabawassee River	18	32	61	235	650	1430	253	682	1491
Shiawassee River	6.8	12.8	19.6	0.5	1.1	2.5	7.3	13.9	22.1
Flint River	40	96	220	-**	-**	-**	40	96	220
Cass River	3	7	12	4	9	16	7	16	28
Total	127.8	267.8	522.6	839.5	1980.1	3718.5	967.3	2247.9	4241.1
Southern Lake Huron***									
Total	4.8	9.8	19.9	12.0	27.0	70.0	16.8	36.8	89.9
Lake Huron Basin ***									
Total	141.8	295.1	575.2	855.8	2027.1	3837.1	997.6	2322.6	4412.3

* Includes municipal water sold to industries.
** Included in municipal water use.
*** Excludes Detroit Metropolitan Water Services System; demands not in Lake Huron Basin.

TABLE 11. INDUSTRIAL WATER SUPPLIES
Lake Huron Basin - Michigan 1965

Area	Surface Flow (MGD)	Surface Number	Ground Flow (MGD)	Ground Number	Municipal Flow (MGD)	Municipal Number	Total Flow (MGD)	Total Number
Upper Peninsula	-	-	-	-	-	-	-	3
Cheboygan River Basin	1.00	1	-	-	-	-	1.00	1
Thunder Bay River Basin	8.31	4	-	-	-	-	8.31	4
Au Sable River Basin	-	-	-	-	-	-	-	-
Total	9.31	5	-	-	-	-	9.31	5
Saginaw River Basin								
Saginaw River	601.90	6	-	-	0.10	1	602.00	7
Tittabawassee River	200.06	2	10.43	4	10.00	1	220.49	7
Shiawassee River	0.20	1	0.10	1	2.20	2	2.50	4
Flint River	-	-	0.06	1	9.76	8	9.82	9
Cass River	4.00	1	-	-	0.13	3	4.13	4
Total	806.16	10	10.59	6	22.19	15	838.94	31
Southern Lake Huron								
Total	12.00	3	-	-	1.19	7	13.19	10
Lake Huron Basin Total	827.47	18	10.59	6	23.38	22	861.44	49

TABLE 12. MAJOR MICHIGAN PORTS AND CARGO
Lake Huron Basin - 1966

Basin Port	Total Tons	Major Commodities: Item	Tons
St. Marys (Upper Peninsula) Port Dolomite	3,367,645	Limestone	3,367,645
Cheboygan River			
Cheboygan Harbor	115,259	Gasoline	53,883
		Limestone	20,158
		Distillate fuel oil	19,703
		Coal and Lignite	16,296
		Kerosene	2,587
		Slag	2,575
Mackinac Harbor	4,553	Miscellaneous manufactured products	3,721
Thunder Bay River			
Calcite	14,266,112	Limestone	14,189,407
		Coal and Lignite	69,343
		Asphalt, tar, and pitches	7,362
Alpena	3,199,105	Miscellaneous nonmetallic mineral product	2,335,071
		Coal and Lignite	771,152
		Gasoline	10,816
		Distillate fuel oil	6,353
		Slag	2,420
Rogers City	63	Fresh fish	63
Stoneport	6,232,360	Limestone	6,221,478
		Nonmetallic minerals	10,882

TABLE 12. MAJOR MICHIGAN PORTS AND CARGO (Cont'd)
Lake Huron Basin - 1966

Basin Port	Total Tons	Major Commodities Item	Major Commodities Tons
Au Sable River			
Harrisville	97,215	Jet Fuel	97,214
Au Sable Harbor	118	Fresh Fish	118
Saginaw Bay and Southern Lake Huron Tributaries			
Saginaw Harbor	7,243,288	Coal and Lignite	3,270,792
		Limestone	2,126,651
		Benzene	109,666
		Gasoline	161,963
		Jet Fuel	34,245
		Distillate fuel oil	128,868
		Naptha Solvents	42,558
Harbor Beach	41,420	Coal and Lignite	41,346
Caseville	58	Fresh Fish	58
Sebewaing	51	Fresh Fish	51
Port Sanilac	1	Fresh Fish	1

TABLE 13. COMMERCIAL SHIPPING - FREIGHT TONNAGE
Lake Huron Basin - 1966

		Through Traffic				Receipts and Shipments			
		Foreign		Domestic		Foreign		Domestic	
Waterway	Total	Overseas	Canadian	Lakewise	Other	Overseas	Canadian	Lakewise	Other
Lake Huron	148,036,065	7,033,878	17,590,637	85,542,772	1,610	105,576	3,198,193	34,172,386	391,013
St. Marys River									
Upbound	8,541,673	51,370	456,429	7,183,488	-	-	47,612	802,774	-
Downbound	78,749,038	3,102,536	7,841,016	65,009,978	-	-	190,620	2,604,764	124
Saginaw River	7,243,288	-	-	-	-	105,576	372,717	6,746,139	18,856
St. Clair River*									
Upbound	31,070,446	1,710,604	8,775,222	16,009,474	18,964	26,630	3,177	4,512,939	13,436
Downbound	82,858,200	5,428,850	9,948,451	66,514,319	1,502	28,414	31,524	905,109	31

* Including ports along St. Clair River.

SOURCES AND CHARACTERISTICS OF WASTE

Municipal

Data contained in this section are based on the 1965 operating records furnished the Michigan Department of Public Health by municipal waste treatment plant operators. Inventory information of the U.S. Public Health Service (PHS), Michigan Department of Public Health (MDPH), Michigan Water Resources Commission (MWRC), and the Federal Water Pollution Control Administration (FWPCA) were also utilized. Table 14 describes the municipal waste treatment plants. Prior to January 1967, all plants were required to practice disinfection from May 15 to September 15. Since that date, MDPH regulations require continuous year-round disinfection. In the basin, there were a total of 47 sewage treatment plants, of which 20 were secondary, 25 were primary, and 2 were of the lagoon type. The majority of these (16 secondary, 14 primary, 1 lagoon type) were in the Saginaw River Basin.

Eight municipal waste treatment plants discharged directly to the lake. Figures 5 through 8 show the location of these treatment plants. The effluents of East Tawas and Tawas City flow into Saginaw Bay and are covered in the report on Saginaw Bay. The impact that the Saginaw River Basin complex has on Lake Huron is apparent from the number of treatment plants and the total waste load discharged to the river.

The St. Ignace primary sewage treatment plant serves 3,300 people, who contribute an average flow of .64 MGD. The effluent from the plant had an average BOD_5 value of 50 mg/l and varied between 27 and 106 mg/l, of which 49 percent was removed.

The 900 residents on Mackinac Island were served by a sewer system that consisted of collection lines, grinding and dilution of the waste by pumping it into Lake Huron through a deep submerged outfall. No records of effluent quality were available.

In Mackinaw City the primary municipal waste treatment plant has an average efficiency of 32 percent. The average flow was .09 MGD for the population of 900.

The City of Cheboygan has a primary waste treatment plant for its 5,800 residents. It was served by a combined storm and sanitary system that had an average flow of 1.00 MGD. The effluent BOD_5 averaged 76 mg/l and ranged from 38 to 120 mg/l.

Rogers City, population 4,500, was served by a primary sewage treatment plant with a flow of .48 MGD. There was a 50 percent removal of BOD_5.

The Alpena primary waste treatment plant served a population of 14,500 through a combination sewer system. The flow from the plant averaged 2.3 MGD with an average efficiency of 44 percent removal of BOD_5.

The Harbor Beach sewage treatment plant, a trickling filter plant, with an average flow of .4 MGD, served 2,300 people. The effluent BOD_5 averaged 18 mg/l and varied from 13 to 27 mg/l.

The Lexington sewage treatment plant had a waste stabilization lagoon for treating the wastes from 700 people. Available information reported the lagoon discharged twice a year and analyses were performed for total coliform densities.

Industrial

In 1965 there were 49 industries in the Lake Huron Basin. These industries discharged approximately 895 MGD waste water effluent to the basin waters. The industries were engaged in machine operations, beet sugar processing, chemical production, food processing, and brewery operations. Wastes from these industries included brine, toxic metals, soluble oil, biochemical oxygen demanding substances (BOD_5), organic and inorganic solids, and heat from cooling water (refer to Saginaw tributaries basins reports). Thirty of these industries discharged either process wastes, manufacturing wastes, or a combination of process and cooling water wastes. Table 15 summarizes these industries according to basin.

Of the total industries in the basin, eight discharged either process or cooling water directly to the lake. These industries with their waste flows are listed in Table 16.

Commercial wastes in the basin originated from a variety of sources, such as commercial and automatic laundries, motels, and automobile washing firms. These commercial industries are rated by the Michigan Water Resources Commission if they discharge directly to surface or subsurface waters.

As additional information is developed, different methods are applied to treatment procedures and incorporated where applicable to maintain desired quality in the receiving waters.

Federal Installations

There are two major Federal installations located in the Lake Huron Basin. Kincheloe Air Force Base is located in the St. Marys River area and is equipped with a trickling filter plant to treat sanitary sewage from approximately 10,000 people. The waste flow averages .8 MGD and the BOD_5 and suspended solids reductions are in the 80 to 90 percent range. Aircraft washings are treated by oil and grease separation. Year-round effluent chlorination is practiced in accordance with Air Force regulations. The treated wastes are discharged to Mud Lake, a tributary of the Waiska River which flows into the St. Marys River.

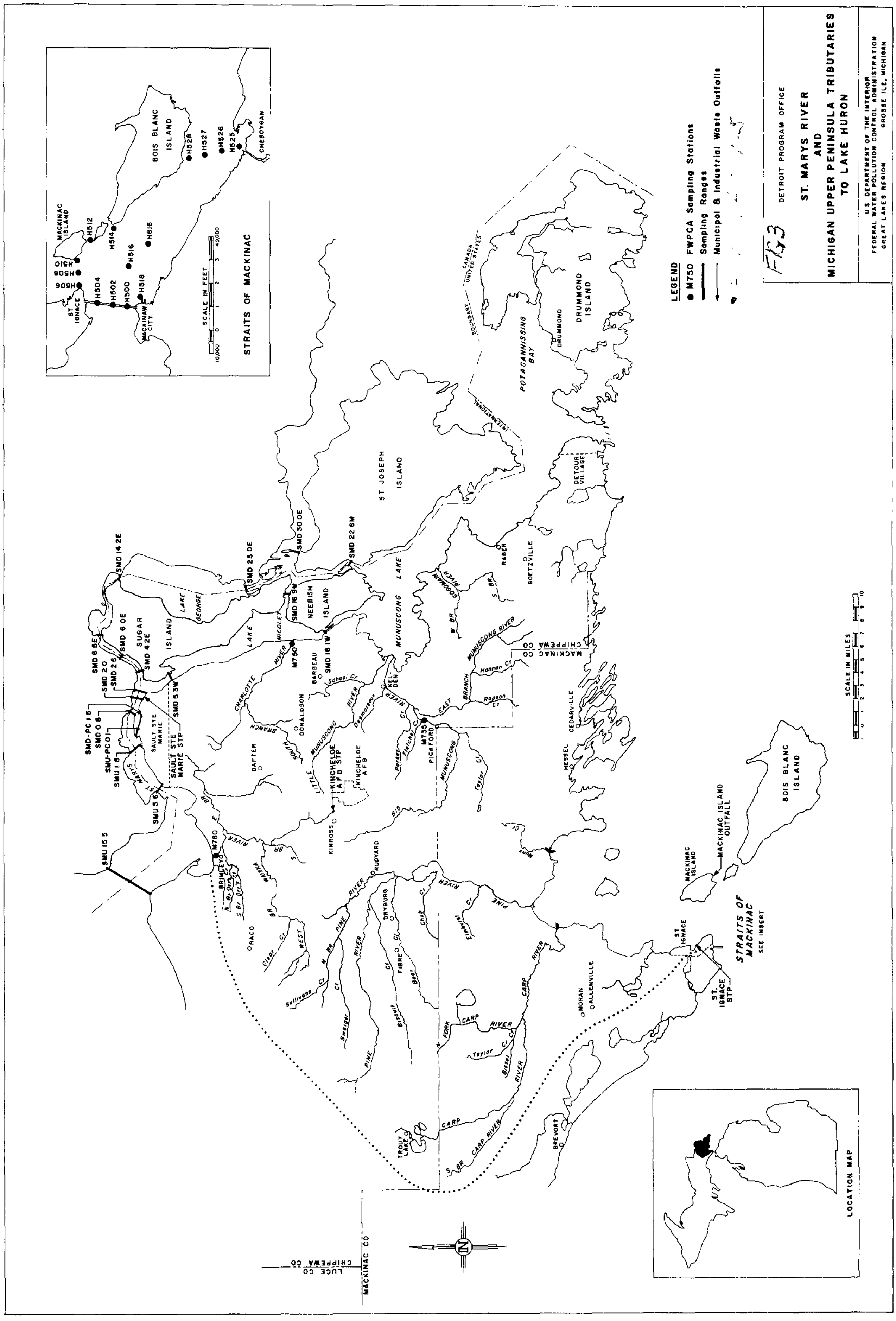
Wurtsmith Air Force Base, located in the Au Sable River area, has a trickling filter plant with the capabilities to treat sanitary sewage from approximately 7,400 people. The waste flow averages .6 MGD and the BOD_5 and suspended solids reductions average 74 and 77 percent, respectively. Aircraft washings are treated by oil and grease separation then released to a separate stormwater system. The effluent is discharged to Van Etten Creek about two miles upstream from its confluence with the Au Sable River.

Other than these two major installations, there are many minor installations, such as campgrounds, picnic grounds, and forest and recreational areas that are Federally owned and/or operated. Due to low waste volume, and ground as a receiving area, these installations were not listed. Table 17 lists the Federal installations that have been studied.

TABLE 14. MUNICIPAL WASTE TREATMENT INVENTORY
Lake Huron Basin - 1965

Area	Population Served	Population Equivalent		Percent Removal Efficiency	Treatment Plants			
		Influent	Effluent		Primary	Secondary	Lagoon	Total
Upper Peninsula	15,330	18,700	13,000	30	2	-	-	2
Cheboygan River	11,200	9,800	6,250	36	3	-	-	3
Thunder Bay River	14,500	8,500	4,800	44	1	-	-	1
Au Sable River	2,840	2,080	1,700	18	2	-	-	2
Total	43,870	39,080	25,750	34	8	-	-	8
Saginaw River Basin								
Saginaw River	163,100	221,300	145,650	22	5	-	-	5
Tittabawassee River	61,700	70,500	33,500	52	5	1	1	7
Shiawassee River	44,700	43,700	15,690	64	4	4	-	8
Flint River	214,500	284,900	22,700	92	-	5	-	5
Cass River	16,300	48,750	5,608	88	-	6	-	6
Total	500,300	669,150	223,148	67	14	16	1	31
Southern Lake Huron								
Total	14,050	12,680	4,210	67	3	4	1	8
Total Lake Huron Basin	558,220	720,910	253,108	65	25	20	2	47

Figure 3



DETROIT PROGRAM OFFICE
ST. MARYS RIVER
AND
MICHIGAN UPPER PENINSULA TRIBUTARIES
TO LAKE HURON
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
FIG 3
LEGEND
● M750 FWPCA Sampling Stations
Sampling Ranges
Municipal & Industrial Waste Outfalls
STRAITS OF MACKINAC
SCALE IN FEET
BOIS BLANC ISLAND
MACKINAC ISLAND
ST IGNACE
MACKINAW CITY
CHEBOYGAN
H500
H502
H504
H506
H508
H510
H512
H514
H516
H518
H525
H526
H527
H528
H816
ST JOSEPH ISLAND
SUGAR ISLAND
NEEBISH ISLAND
DRUMMOND ISLAND
POTAGANNISSING BAY
MUNUSCONG LAKE
LAKE GEORGE
LAKE NICOLET
SAULT STE MARIE
SAULT STE MARIE STP
KINCHELOE AFB STP
MACKINAC ISLAND OUTFALL
ST. IGNACE STP
STRAITS OF MACKINAC SEE INSERT
SMU 15 5
SMU 5 6
SMU 1 8
SMU-PC 0 1
SMD-PC 1 5
SMD 0 8
SMD 2 0
SMD 2 6
SMD 4 2E
SMD 5 3W
SMD 6 0E
SMD 6 5E
SMD 14 2E
SMD 16 1W
SMD 16 9M
SMD 22 6M
SMD 25 0E
SMD 30 0E
M750
M735
M780
DETOUR VILLAGE
RABER
GOETZVILLE
CEDARVILLE
HESSEL
PICKFORD
KINROSS
RUDYARD
DAFTER
DONALDSON
BARBEAU
KELDEN
BRIMLEY
RACO
DRYBURG
FIBRE
MORAN
ALLENVILLE
BREVORT
TROUT LAKE
DRUMMOND
CHIPPEWA CO
MACKINAC CO
LUCE CO
SCALE IN MILES
LOCATION MAP

Figure 4

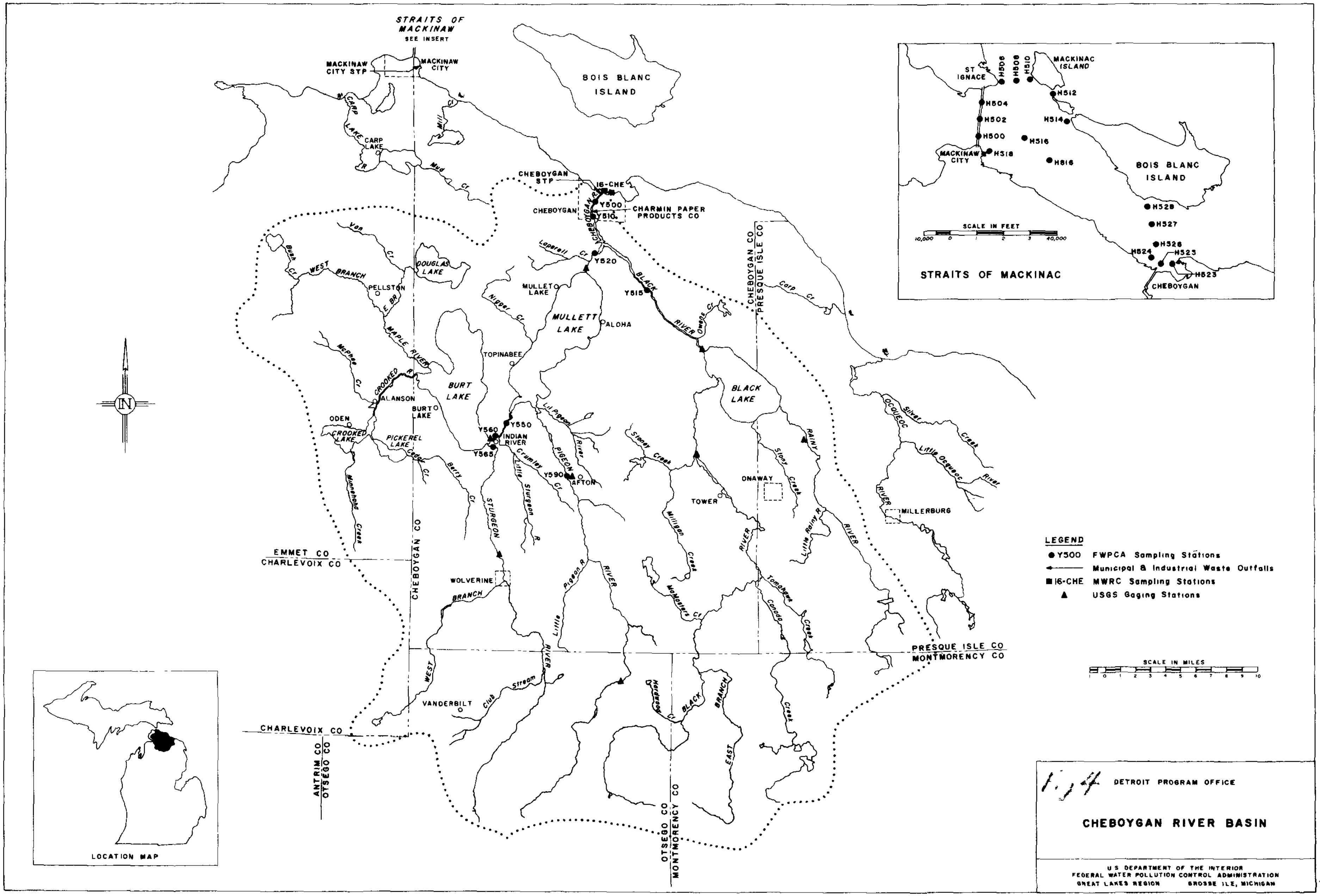
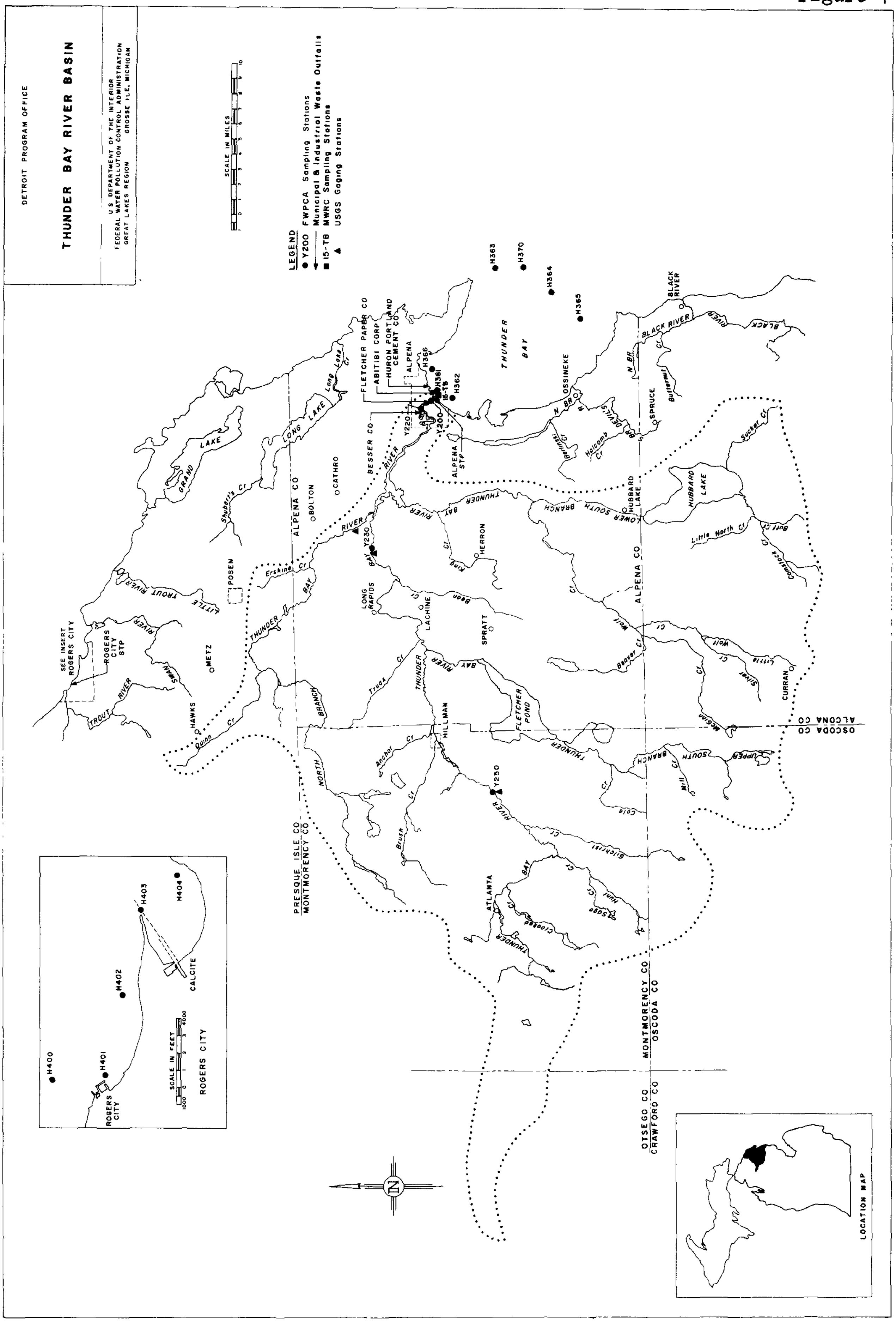

DETROIT PROGRAM OFFICE
CHEBOYGAN RIVER BASIN
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
LEGEND
● Y500 FWPCA Sampling Stations
Municipal & Industrial Waste Outfalls
■ 16-CHE MWRC Sampling Stations
▲ USGS Gaging Stations
SCALE IN MILES
STRAITS OF MACKINAC
SCALE IN FEET
STRAITS OF MACKINAW
SEE INSERT
MACKINAW CITY STP
MACKINAW CITY
BOIS BLANC ISLAND
MACKINAC ISLAND
ST IGNACE
CHEBOYGAN STP
CHEBOYGAN
CHARMIN PAPER PRODUCTS CO
MULLETT LAKE
BURT LAKE
BLACK LAKE
DOUGLAS LAKE
CROOKED LAKE
PICKEREL LAKE
CARP LAKE
MULLETT LAKE
ALOHA
TOPINABEE
PELLSTON
ALANSON
ODEN
BURT LAKE
INDIAN RIVER
AFTON
TOWER
ONAWAY
MILLERBURG
WOLVERINE
VANDERBILT
EMMET CO
CHARLEVOIX CO
CHEBOYGAN CO
PRESQUE ISLE CO
MONTMORENCY CO
OTSEGO CO
ANTRIM CO
LOCATION MAP

Figure 7



DETROIT PROGRAM OFFICE
THUNDER BAY RIVER BASIN
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
SCALE IN MILES
LEGEND
Y200 FWPCA Sampling Stations
Municipal & Industrial Waste Outfalls
15-TB MWRC Sampling Stations
USGS Gaging Stations
FLETCHER PAPER CO
ABITIBI CORP
HURON PORTLAND CEMENT CO
ALPENA
BESSER CO
ALPENA STP
H366
H361
H362
15-TB
Y200
Y220
H363
H370
H364
H365
THUNDER BAY
OSSINEKE
BLACK RIVER
SPRUCE
HUBBARD LAKE
CATHRO
BOLTON
HERRON
POSEN
LONG RAPIDS
LACHINE
SPRATT
METZ
HAWKS
ROGERS CITY STP
SEE INSERT ROGERS CITY
HILLMAN
FLETCHER POND
CURRAN
ATLANTA
Y230
Y250
ALPENA CO
PRESQUE ISLE CO
MONTMORENCY CO
ALCONA CO
OSCODA CO
OTSEGO CO
CRAWFORD CO
GRAND LAKE
LONG LAKE
H400
H401
H402
H403
H404
CALCITE
SCALE IN FEET
ROGERS CITY
LOCATION MAP
N

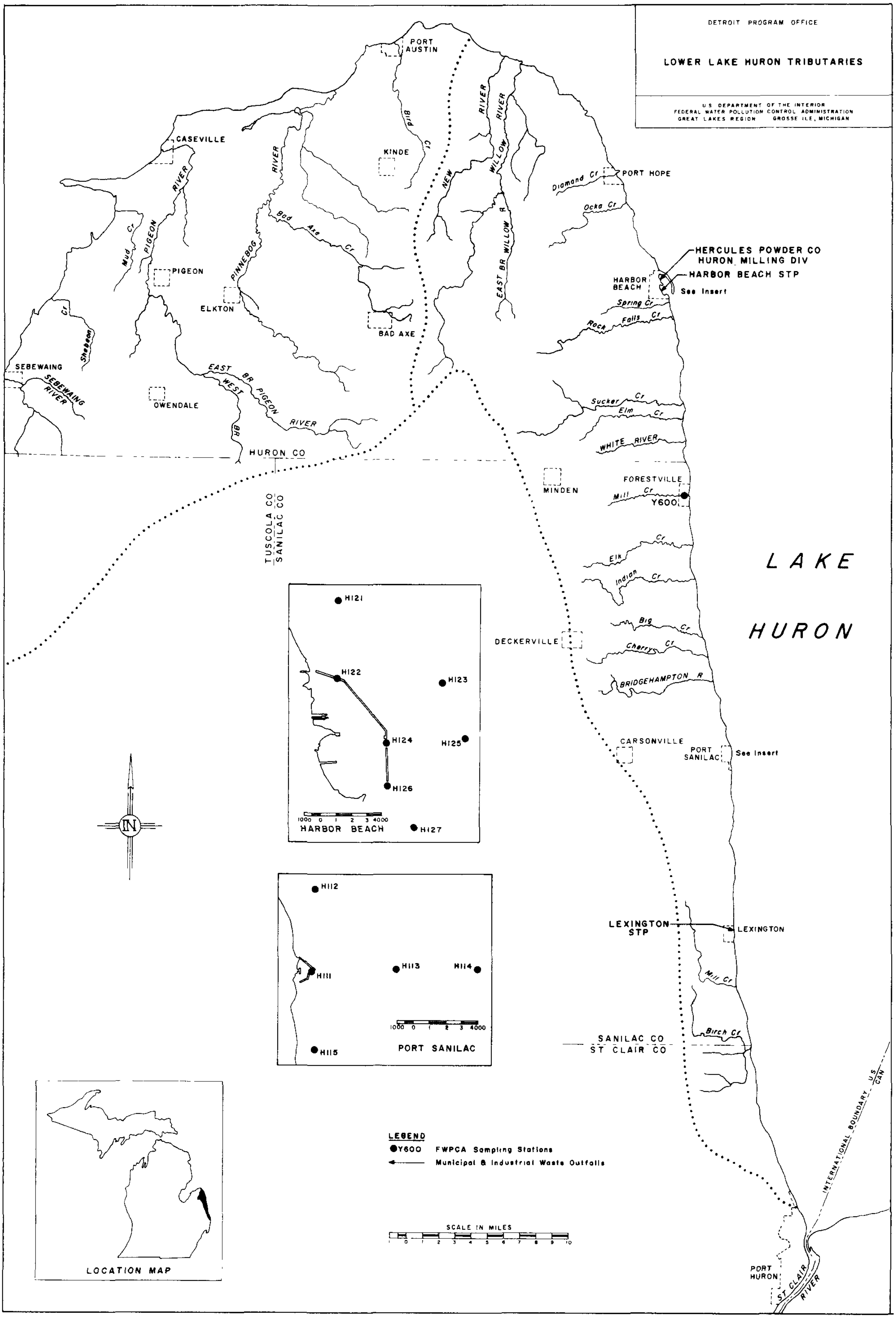

DETROIT PROGRAM OFFICE
LOWER LAKE HURON TRIBUTARIES
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
PORT AUSTIN
CASEVILLE
KINDE
PORT HOPE
PIGEON
ELKTON
BAD AXE
HARBOR BEACH
HERCULES POWDER CO
HURON MILLING DIV
HARBOR BEACH STP
See Insert
SEBEWAING
OWENDALE
HURON CO
TUSCOLA CO
SANILAC CO
FORESTVILLE
MINDEN
Y600
LAKE HURON
DECKERVILLE
CARSONVILLE
PORT SANILAC
See Insert
LEXINGTON STP
LEXINGTON
SANILAC CO
ST CLAIR CO
PORT HURON
ST CLAIR RIVER
INTERNATIONAL BOUNDARY
U.S. CAN
HARBOR BEACH
H121
H122
H123
H124
H125
H126
H127
1000 0 1 2 3 4000
PORT SANILAC
H112
H111
H113
H114
H115
1000 0 1 2 3 4000
LOCATION MAP
LEGEND
Y600 FWPCA Sampling Stations
Municipal & Industrial Waste Outfalls
SCALE IN MILES
1 0 1 2 3 4 5 6 7 8 9 10

TABLE 15. INDUSTRIAL WASTE TREATMENT INVENTORY
Lake Huron Basin - 1965

Area	Process No.	Process Flow (MGD)	Cooling No.	Cooling Flow (MGD)	Process and Cooling No.	Process and Cooling Flow (MGD)	Total No.	Total Flow (MGD)
Upper Peninsula	3	NA	0	-	0	-	3	NA
Cheboygan River Basin	1	1.0	0	-	0	-	1	1.0
Thunder Bay River Basin	1	2.4	2	5.1	1	.8	4	8.3
Au Sable River Basin	0	-	0	-	0	-	0	-
Total	5	3.4	2	5.1	1	.8	8	9.3
Saginaw River Basin Tributaries								
Saginaw River	3	16.3	1	500.0	4	81.0	8	597.3
Tittabawassee River	2	.1	0	-	4	260.4	6	260.5
Shiawassee River	2	.3	1	NA	1	.2	4	.5
Flint River	7	6.9	0	-	2	3.7	9	10.6
Cass River	2	.6	0	-	2	4.1	4	4.7
Total	16	24.2	2	500.0	13	349.4	31	873.6
Southern Lake Huron Tributaries	5	1.0	3	2.2	2	10.0	10	13.2
Lake Huron Basin	26	28.6	7	507.3	16	360.2	49	896.1

TABLE 16. INDUSTRIAL WASTE DISCHARGE
Lake Huron Basin (U.S.) - 1965
(Directly to Lake Huron, St. Marys River, and Saginaw Bay)

Basin	Industry	Location	Water Affected	Flow (MGD)	Use
Upper Peninsula	Drummond Dolomite, Inc.	DeTour	St. Marys River	NA	Process
Thunder Bay	Abitibi Corp.	Alpena	Thunder Bay	2.40	Process
	Fletcher Paper Co.	Alpena	Thunder Bay	0.85	Process & Cooling
	Huron Portland Cement Co.	Alpena	Thunder Bay	5.00	Cooling
Saginaw River	Consumers Power Co.	Essexville	Saginaw Bay	500.00	Cooling
Southern Lake Huron Tributaries	Hercules, Inc., Huron Milling Div.	Harbor Beach	Lake Huron	6.00	Process & Cooling
	Michigan Producers Dairy Co.	Sebewaing	Saginaw Bay	0.30	Process
	Michigan Sugar Co.	Sebewaing	Saginaw Bay	4.00*	Process & Cooling

* Seasonal

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL
AT FEDERAL INSTALLATIONS
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
Department of Defense				
U.S. Air Force				
Kincheloe AFB, Kinross	Sanitary 784,000 GPD	Mud Lake to Waiska River to St. Marys River to Lake Huron	Secondary, Chlorination	Sanitary waste treatment plant is currently overloaded. However, present Air Force plans call for phasing out installation activities commencing in calendar year 1969. On this basis, no remedial action will be taken.
Wurtsmith AFB, Oscoda	Sanitary 660,000 GPD	Van Etten Creek to Au Sable River to Lake Huron	Secondary, Chlorination	Contract has been let to construct new pumping station laboratory and primary settling tank. The construction phase of this work will begin at end of 8/68, and completion is expected by spring 1969. These improvements will not be sufficient to accomplish the goals set by the State of Michigan for quality of effluent discharged to Van Etten

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL AT FEDERAL INSTALLATIONS (Cont'd)
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
Wurtsmith AFB (Cont'd)				Creek, a spawning ground for salmon. The above improvements are interim measures pending construction of facilities to divert the effluent from Van Etten Creek to the ground in another drainage basin. The diversion design phase has already been completed and funds have been requested for this construction. Pending early approval of funds, the expected completion date is FY 71.
Phelps Collins Airport (Air National Guard), Alpena	Sanitary 20,000 GPD	Thunder Bay River to Lake Huron	Secondary, Chlorination	None
Port Austin Air Force Station, Port Austin	Sanitary 15,000 GPD	Ditch tributary	Secondary, Chlorination	MDPH had indicated that better operation and maintenance control is needed at this plant along with an effective program for disinfection of waste prior to discharge.

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL
AT FEDERAL INSTALLATIONS (Cont'd)
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
Sault Ste. Marie Air Force Station, Sault Ste. Marie	Sanitary 13,800 GPD	Ground	Septic Tank, Drain Field	Completion of secondary treatment plant previously constructed and connection of last waste source to this system scheduled for FY 1969.
U.S. Army Corps of Engineers				
St. Marys River Project, Sault Ste. Marie	Sanitary 4,800 GPD	St. Marys River to Lake Huron	None	Installation presently has no waste treatment facilities. However, septic tank and tile field with discharge to ground will be installed concurrently with construction of new lock now in process.
St. Marys Canal, Sault Ste. Marie	Sanitary 4,800 GPD	Ground	Septic Tank, Drain Field	None
U.S. Navy				
Reserve Training Center, Bay City	Sanitary 700 GPD	Ground	Septic Tank, Drain Field	None

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL
AT FEDERAL INSTALLATIONS (Cont'd)
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
Department of Transportation				
U.S. Coast Guard				
Thunder Bay Island Light Station, Alpena	Sanitary 560 GPD	Ground	Septic Tank, Drain Field	Drainfield installed in 1956. Condition is satisfactory.
Saginaw River Light Station, Essexville	Sanitary 700 GPD	Saginaw River to Saginaw Bay to Lake Huron	Septic Tank	Condition of septic tank satisfactory. CG plans to construct new station at different location within 5 years.
Martin Reef Light Station, Cheboygan	Sanitary 280 GPD	Lake Huron	None	Propose unmanning 1977.
Poe Reef Light Station, Cheboygan	Sanitary 350 GPD	Lake Huron	None	Propose unmanning 1977.
Spectacle Reef Light Station, Cheboygan	Sanitary 300 GPD	Lake Huron	None	Propose unmanning 1969.
Middle Neebish Cut Light Attendant Station, Barbeau	Sanitary 700 GPD	Ground	Septic Tank, Drain Field	None

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL
AT FEDERAL INSTALLATIONS (Cont'd)
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
U.S. Coast Guard (Cont'd)				
Detour Reef Light Station, Detour	Sanitary 400 GPD	Lake Huron	None	Propose unmanning 1970.
Harbor Beach Lifeboat Station, Harbor Beach	Sanitary 840 GPD	Lake Huron	Secondary, Chlorination	100 gal. aerobic digesto[illegible] plus chlorination installed in 1967.
Tawas Lifeboat Station, East Tawas	Sanitary	Ground	Septic Tank, Drain Field	Station capacity 28 people. 1 - 2,500 gal. 2-compartment, concrete septic tank installed in 1967. 3 - 1,000 gal. one-compartment septic tanks installed in 1966. All tanks are functioning well.
Forty Mile Point Light Station, Rogers City	Sanitary 100 GPD	Ground	Septic Tank, Drain Field	Drainfield installed in 1944 is in satisfactory condition.
Presque Isle Light Station, Presque Isle	Sanitary 35 GPD	Ground	Septic Tank,	Drainfield is in satisfactory condition

TABLE 17. INVENTORY OF WASTE WATER DISPOSAL AT FEDERAL INSTALLATIONS (Cont'd)
Lake Huron Basin

Installation (Municipality and County)	Type/Volume of Wastes	Receiving Waters	Treatment Provided	Remarks
U.S. Coast Guard (Cont'd)				
Mackinac Lifeboat Station Mackinac Island	Sanitary 980 GPD	Lake Huron	None	Mackinac will be replaced by St. Ignace lifeboat station which will discharge wastes to city sewer.
Department of Agriculture				
U.S. Forest Service				
Huron National Forest, Alcona, Iosco, and Oscoda Counties	Sanitary	Ground	Miscellaneous Septic Tanks, Drain Field, Pit Toilet	Forest capacity 1,100 people.
Hiawatha National Foe Forest, Chippeau and Mackinac Counties	Sanitary	Ground	Miscellaneous Septic Tanks, Drain Field, Pit Toilet	Forest capacity 300 people.
Department of the Interior				
U.S. Fish and Wildlife Service, Hammond Bay Biological Station, Millersburg	Sanitary 100 GPD	Ground	Septic Tank, Drain Field	Drainfield will be replaced.
Shiawassee National Wildlife Refuge, Saginaw	Sanitary 300 GPD	Ground	Septic Tank, Drain Field	None

POPULATION AND WASTE LOAD PROJECTIONS

Demographic studies were conducted by the Great Lakes-Illinois River Basins Project, Chicago, Illinois, for the Lake Huron Basin. Population trends on a national, regional, and county basis were analyzed, and population projections were developed for the various areas of the Lake Huron Basin. In 1960, approximately 1.2 million persons lived in the Lake Huron Watershed - about double the 1920 population. By the year 2020, it is estimated that the population of the watershed will be approximately 3.2 million.

The population centers in the Lake Huron Basin are Flint (196,940), Saginaw (98,265), Bay City (53,604) and Midland (27,779) according to 1960 census. Table 18 lists the fifteen largest cities in the Lake Huron Basin. For this report, the various populations in each basin and area were analyzed assuming that by 2020 these centers would be urbanized and served by water and sewer systems. The individual areas were added to yield the total population served. For certain areas such as the Northeastern Michigan basins, the adjacent shoreline projections were proportioned and added to the basin projections. For the total basin, the 1965 population served by sewer systems was estimated to be 580,000 and projected to 1,340,000 by 1990 and 2,500,000 by 2020. Table 19 lists the present and projected population served by river waste treatment facilities.

A similar technique was used to project waste flow, both municipal and industrial. Table 20 lists the present and projected waste flows for municipal, industrial and total waste flows.

BOD_5 projections were based on present day inventory information obtained from the Michigan Water Resources Commission, Michigan Department of Public Health, and the Federal Water Pollution Control Administration. Municipal and industrial BOD_5 projections, in terms of population equivalents, were determined from studies on the Lake Michigan Basin and applied to the inventory data obtained for the Lake Huron Basin. The results of these projections are shown in Table 21, which lists the municipal, industrial, and total BOD_5 generated by the Michigan area of the Lake Huron Basin. The municipal BOD_5 load for 1965 was calculated on the basis of .17 pounds per day of BOD_5 per person served, and the 1990 and 2020 load factors, .18 and .20 pounds per day of BOD_5 per person.

Table 22 lists the treated BOD_5 loadings discharged during 1965. The percent treatment achieved in 1965 was also indicated for municipal, industrial, and total wastes. The projected BOD_5 waste loadings are listed on Table 23.

TABLE 18. POPULATION CENTERS
Lake Huron Basin

City	Basin	1960 Population	SMSA*
Flint	Flint	196,940	416,239
Saginaw	Saginaw	98,265	190,752
Bay City	Saginaw	53,604	107,042
Midland	Tittabawassee	27,779	
Sault Ste. Marie	Upper Peninsula	18,772	
Owosso	Shiawassee	17,006	
Mt. Pleasant	Tittabawassee	14,875	
Alpena	Thunder Bay	14,682	
Alma	Tittabawassee	8,978	
Lapeer	Flint	6,160	
Fenton	Shiawassee	6,142	
Cheboygan	Cheboygan	5,859	
Howell	Shiawassee	4,861	
Rogers City	Lake Huron Shoreline	4,722	
Essexville	Saginaw	4,590	

* Standard Metropolitan Statistical Area.

TABLE 19. **PROJECTED SEWERED POPULATION**
Lake Huron Basin

	1965	1990	2020
Upper Peninsula	21,780	33,000	46,000
Cheboygan	6,745	10,050	13,250
Thunder Bay	19,780	39,000	69,000
Au Sable	6,545	14,250	23,750
Total	54,850	96,300	152,000
Saginaw River Basin			
Saginaw	180,000	340,000	570,000
Tittabawassee	58,800	125,000	255,000
Shiawassee	46,650	80,000	115,000
Flint	210,000	620,000	1,300,000
Cass	18,400	28,500	40,100
Total	513,850	1,193,500	2,280,100
Southern Lake Huron Tributaries	14,150	47,500	67,500
Lake Huron Basin Total	582,850	1,337,300	2,499,600

TABLE 20. WASTE FLOW PROJECTIONS
Lake Huron Basin
(MGD)

	Municipal *			Industrial			Total		
	1965	1990	2020	1965	1990	2020	1965	1990	2020
Upper Peninsula	4.1	7.2	11.5	-	2.0	5.0	4.1	9.2	16.5
Cheboygan River Basin	1.4	2.9	5.2	1.0	4.8	11.1	2.4	7.7	16.3
Thunder Bay River Basin	2.8	6.2	12.3	3.3	10.6	25.0	6.1	16.8	37.3
Au Sable River Basin	0.7	1.8	2.8	-	2.0	5.0	0.7	3.8	7.8
Total	9.0	18.1	31.8	4.3	19.4	46.1	13.3	37.5	77.9
Saginaw River Basin									
Saginaw River	34.7	81.0	144.5	100.0	220.0	378.0	134.7	301.0	522.5
Tittabawassee River	10.0	29.8	67.2	58.0	163.0	354.0	68.0	192.8	421.2
Shiawassee River	4.9	10.6	18.2	0.5	1.1	2.5	5.4	11.7	20.7
Flint River	27.5	95.0	226.0	9.5	22.0	48.0	37.0	117.0	274.0
Cass River	2.9	5.5	9.1	4.1	9.0	15.6	7.0	14.5	24.7
Total	80.0	221.9	465.0	172.1	415.1	798.1	252.1	637.0	1,263.1
Southern Lake Huron Tributaries	2.1	7.2	12.5	12.8	37.7	96.0	14.9	44.9	108.5
Lake Huron Basin	91.1	247.2	509.3	189.2	472.2	940.2	280.3	719.4	1,449.5

* Residential and commercial.

TABLE 21. PROJECTED BOD_5 LOADINGS
Lake Huron Basin
(Pounds per Day)

	Percent Treatment	1965	1990	2020
Municipal	0	120,892	289,815	594,572
	64 (Present)	43,932	105,316	216,062
	90	12,089	28,982	59,457
	95	6,045	14,491	29,728
	99	1,209	2,898	5,946
Industrial	0	196,825	566,250	1,272,840
	59(Present)	81,344	234,020	526,039
	90	19,683	56,625	127,284
	95	9,841	28,313	63,642
	99	1,968	5,663	12,728
Total	0	317,717	856,065	1,867,412
	60 (Present)	125,276	339,336	742,101
	90	31,772	85,607	186,741
	95	15,886	42,804	93,370
	99	3,177	8,561	18,674

TABLE 22. TREATED BOD_5 LOADINGS
Lake Huron Basin - 1965
(Pounds per Day)

Area	Municipal	Industrial	Total
Upper Peninsula	1,972	-	1,972
Cheboygan River Basin	888	765	1,653
Thunder Bay River Basin	1,125	35,500	36,625
Au Sable River Basin	368	-	368
Total	4,353	36,265	40,618
Saginaw River Basin			
Saginaw River	24,260	9,770	34,030
Tittabawassee River	5,760	7,647	13,407
Shiawassee River	3,500*	1,065	4,665
Flint River	3,380	917	4,297
Cass River	1,349	5,000	6,349
Total	38,249	24,399	62,748
Southern Lake Huron Tributaries Total	1,330	20,680	22,280
Total Lake Huron Basin	43,932	81,344	125,646

* Estimated.

TABLE 23. PROJECTED UNTREATED BOD_5 LOADINGS
Lake Huron Basin
(Pounds per Day)

Area	Municipal*			Industrial			Total		
	1965	1990	2020	1965	1990	2020	1965	1990	2020
Upper Peninsula	3,432	6,472	10,400	-	10,500	25,000	3,432	16,972	35,400
Cheboygan River Basin	1,323	2,318	3,800	1,250	14,000	32,600	2,573	16,318	36,400
Thunder Bay River Basin	2,140	7,492	15,620	58,300	162,000	381,000	60,440	169,492	396,620
Au Sable River Basin	1,133	2,628	4,900	-	10,500	25,000	1,133	13,128	29,900
Total	8,028	18,910	34,720	59,550	197,000	463,600	67,578	215,910	498,320
Saginaw River Basin									
Saginaw	37,620	77,300	141,700	16,000	35,200	60,500	53,620	112,500	202,200
Tittabawassee	12,810	30,305	67,020	73,460	205,590	448,380	86,270	235,895	515,400
Shiawassee	8,100	14,850	24,000	1,065	2,400	5,320	9,165	17,250	29,320
Flint	41,620	125,100	290,500	1,310	2,960	6,640	42,930	128,060	297,140
Cass	9,754	13,120	18,672	7,140	15,700	27,100	16,894	28,820	45,772
Total	109,904	260,675	541,892	98,975	261,850	547,940	208,879	522,525	1,089,832
Southern Lake Huron Tributaries Total	2,960	10,230	17,960	38,300	107,400	261,300	41,260	117,630	279,260
Total Lake Huron Basin	120,892	289,815	594,572	196,825	566,250	1,272,840	317,717	856,065	1,867,412

* Residential and commercial.

WATER QUALITY DATA

In 1965 a water quality sampling program was conducted by the Federal Water Pollution Control Administration (FWPCA) as part of the Great Lakes-Illinois River Basins Project. This program included periodic sampling at key locations on basin streams; sampling to determine oxygen resources of the major reaches of streams in the Saginaw system; routine sampling of harbor, bay, and nearshore lake waters; a number of cruises on deepwater Lake Huron; and special studies.

Samples were collected in Lake Huron from 50 offshore stations at the following depths:

1. surface
2. 20 meters
3. depth when 1 percent of incident light is measured
4. 5 feet above the thermocline
5. midway between thermocline and bottom
6. 5 feet above the bottom

Variations in the above program were made to take into account differences in depth or other physical data that would result in duplication of sampling at a given depth.

Surface samples were collected at harbor areas and for a distance of about 1 mile lakeward to determine the difference in quality in these waters.

Lake Huron Deepwater Stations

Based on the values obtained from the water quality parameters for the 50 chemical and 40 microbiological stations, the two 1965

Lake Huron deepwater surveys showed the water to be of excellent quality. The stations were grouped into the following ranges and found in Figure 3:

Range	Stations
Straits of Mackinac	H814
Cheboygan	H530, H532, H534, H536
Presque Isle	H420, H422, H424, H426, H428, H432
North Channel	H808, H809, H810, H812
Georgian Bay	H382, H384, H386, H388
Alpena	H370, H372, H374, H376, H378, H380
Oscoda	H320, H321, H322, H324, H326, H328, H330
Mouth of Saginaw Bay	H200, H202, H204, H206
Pte. Aux Barques	H250, H252 H254
Harbor Beach	H130, H132, H133, H134, H136
Port Huron	H100, H102, H104, H106, H108, H110

The parameters analyzed were: dissolved Oxygen (DO); 5-day biochemical oxygen demand (BOD_5); nitrogens - ammonia, organic, and nitrate; phosphates - total and total soluble; total solids; chlorides; phenols; sodium; potassium; calcium; magnesium; sulfate; conductivity; total coliform; and total plate counts.

Analyses of the parameters reported in the lake showed uniform concentrations, with the exception of a few localized areas that showed greater concentrations. These exceptions occurred mainly in the harbor areas and near the mouths of the major tributaries.

Data for the ranges (total of surface, depths, and bottom samples) are listed in Table 24 and individual stations are compiled in Tables 25 through 35. Each station was sampled once during late July 1967, and the data are listed in Table 36, along with the six new stations - H430, H800, H802, H804, H806, and H816.

The average DO concentrations for the entire lake were in sufficient quantities to meet all water uses. The central portion and the southern half of Georgian Bay averaged 12.0 mg/l or greater and the surrounding shoreline areas ranged from 11.0 to 12.0 mg/l (Table 24). The North Channel and the immediate Cheboygan Harbor area showed a range of 10.0 to 11.0 mg/l, which is also at acceptable levels (Fig. 9). A reduction in oxygen concentrations occurred in the Saginaw Bay area where the DO ranged from 8.0 to 11.0 mg/l. The BOD_5 averaged from <1 to 2 mg/l for the entire lake, except at the mouth of Saginaw Bay where the range was 1 to 4 mg/l. Otherwise, the oxygen relationship indicated acceptable water quality in the Lake Huron deepwater stations (Tables 25-35).

Some nutrient values indicated slight water quality degradation at the deepwater stations. Higher levels were noted in the southern ranges and from the Saginaw Bay and nearshore areas. The Straits of Mackinac, Cheboygan, Georgian Bay, North Channel, and Presque Isle ranges showed low concentrations of ammonia nitrogen from $<.05$ to .06 mg/l, nitrate nitrogen average of .2 mg/l, and total and total soluble phosphate ranging from $<.04$ to .05 mg/l. Slightly higher concentrations of these parameters were noted in the southern ranges of Lake Huron in comparison of the northern ranges, with occasional high isolated areas. Ammonia nitrogen averaged $<.05$ mg/l in the northern areas, showed an increase at Oscoda ranging from $<.05$ to 1.10 mg/l (all depths included), ranged from $<.05$ to .48 mg/l at the mouth of the Saginaw Bay, and finally, averaged .12 mg/l at Port Huron (Fig. 10).

Average nitrate values of the open waters appeared to be .3 mg/l or less (Fig. 11). There were areas where the average concentrations were greater than .3 mg/l as these values included surface depths and bottom sample results, but no pattern was apparent when evaluating the data. The total and total soluble phosphates ranged from $<$.04 to .08 mg/l in the Straits of Mackinac, and the Cheboygan, North Channel, Presque Isle, Georgian Bay, and Alpena ranges, except for the first station outside Thunder Bay Harbor which ranged from $<$.04 to .1 mg/l. The Oscoda range was higher, ranging from $<$.04 to .2 mg/l. The higher values were nearer the Michigan shore and appeared to be reduced across the lake. At the mouth of Saginaw Bay, a range of $<$.04 to .2 mg/l was observed. Lower water quality at Pointe Aux Barques was indicated by the highest range of phosphate concentration, $<$.04 to .6 mg/l, in the entire lake area. This concentration appeared to be diluted as shown by the decrease at Harbor Beach of $<$.04 to .4 mg/l, and finally to $<$.04 to .3 mg/l at Port Huron (Figure 12).

The open waters of the lake, including the North Cahnnel, appeared to have .04 mg/l phosphate or less and this was within recommended levels. Georgian Bay and some of the shoreline areas range up to .1 mg/l of phosphate, and this exceeds the level at which algal growths are stimulated. Many of the nearshore areas, as well as Saginaw Bay, range from $<$.04 to .2 mg/l phosphate. A few isolated areas are higher than .2 mg/l but do not follow any pattern.

The average chloride concentrations increased from 4 mg/l at the Straits of Mackinac to 5 mg/l across the Oscoda range to 6 mg/l at the

Saginaw Bay mouth to a range of 5 to 7 mg/l at Port Huron (Fig. 13). Total solids also showed a slight increase from the Straits of Mackinac, ranging from 97 to 120 mg/l, to Port Huron where the range was 93 to 140 mg/l. Despite the distance and amount of water moving through the area, there appears to be a slight increase in most of the parameters.

Throughout the lake, little variance was noted in the sodium, potassium, magnesium, and sulfate parameters.

The water quality did not exceed recommended levels, with the exception of small localized areas.

Microbiology

In 1965, two deepwater cruises were undertaken during which time a total of 40 deepwater stations were sampled at depths ranging from the surface to 500 feet. Figure 3 shows the location of these stations. The following bacterial parameters were measured aboard the survey vessel: total coliforms, total bacteria (at 20°C and 35°C), fecal coliform, and fecal streptococci. Some measurements were made of the last two parameters due to the extremely low total coliform values that were observed and too, previous evaluations of these waters had shown very low bacterial counts at deepwater points. Table 37 lists the 40 stations and the range of depths sampled.

Median total coliform densities at all the stations were very low, ranging from <1 organism/100 ml to 5 organisms/100 ml of sample. Values for all points ranged from a minimum of <1 organism/100 ml at the greater majority of stations to a maximum density of 40 organisms/ 100 ml of sample at station H536, located at the De Tour Passage where the St. Marys River empties into Lake Huron. Wastes from De Tour Village or ships passing through the channel may account for this last value.

Fecal coliform densities were determined at seven deepwater stations. Values ranged from <1 organism/100 ml to 14 organisms/100 ml of sample; median values were <1 organism/100 ml of sample.

Fecal streptococci densities were determined at five stations. Values ranged from <1 organism/100 ml to 5 organisms/100 ml of sample.

Total bacteria plate count values at 20°C and 35°C were much higher than those of the previous parameters. This was to be expected since highly selective media were employed to determine total coliforms, fecal coliforms, and fecal streptococci in water samples. Total bacteria counts are determined through use of less selective media that allow a greater variety of organisms to develop, many being harmless saprophytes. Total plate count values (20°C) ranged from 1 organism/100 ml to 700 organisms/100 ml of sample. Median values over all stations ranged from 2 organisms/100 ml to 250 organisms/100 ml. The two maximum values were noted at station H428, which was located in the mouth of the channel between Cockburn and Manitoulin Islands.

Total plate count values (35°C) ranged from 1 organism/100 ml to 720 organisms/100 ml, the maximum being found at station H814 located north of Bois Blanc Island. Median values ranged from 1 organism/100 ml to 47 organisms/100 ml at station H536 at the De Tour Passage. Values for all microbiological parameters are shown in Tables 25 through 35.

Lake Huron Nearshore Areas

There are a number of Lake Huron nearshore areas located along the Michigan shoreline of the lake from Mackinaw City to Port Huron, which are of significance to the water quality of the lake. These locations, as shown in the inserts on Figure 3 are: Straits of Mackinac, Cheboygan, Rogers City, Alpena, Harrisville, Oscoda, Harbor Beach, and Port Sanilac. A harbor, breakwater enclosure, or tributary was located at each nearshore station. Major areas also studied were the St. Marys River (Eastern Upper Peninsula River Basins), Cheboygan, Thunder Bay and Au Sable Rivers, Saginaw Bay, and southern tributaries, (Saginaw Bay and southern Lake Huron tributaries) which were discussed in the FWPCA Lake Huron tributary basin reports.

The St. Marys River, above the Soo Locks, represented the water quality from Lake Superior and the Straits of Mackinac represented the Lake Michigan water quality as they enter Lake Huron. The St. Clair River above Port Huron represented the Lake Huron water quality as it enters the Lake Erie Basin.

During 1965, the FWPCA sampled the nearshore station ranges and made physical, chemical, and microbiological measurements. The Michigan Water Resources Commission has water quality monitoring stations on a number of these main tributaries flowing into Lake Huron, and portions of their data have been included.

The eight nearshore stations are reported individually and described with short narratives and tables.

Straits of Mackinac

A summary of the data on samples collected by the FWPCA for the Straits of Mackinac ranges is compiled in Table 38. The 10 sample stations were divided into three selected ranges: Range 1 - stations H500, H502, and H504; Range 2 - stations H506, H508, H510, and H512; and Range 3 - stations H514, H516, and H518. Table 39 presents the data on the individual stations for the Straits. Examination of these tables revealed significant water quality information.

In the waters of the Straits of Mackinac, the average DO concentration exceeded 11.3 mg/l. The lowest DO value, 9.7 mg/l, was found in Range 3, outside of Mackinaw City. There was no supersaturation and no apparent problems. The BOD_5 did not exceed 3 mg/l.

Ammonia concentrations throughout the sampled area ranged from $<$.05 to .53 mg/l. A high level of nitrates, .9 mg/l, was observed at St. Ignace. Undesirable blooms can be expected above levels of .30 mg/l of inorganic nitrogen (nitrates, nitrites, and ammonia). Total phosphate concentrations ranging from $<$.04 to 1.2 mg/l were found south of Mackinac Island, and the total soluble phosphate values ranged from $<$.04 to 1.0 mg/l. In combination with excess inorganic nitrogen and satisfactory light and heat, algal growths and odors can be stimulated.

Total iron level of 1,000 μg/l was observed at St. Ignace and can pose a threat to aquatic life at concentrations over 300 μg/l.

The microbiological data for the Straits of Mackinac indicated that the waters are of suitable bacteriological quality for all uses.

Cheboygan

The Cheboygan nearshore stations, including Y500, were sampled five times or more by the FWPCA. Table 40 presents the results of the sample stations Y500, H525, H526, H527, and H528; and 16-CHE (MWRC) for Cheboygan Harbor and Cheboygan River derived from the 1965 surveys. The data showed some water quality variations.

The waters of Cheboygan Harbor contained concentrations of DO that were near 100 percent saturation. The lowest DO value, 6.5 mg/l, was found at the mouth of the Cheboygan River and indicated some degradation from the river. Average BOD_5 values in the Cheboygan River ranged from 1 to 3 mg/l and was diluted to range 1 to 2 mg/l in the harbor area.

Nutrient ranges indicated degradation from the mouth and then appeared erratic across the harbor. The ammonia nitrogen ranged from <.05 to .25 mg/l; nitrate from <.1 to .4 mg/l; and the total phosphates from <.04 to .2 mg/l. With adequate light and heat, this could develop into a problem area.

Total solids concentrations at the mouth of the Cheboygan River averaged 190 mg/l and was diluted across the Cheboygan Harbor to range from 140 to 110 mg/l.

Average phenol concentrations in the harbor ranged from <2 to 5 μg/l, while values ranged from 2 to 8 μg/l at the mouth of the Cheboygan River and in the immediate vicinity. Other areas in the Cheboygan Harbor were of suitable bacteriologic quality for all uses.

Rogers City

The FWPCA sampled the Rogers City Harbor in May to determine the immediate quality of these waters. Table 41 summarizes the parameters for the sampling stations H400, H401, H402, and H403 for the Rogers City Harbor. The brief investigation showed little indication of any pollution of these waters.

DO values of the Rogers City Harbor ranged from 98 to 104 percent saturation. Ammonia nitrogen concentrations ranged from .22 to .28 mg/l and in combination with a total phosphate concentration of .2 mg/l, satisfactory temperature, and light conditions could develop into a problem area. Total solids concentration ranged from 120 to 140 mg/l, and chlorides were <5 mg/l. Neither value indicates any pollution problem.

From the four stations, it appeared that the bacterial levels increased below the marina area and were reduced in passage to the Port of Calcite.

Alpena

The FWPCA conducted water quality surveys in the Thunder Bay area. The sampling stations - H361, H362, H363, H364, H365, H366, H370 and Y200, were divided into three ranges to facilitate presentation and interpretation of the collected data. Station Y200, located at the mouth of the river, and 15-TB (MWRC) were presented as Range 1 to give an overall picture of the river. Range 2 was stations H361, H362, and H366; and Range 3 contained H363, H364, H365, and H370.

Table 42 presents a summary of the chemical and microbiological range data as collected by the FWPCA and Michigan Water Resources Commission. Examination of the table revealed significant water quality variations. Individual station data were compiled on Table 43.

DO concentration in Range 3 averaged 11.1 mg/l, diminished to an average of 9.7 mg/l outside the mouth of the Thunder Bay River, and dropped to 7.4 mg/l at the mouth. BOD_5 concentration increased from average values of 1 and 2 mg/l in Ranges 3 and 2, to 4 mg/l at the mouth of the river. This oxygen depletion indicated definite water quality degradation.

Ammonia nitrogen in Thunder Bay averaged .14 mg/l on Range 3, .18 mg/l on Range 2, and ranged from $<$.05 to .33 mg/l at the mouth. An increase was also noted in the organic nitrogen from the outer area to the mouth as the range increased from $<$.05 to .29 mg/l, to .10 to .36 mg/l, and finally from .21 to .83 mg/l at the mouth. Total phosphate values in Ranges 3 and 2 ranged from $<$.04 to .2 mg/l and $<$04 to .3 mg/l at the mouth. These nutrient values in the right combination with satisfactory temperature and light could become a problem area.

Total solids concentration decreased from the mouth of the Thunder Bay River toward the bay from average values of 240, then 150, and finally 120 mg/l. The concentration at the mouth was greater than the maximum recommended level of 200 mg/l. Phenol concentrations were the highest below the treatment plant and averaged 3 μg/l, then were diluted to range from $<$2 to 3 μg/l by the time the outer harbor area was reached.

The highest total coliform, found directly below the treatment plant outfall, had a high of 43,000 organisms/100 ml and an average of 4,300 organisms/100 ml, which exceeds the recommended maximum of 2,000 organisms/100 ml. The high is still above maximum at H361, but is diluted in Range 3 to average 6.

Harrisville

Water quality surveys of the Harrisville Harbor were conducted by the FWPCA. Water quality data for sampling stations H350, H351, H352, H353, and H354 were compiled in Table 44. Examination of the table showed some variations in the quality of the water.

Variable lake currents caused the flow to run in erratic patterns. Occasional high values were observed at both the breakwater stations and those stations about a mile from the breakwater, although the concentrations appeared to be greatest near the breakwater and reduced at the stations further out. Exceptions to this were total and total soluble phosphates that were the highest at H353, the most southern station of the area. Solids and nutrient values at the southern breakwater station, H354, were the highest of the location, averaging 170 mg/l total solids, 35 mg/l chlorides, and ranging .04 to .6 mg/l for total phosphates. These three parameters indicated some degradation. Because of these occasional high values, further investigation is necessary.

Bacteriological data indicated the highest total coliform density was at the southern end of the breakwater, but the count was still below the maximum recommended levels; therefore, the water quality was acceptable for all uses.

Oscoda

The FWPCA also conducted water quality surveys of Oscoda Harbor. The stations in the harbor which were sampled five times or more during the year included stations H301, H302, H303, and H304. The Au Sable River was also sampled at Y010 and at 14-AuS (MWRC) for comparison of the water quality of the river and that of the harbor area. Table 45 presents the results of the chemical and microbiological parameters and reveals water quality variations.

Most of the waters of Oscoda Harbor displayed high levels of DO. Some oxygen depletion was evident near the mouth of the Au Sable River at stations Y010 and 14-AuS(MWRC) and in the immediate vicinity of the channel of the harbor at station H302, dropping to 71 percent saturation at one time in the river and 72 percent at the mouth, station H302.

Average ammonia nitrogen concentration of .20 mg/l, with a range of .14 to .32 mg/l, was found at station H302. Average ammonia nitrogen levels greater than .10 mg/l were found throughout the other areas in the Oscoda Harbor and in the Au Sable River. Nitrate nitrogen, with a range of .1 to .3 mg/l, was found at station Y010, and ranged from $<$.1 to .2 mg/l in the Oscoda Harbor. High concentration of total and total soluble phosphate, .6 mg/l, was found at station H303. In the remaining waters adjacent to the harbor and at station Y010, the total and total soluble phosphate levels ranged from .04 to .2 mg/l. If the nutrients are in the right combination, and with satisfactory heat and light, algal growths can be produced.

Total solids concentrations were highest at stations Y010 and H302, but less than the maximum recommended level of 200 mg/l. High total iron levels above the 300 μg/l maximum recommended concentration observed at stations Y010, H301, H302, and H303 were 500 μg/l, 1,200 μg/l, 1,000, and 800 ug/l, respectively.

The bacteriological water quality of Oscoda Harbor was determined from evaluation of the survey data. High total and fecal coliform densities were found at stations Y010 and H302. These organisms are indicators of bacterial contamination and serve to warn that a health hazard may exist for those exposed to or consuming these waters. Other areas were of suitable bacteriological quality for all uses.

Harbor Beach

The stations in the surveys at Harbor Beach were combined into 2 areas: Breakwater Area - H122, H124, and H126, and the Outer Harbor Area - H121, H123, H125, and H127. The data (Table 46) summarizes the two areas as well as the individual stations. Although this nearshore area lies within the area known as southern Lake Huron, it actually flows into Lake Huron.

DO concentration at the Harbor Beach Outer Harbor Area averaged 11.7 mg/l, but a slight decrease to 11.2 mg/l was noted at the breakwater. BOD_5 ranged from 1 to 2 mg/l in the outer area and 1 to 4 mg/l at the breakwater.

Occasionally, the lake currents caused the flow around the breakwater to become erratic and sometimes variable, resulting in some variable data.

Average ammonia nitrogen concentrations in the Harbor Beach waters ranged from .09 to .19 mg/l. A high value of .40 mg/l was observed at station H121, probably from the Saginaw Bay area or Port Austin. The highest total phosphate levels, 1.9 mg/l and 1.4 mg/l, were found in the center of the breakwall at station H124, and in an area south of the breakwall at station H126. The maximum soluble phosphate values for stations H124 and H126 were 1.6 and .2 mg/l, respectively. Another area of high total and total soluble phosphate concentrations, both being .7 mg/l, was found at station H121 approximately 5,000 feet north of Harbor Beach. The previously-mentioned currents from Lake Huron could have caused this variability. The nutrient concentrations were above the recommended levels and could be conducive to algal growths. The maximum total iron concentrations, 1,000 and 1,300 µg/l, were found at stations H122 and H127, respectively. The breakwater iron averaged 400 µg/l and the outer harbor was 300 µg/l. Iron concentration maximum recommended level is 300 µg/l, and both areas were above this level.

The water quality of Harbor Beach was bacteriologically acceptable for all uses, both at the breakwater and in the outer harbor. The breakwater area has the higher counts of the two areas but the counts were below the recommended maximum limits.

Port Sanilac

Another area surveyed by the FWPCA for water quality was Port Sanilac. This nearshore area is located in the southern Lake Huron area but flows directly into Lake Huron. The chemical and bacteriological data from the stations, H111, H112, H113, H114, and H115 were compiled in Table 47.

Levels of DO in all parts of Port Sanilac averaged 11.5 to 11.8 mg/l and BOD5 $<$ 1 mg/l to 2 mg/l, so little oxygen degradation was observed.

Average ammonia nitrogen values in the Port Sanilac water ranged from .13 to .18 mg/l. Nitrate nitrogen ranged from .1 to .5 mg/l in the area. High levels of total and total soluble phosphate, .3 mg/l, were found at station H111, while the rest of the stations ranged from $<$.04 to .2 mg/l for total, and $<$.04 to .07 mg/l for total soluble phosphate. The nutrient concentrations ranged to levels where algal blooms could occur.

Total solids concentration ranged from 110 to 160 mg/l. There were two or three times more suspended solids at H111, averaging 13 mg/l, than the other stations. Phenol concentrations were the greatest at H111 and H115, ranging from $<$2 to 8 μg/l; the higher values were over the maximum recommended level of 2 μg/l. Total iron concentrations of 500, 500, and 1,000 μg/l were observed at stations H115, H112, and H111, respectively.

Occasionally, small amounts of phosphates and solids were found at the breakwater, but these were below the recommended maximum levels.

All stations in the Port Sanilac area showed total coliform densities of $<$10 org/100 ml, except station H111 located in the center of the breakwall. The median total coliform count for station H111 was 66 org/100 ml, with range values of $<$2 to 154 org/100 ml. The water is bacteriologically good for all water uses.

Radiochemistry

Lake Huron Basin radiochemistry results for water, sediment, and plankton samples were analyzed for alpha and beta activity levels. The water samples were filtered through a 1.2 micromembrane filter, analyzed in terms of suspended (nonfiltrable) and dissolved (filtrable) portions, and reported in picocuries per liter (pc/l). Sediment and plankton samples were measured in picocuries per gram (pc/g). The maximum values were as follows:

	Dissolved		Suspended		Sediment		Plankton	
	A	B	A	B	A	B	A	B
Deepwater Ranges								
Straits of Mackinac	.50	4.3	<.05	.80	14	54	5.3	26
North Channel	<.05	5.8	.20	.80	26	54	7.0	67
Georgian Bay	<.05	5.7	<.05	.90	16	60	9.2	83
Cheboygan	<.05	4.7	<.05	1.5	18	100	4.2	27
Presque Isle	<.05	5.4	.20	.80	29	88	6.1	62
Alpena	<.05	5.4	.30	1.5	36	98	8.2	83
Oscoda	<.05	4.8	.20	2.1	18	33	7.6	54
Harbor Beach	<.05	4.9	.20	.60	13	28	6.0	40
Port Huron	<.05	5.0	.50	1.3	-	-	-	-
Nearshore Ranges								
Straits of Mackinac	.80	15	.20	2.9	-	-	-	-
Harbor Beach	<.05	6.5	.20	2.2	-	-	-	-
Port Sanilac	<.05	8.0	<.05	3.2	-	-	-	-

Table 48 contains the deepwater data and Table 49 contains the nearshore data.

Since the counting error was as high or higher, or in the magnitude of the activity, it was indicated that the activity was 0 or below the sensitivity of the test.

The North Channel water quality was apparently not affected by the mining operations in the area. Due to limited data, no conclusions could be drawn as to bottom sediments or plankton. The data for the deepwater and nearshore stations did not indicate any radioactivity water quality problems.

KEY FOR WATER QUALITY TABLES

Station-Location shown in Figure 3.

<u>Chemical Parameters</u>	-	all results in milligrams per liter (mg/l) (exceptions noted).
Phosphate	-	reported as phosphate (PO_4).
Total Phosphate	-	includes ortho, poly, biological, and organic.
Total Soluble Phosphate	-	includes soluble ortho, soluble poly, and soluble organic.
Vol. Susp. Solids	-	volatile suspended solids.
Phenol	-	reported as micrograms per liter (µg/l).
pH	-	measure of hydrogen ion activity - acidic (0), alkaline (14), neutral (7).
Percent Saturation	-	reported as percent.
Total Iron	-	reported as micrograms per liter (µg/l).
Total Hardness	-	reported as calcium carbonate ($CaCO_3$).
Conductivity	-	micromhos per centimeter (umhos/cm).
<u>Microbiological Parameters</u>	-	values obtained by membrane filter technique, unless otherwise noted. Median values shown in Average column.
Total Coliform, Fecal Coliform, Fecal Streptococcus	-	reported as organisms per one hundred milliliters (org/100 ml).
Total Plate Count	-	number of bacteria/ml.

Michigan Water Resources Commission reported values in terms of most probable number/100 ml (MPN/100 ml).

NS = number of samples.

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
Range - Straits of Mackinac

Parameters	NS	Avg.	Low	High		NS	Avg.	Low	High
Dissolved Oxygen	7	11.5	9.8	12.7	Temperature (°C)	7	9.0	3.5	14.5
Biochemical Oxygen Demand	7	-	< 1	1	Percent Saturation	7	98	91	105
Ammonia Nitrogen	7	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	6	.2	.1	.5	Potassium	4	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	0	-	-	-	Magnesium	4	7	7	7
Total Soluble Phosphate	7	-	<.04	.04	Sulfate	4	13	13	13
Total Solids	7	110	97	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	7	180	170	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	<1	<1	12
Chlorides	7	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	7	7.9	7.7	8.2	Total Plate Count 20°C	7	27	1	62
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	7	6	1	720

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
Range - Cheboygan

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	24	11.4	9.3	13.5	Temperature (°C)	24	9.0	4.0	17.5
Biochemical Oxygen Demand	24	-	<1	1	Percent Saturation	24	98	90	106
Ammonia Nitrogen	21	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	13	3	3	4
Nitrate Nitrogen	23	.2	.1	.6	Potassium	13	.8	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	13	24	22	26
Total Phosphate	0	-	-	-	Magnesium	13	7	5	9
Total Soluble Phosphate	22	-	<.04	.05	Sulfate	13	14	11	16
Total Solids	23	100	80	140	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	24	180	140	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	24	<1	<1	40
Chlorides	23	4	3	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	24	7.9	7.5	8.2	Total Plate Count 20°C	24	16	1	600
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	24	8	1	330

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
Range - Presque Isle

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	40	11.9	9.2	13.8	Temperature (^{o}C)	41	7.5	3.5	18.0
Biochemical Oxygen Demand	41	-	$\angle$1	1	Percent Saturation	40	99	81	116
Ammonia Nitrogen	26	-	$\angle$.05	.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	20	3	2	3
Nitrate Nitrogen	26	.2	.1	.3	Potassium	20	.8	.7	.9
Nitrite Nitrogen	0	-	-	-	Calcium	20	24	22	25
Total Phosphate	1	$\angle$.04	-	-	Magnesium	20	7	6	8
Total Soluble Phosphate	26	-	$\angle$.04	.05	Sulfate	20	14	11	16
Total Solids	28	110	82	140	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	41	180	140	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	40	$\angle$1	$\angle$1	7
Chlorides	28	5	3	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	41	7.7	6.9	8.3	Total Plate Count 20°C	20	22	1	700
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	40	3	0	70

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
Range - North Channel

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	21	10.9	9.3	13.2	Temperature (°C)	21	10.0	4.5	15.5
Biochemical Oxygen Demand	21	-	<1	1	Percent Saturation	21	96	85	108
Ammonia Nitrogen	11	-	<.05	.06	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	10	3	2	3
Nitrate Nitrogen	11	.2	.1	.3	Potassium	10	.7	.7	.8
Nitrite Nitrogen	0	-	-	-	Calcium	10	22	20	24
Total Phosphate	0	-	-	-	Magnesium	10	6	5	7
Total Soluble Phosphate	12	-	<.04	<.04	Sulfate	10	14	11	16
Total Solids	11	110	78	220	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	21	160	120	180
Vol. Susp. Solids	0	-	-	-	Total Coliform	21	<1	<1	5
Chlorides	11	3	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	21	7.8	7.6	8.0	Total Plate Count 20°C	16	54	10	150
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	20	2	1	14

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
Range - Georgian Bay

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	29	11.7	9.7	13.9	Temperature (°C)	29	9.5	4.0	17.0
Biochemical Oxygen Demand	29	-	<1	1	Percent Saturation	29	101	92	108
Ammonia Nitrogen	29	-	<.05	.17	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	14	3	3	3
Nitrate Nitrogen	29	-	<.1	.2	Potassium	14	.8	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	14	25	24	26
Total Phosphate	2	-	<.04	.05	Magnesium	14	8	7	9
Total Soluble Phosphate	29	-	<.04	.08	Sulfate	14	13	11	15
Total Solids	29	100	93	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	29	180	140	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	28	<1	<1	17
Chlorides	29	4	3	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	29	7.9	7.2	8.4	Total Plate Count 20°C	29	5	1	19
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	29	2	1	12

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Alpena

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	51	12.0	9.2	14.0	Temperature (°C)	51	8.0	3.0	18.0
Biochemical Oxygen Demand	50	-	<1	1	Percent Saturation	51	99	74	109
Ammonia Nitrogen	51	-	<.05	.23	Total Iron	0	-	-	-
Organic Nitrogen	4	.18	.11	.29	Sodium	27	3	3	4
Nitrate Nitrogen	51	-	<.1	.5	Potassium	27	1.0	.8	2.4
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	27	26	24	30
Total Phosphate	8	-	<.04	.1	Magnesium	27	8	6	9
Total Soluble Phosphate	51	-	<.04	.08	Sulfate	27	14	11	25
Total Solids	51	110	98	130	Total Hardness	4	95	88	100
Suspended Solids	4	3	1	5	Conductivity	50	200	180	220
Vol. Susp. Solids	4	2	0	4	Total Coliform	52	<1	<1	6
Chlorides	51	5	3	6	Fecal Coliform	2	-	<1	<2
Phenols	2	-	<2	2	Fecal Streptococcus	2	-	<1	<2
pH	51	7.8	7.4	8.3	Total Plate Count 20°C	50	2	1	140
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	51	1	1	55

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Oscoda

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	66	11.8	9.1	13.6	Temperature (^{o}C)	67	8.0	3.0	18.5
Biochemical Oxygen Demand	49	-	<1	1	Percent Saturation	66	99	87	106
Ammonia Nitrogen	57	-	$<.05$	1.10	Total Iron	0	-	-	-
Organic Nitrogen	12	-	$<.05$	.30	Sodium	24	3	3	4
Nitrate Nitrogen	63	-	$<.1$	.2	Potassium	24	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	24	25	24	26
Total Phosphate	20	-	$<.04$	.2	Magnesium	24	8	8	8
Total Soluble Phosphate	49	-	$<.04$	.05	Sulfate	24	14	12	16
Total Solids	49	100	92	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	67	190	180	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	49	<1	<1	14
Chlorides	67	5	4	6	Fecal Coliform	0	-	-	-
Phenols	12	-	<2	6	Fecal Streptococcus	0	-	-	-
pH	66	7.8	7.5	8.5	Total Plate Count 20°C	49	9	1	81
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	49	2	1	40

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Mouth of Saginaw Bay

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	70	10.4	8.0	12.5	Temperature (°C)	70	12.5	7.0	20.0
Biochemical Oxygen Demand	31	1	1	4	Percent Saturation	70	98	84	120
Ammonia Nitrogen	47	-	<.05	.48	Total Iron	18	300	<100	900
Organic Nitrogen	36	.13	<.05	.24	Sodium	17	4	3	7
Nitrate Nitrogen	47	.2	<.1	.5	Potassium	17	1.2	.8	2.2
Nitrite Nitrogen	13	-	<.01	<.01	Calcium	25	26	22	34
Total Phosphate	33	-	<.04	.2[a]	Magnesium	25	10	8	19
Total Soluble Phosphate	37	-	<.04	.1	Sulfate	25	14	9	24
Total Solids	35	120	95	160	Total Hardness	17	99	88	130
Suspended Solids	16	3	0	7	Conductivity	64	200	120	240
Vol. Susp. Solids	16	1	0	4	Total Coliform	36	<1	<1	5
Chlorides	58	6	1	15	Fecal Coliform	13	<1	<1	<2
Phenols	33	-	< 2	9	Fecal Streptococcus	13	<2	<1	5
pH	59	7.9	7.4	8.4	Total Plate Count 20°C	36	7	1	150
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	26	20	1	140

a - one value of .7 mg/l not used in calculating data

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Pte. Aux Barques

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	14	11.4	11.2	11.7	Temperature (^{o}C)	14	7.5	6.0	8.0
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	14	95	94	97
Ammonia Nitrogen	12	-	$\angle$.05	.13	Total Iron	0	-	-	-
Organic Nitrogen	12	.17	.06	.46	Sodium	0	-	-	-
Nitrate Nitrogen	14	-	$\angle$.1	.2	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	14	-	$\angle$.04	.5	Magnesium	0	-	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	0	-	-	-
Total Solids	0	-	-	-	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	14	190	180	230
Vol. Susp. Solids	0	-	-	-	Total Coliform	0	-	-	-
Chlorides	14	5	4	6	Fecal Coliform	0	-	-	-
Phenols	12	-	$\angle$2	2	Fecal Streptococcus	0	-	-	-
pH	14	7.6	7.5	7.8	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Harbor Beach

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	53	11.7	8.4	14.2	Temperature (^{o}C)	55	8.5	4.0	21.0
Biochemical Oxygen Demand	33	-	<1	1	Percent Saturation	53	99	90	112
Ammonia Nitrogen	48	-	$<.05$	.42	Total Iron	0	-	-	-
Organic Nitrogen	22	-	$<.05$	.45	Sodium	14	3	3	4
Nitrate Nitrogen	55	-	$<.1$	.5	Potassium	14	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	14	28	26	35
Total Phosphate	36	-	$<.04$	.4[a]	Magnesium	14	8	8	8
Total Soluble Phosphate	33	-	$<.04$	.09	Sulfate	14	14	13	15
Total Solids	33	110	85	190	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	55	190	110	260
Vol. Susp. Solids	0	-	-	-	Total Coliform	33	<1	<1	33
Chlorides	55	5	4	9	Fecal Coliform	0	-	-	-
Phenols	24	-	<2	3	Fecal Streptococcus	0	-	-	-
pH	53	7.9	6.8	8.9	Total Plate Count 20°C	33	10	1	110
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	33	4	1	350

a - one value of .9 mg/1 not used in computing data

NS = number of samples

TABLE 24. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965 (cont.)
Range - Port Huron

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	40	11.1	8.7	13.3	Temperature (°C)	44	10.5	0.0	20.5
Biochemical Oxygen Demand	23	-	<1	3	Percent Saturation	40	99	80	111
Ammonia Nitrogen	28	.12	<.05	.32	Total Iron	28	-	<100	600
Organic Nitrogen	29	.11	<.05	.59	Sodium	23	4	4	6
Nitrate Nitrogen	44	.2	<.1	.5	Potassium	23	-	<.4	2.9
Nitrite Nitrogen	17	-	<.01	.01	Calcium	32	26	18	32
Total Phosphate	37	-	<.04	.2	Magnesium	32	9	6	13
Total Soluble Phosphate	31	-	<.04	.2	Sulfate	32	18	6	36
Total Solids	36	110	93	140	Total Hardness	28	94	86	100
Suspended Solids	28	4	0	18	Conductivity	44	180	110	210
Vol. Susp. Solids	28	2	0	11	Total Coliform	36	1	<1	50
Chlorides	44	6	5	9	Fecal Coliform	11	<1	<1	<2
Phenols	36	-	<2	5	Fecal Streptococcus	11	<2	<2	<2
pH	43	7.9	7.4	8.5	Total Plate Count 20°C	30	32	1	81
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	36	10	1	53

NS = number of samples

TABLE 25. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H814 - Straits of Mackinac

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	7	11.5	9.8	12.7	Temperature (°C)	7	9.0	3.5	14.5
Biochemical Oxygen Demand	7	-	∠1	1	Percent Saturation	7	98	91	105
Ammonia Nitrogen	7	-	∠.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	6	.3	.1	.5	Potassium	4	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	0	-	-	-	Magnesium	4	7	7	7
Total Soluble Phosphate	7	-	∠.04	.04	Sulfate	4	13	13	13
Total Solids	7	110	97	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	7	180	170	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	∠1	∠1	12
Chlorides	7	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	7	7.9	7.7	8.2	Total Plate Count 20°C	7	27	1	62
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	7	6	1	720

NS = number of samples

TABLE 26. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H530 - Cheboygan

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	10.2	9.3	11.2	Temperature (°C)	4	14.5	12.5	17.5
Biochemical Oxygen Demand	4	-	$\angle$ 1	1	Percent Saturation	4	100	92	105
Ammonia Nitrogen	4	-	$\angle$.05	$\angle$.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	2	-	3	3
Nitrate Nitrogen	4	.1	.1	.1	Potassium	2	-	.9	.9
Nitrite Nitrogen	0	-	-	-	Calcium	2	-	26	26
Total Phosphate	0	-	-	-	Magnesium	2	-	8	9
Total Soluble Phosphate	4	-	$\angle$.04	$\angle$.04	Sulfate	2	-	16	16
Total Solids	4	120	110	140	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	4	210	200	220
Vol. Susp. Solids	0	-	-	-	Total Coliform	4	1	$\angle$1	2
Chlorides	4	5	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	4	8.0	7.7	8.2	Total Plate Count 20°C	4	23	1	52
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	2	1	7

NS = number of samples

TABLE 26. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H532 - Cheboygan (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	7	11.3	9.3	12.8	Temperature (°C)	7	9.5	4.5	17.5
Biochemical Oxygen Demand	7	-	<1	1	Percent Saturation	7	98	93	106
Ammonia Nitrogen	7	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	7	.2	.1	.2	Potassium	4	.8	.8	.8
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	0	-	-	-	Magnesium	4	7	7	7
Total Soluble Phosphate	7	-	$<.04$	.05	Sulfate	4	12	12	13
Total Solids	7	110	93	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	7	170	160	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	<1	<1	2
Chlorides	7	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	7	7.9	7.5	8.2	Total Plate Count 20°C	7	20	1	46
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	7	25	1	200

NS = number of samples

TABLE 26. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H534 - Cheboygan (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	11.9	9.6	13.5	Temperature (°C)	8	8.0	4.0	15.0
Biochemical Oxygen Demand	7	-	<1	1	Percent Saturation	8	99	93	106
Ammonia Nitrogen	8	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	4
Nitrate Nitrogen	7	.2	.1	.3	Potassium	4	.8	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	23	24
Total Phosphate	0	-	-	-	Magnesium	4	7	7	7
Total Soluble Phosphate	8	-	$<.04$	$<.04$	Sulfate	4	14	13	15
Total Solids	8	110	80	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	180	170	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	1
Chlorides	8	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	7.9	7.7	8.1	Total Plate Count 20°C	8	2	1	28
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	2	1	31

NS = number of samples

TABLE 26 WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H536 - Cheboygan (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.7	10.2	13.0	Temperature (°C)	5	7.0	4.0	11.5
Biochemical Oxygen Demand	5	1	1	1	Percent Saturation	5	95	90	100
Ammonia Nitrogen	2	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	5	.3	.1	.6	Potassium	3	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	3	23	22	24
Total Phosphate	0	-	-	-	Magnesium	3	6	5	7
Total Soluble Phosphate	3	-	<.04	<.04	Sulfate	3	12	11	13
Total Solids	4	79	82	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	5	170	150	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	5	1	<1	40
Chlorides	4	3	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	5	7.7	7.5	7.8	Total Plate Count 20°C	5	28	12	600
Chemical Oxygen Demand	0	- -	-	-	Total Plate Count 35°C	5	47	1	330

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H420 - Presque Isle

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.4	9.2	12.7	Temperature (°C)	6	8.5	5.0	16.0
Biochemical Oxygen Demand	6	-	$\angle$ 1	1	Percent Saturation	6	97	90	104
Ammonia Nitrogen	6	-	$\angle$.05	.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	6	.2	.1	.2	Potassium	3	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	3	25	24	25
Total Phosphate	0	-	-	-	Magnesium	3	7	6	7
Total Soluble Phosphate	6	-	$\angle$.04	.05	Sulfate	3	12	11	14
Total Solids	6	110	99	140	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	190	160	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	6	$\angle$ 1	$\angle$1	4
Chlorides	6	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	6	7.6	6.9	7.9	Total Plate Count 20°C	6	10	2	25
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	6	1	1	23

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H422 - Presque Isle (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	12.4	9.4	13.8	Temperature (°C)	10	7.0	4.0	18.0
Biochemical Oxygen Demand	10	-	<1	1	Percent Saturation	10	101	91	106
Ammonia Nitrogen	5	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	5	3	2	3
Nitrate Nitrogen	5	.2	.1	.2	Potassium	5	.8	.7	.8
Nitrite Nitrogen	0	-	-	-	Calcium	5	25	24	25
Total Phosphate	1	<.04	-	-	Magnesium	5	6	6	7
Total Soluble Phosphate	5	-	<.04	<.04	Sulfate	5	13	11	16
Total Solids	5	110	100	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	10	180	150	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	10	<1	<1	6
Chlorides	5	4	3	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	7.7	7.2	7.9	Total Plate Count 20°C	5	13	8	24
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	10	2	1	17

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H424 - Presque Isle (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	12.2	10.7	13.4	Temperature (°C)	8	7.0	4.0	12.5
Biochemical Oxygen Demand	8	-	<1	1	Percent Saturation	8	100	93	104
Ammonia Nitrogen	5	-	$<.05$	.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	5	.2	.1	.2	Potassium	4	.7	.7	.8
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	0	-	-	-	Magnesium	4	8	7	8
Total Soluble Phosphate	5	-	$<.04$	$<.04$	Sulfate	4	15	14	16
Total Solids	6	110	100	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	190	170	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	2	<1	7
Chlorides	6	5	5	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	8.1	7.8	8.3	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	7	11	0	70

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H426 - Presque Isle (cont.)

Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	11.7	10.5	13.4
Biochemical Oxygen Demand	9	-	< 1	1
Ammonia Nitrogen	6	-	<.05	<.05
Organic Nitrogen	0	-	-	-
Nitrate Nitrogen	6	.2	.1	.2
Nitrite Nitrogen	0	-	-	-
Total Phosphate	0	-	-	-
Total Soluble Phosphate	6	-	<.04	.05
Total Solids	7	100	82	120
Suspended Solids	0	-	-	-
Vol. Susp. Solids	0	-	-	-
Chlorides	7	5	4	6
Phenols	0	-	-	-
pH	9	8.0	7.8	8.1
Chemical Oxygen Demand	0	-	-	-

Parameters	NS	Avg.	Low	High
Temperature (^{o}C)	9	7.5	3.5	12.5
Percent Saturation	8	98	81	116
Total Iron	0	-	-	-
Sodium	4	3	3	3
Potassium	4	.7	.7	.8
Calcium	4	25	25	25
Magnesium	4	8	8	8
Sulfate	4	14	14	16
Total Hardness	0	-	-	-
Conductivity	9	180	150	210
Total Coliform	9	<1	< 1	3
Fecal Coliform	0	-	-	-
Fecal Streptococcus	0	-	-	-
Total Plate Count 20°C	5	50	50	60
Total Plate Count 35°C	9	19	2	39

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H428 - Presque Isle (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	11.6	9.7	13.2	Temperature (°C)	8	8.5	4.0	15.0
Biochemical Oxygen Demand	8	-	<1	1	Percent Saturation	8	98	89	104
Ammonia Nitrogen	4	-	<.05	.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	4	.2	.2	.3	Potassium	4	.7	.7	.7
Nitrite Nitrogen	0	-	-	-	Calcium	4	23	22	24
Total Phosphate	0	-	-	-	Magnesium	4	7	6	8
Total Soluble Phosphate	4	-	<.04	<.04	Sulfate	4	14	13	15
Total Solids	4	100	99	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	170	140	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	6
Chlorides	4	4	3	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	7.9	7.5	8.2	Total Plate Count 20°C	4	250	1	700
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	2	1	8

NS = number of samples

TABLE 27. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H432 - Presque Isle (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.5	9.6	12.9	Temperature (°C)	5	9.0	4.0	15.5
Biochemical Oxygen Demand	5	-	<1	1	Percent Saturation	5	98	93	102
Ammonia Nitrogen	2	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	2	-	3	3
Nitrate Nitrogen	2	-	.2	.2	Potassium	2	-	.8	.8
Nitrite Nitrogen	0	-	-	-	Calcium	2	-	21	24
Total Phosphate	0	-	-	-	Magnesium	2	-	5	7
Total Soluble Phosphate	2	-	$<.04$	$<.04$	Sulfate	2	-	11	15
Total Solids	2	-	100	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	5	170	140	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	5	<1	<1	1
Chlorides	2	-	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	5	7.9	7.6	8.1	Total Plate Count 20°C	5	33	17	60
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	5	2	1	3

NS = number of samples

TABLE 28. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H808 - North Channel

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	7	10.8	9.3	12.0	Temperature (°C)	7	10.0	6.0	15.5
Biochemical Oxygen Demand	7	-	<1	1	Percent Saturation	7	95	90	103
Ammonia Nitrogen	4	-	<.05	.06	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	2	3
Nitrate Nitrogen	4	.2	.2	.3	Potassium	3	.7	.7	.7
Nitrite Nitrogen	0	-	-	-	Calcium	3	21	20	23
Total Phosphate	0	-	-	-	Magnesium	3	6	5	6
Total Soluble Phosphate	3	-	<.04	<.04	Sulfate	3	15	14	16
Total Solids	3	97	91	100	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	7	160	150	170
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	2	<1	5
Chlorides	3	3	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	7	7.8	7.6	7.9	Total Plate Count 20°C	4	63	10	150
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	6	3	1	14

NS = number of samples

TABLE 28. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H809 - North Channel (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	10.7	9.4	11.9	Temperature (^{o}C)	4	10.0	6.0	15.5
Biochemical Oxygen Demand	4	-	$<$ 1	1	Percent Saturation	4	95	85	105
Ammonia Nitrogen	2	-	$<$.05	.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	2	-	2	3
Nitrate Nitrogen	2	-	.2	.2	Potassium	2	-	.7	.7
Nitrite Nitrogen	0	-	-	-	Calcium	2	-	20	22
Total Phosphate	0	-	-	-	Magnesium	2	-	6	6
Total Soluble Phosphate	2	-	$<$.04	$<$.04	Sulfate	2	-	14	14
Total Solids	2	-	98	100	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	4	160	160	170
Vol. Susp. Solids	0	-	-	-	Total Coliform	4	2	$<$1	4
Chlorides	2	-	4	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	4	7.8	7.6	7.9	Total Plate Count $20^{o}C$	2	-	90	140
Chemical Oxygen Demand	0	-	-	-	Total Plate Count $35^{o}C$	4	2	1	3

NS = number of samples

TABLE 28. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H810 - North Channel (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.5	10.6	13.2	Temperature (°C)	4	9.0	7.0	11.5
Biochemical Oxygen Demand	4	-	<1	1	Percent Saturation	4	100	90	108
Ammonia Nitrogen	2	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	2	-	3	3
Nitrate Nitrogen	2	-	.2	.2	Potassium	2	-	.7	.8
Nitrite Nitrogen	0	-	-	-	Calcium	2	-	23	24
Total Phosphate	0	-	-	-	Magnesium	2	-	6	6
Total Soluble Phosphate	2	-	<.04	<.04	Sulfate	2	-	13	16
Total Solids	2	-	100	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	4	170	160	180
Vol. Susp. Solids	0	-	-	-	Total Coliform	4	<1	<1	<1
Chlorides	2	-	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	4	7.9	7.7	8.0	Total Plate Count 20°C	4	77	12	150
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	1	1	2

NS = number of samples

TABLE 28. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H812 - North Channel (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	10.8	9.6	12.3	Temperature (°C)	6	10.5	4.5	15.5
Biochemical Oxygen Demand	6	-	<1	1	Percent Saturation	6	96	93	101
Ammonia Nitrogen	3	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	2	3
Nitrate Nitrogen	3	.2	.1	.2	Potassium	3	.7	.7	.8
Nitrite Nitrogen	0	-	-	-	Calcium	3	21	20	23
Total Phosphate	0	-	-	-	Magnesium	3	6	5	7
Total Soluble Phosphate	5	-	<.04	<.04	Sulfate	3	12	11	12
Total Solids	4	120	78	220	Total Hardness	0	-	-	-
Suspended solids	0	-	-	-	Conductivity	6	150	120	180
Vol. Susp. Solids	0	-	-	-	Total Coliform	6	<1	<1	1
Chlorides	4	3	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	6	7.8	7.6	8.0	Total Plate Count 20°C	6	35	11	82
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	6	2	1	10

NS = number of samples

TABLE 29. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H382 - Georgian Bay

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.1	9.9	12.5	Temperature (°C)	6	11.0	6.0	16.0
Biochemical Oxygen Demand	6	-	<1	1	Percent Saturation	6	100	92	105
Ammonia Nitrogen	6	-	<.05	.15	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	6	.1	.1	.2	Potassium	3	.9	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	3	25	25	26
Total Phosphate	0	-	-	-	Magnesium	3	8	8	9
Total Soluble Phosphate	6	-	<.04	.05	Sulfate	3	11	11	11
Total Solids	6	100	93	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	190	140	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	6	<1	<1	8
Chlorides	6	5	4	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	6	7.6	7.2	8.0	Total Plate Count 20°C	6	9	6	19
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	6	2	1	8

NS = number of samples

TABLE 29. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H384 - Georgian Bay (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.5	9.8	12.7	Temperature (°C)	6	10.0	5.5	16.5
Biochemical Oxygen Demand	6	-	$<$ 1	1	Percent Saturation	6	102	100	104
Ammonia Nitrogen	6	-	$<$.05	.17	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	6	.1	.1	.2	Potassium	3	.8	.8	.8
Nitrite Nitrogen	0	-	-	-	Calcium	3	25	24	25
Total Phosphate	0	-	-	-	Magnesium	3	8	8	8
Total Soluble Phosphate	6	-	$<$.04	.08	Sulfate	3	13	11	15
Total Solids	6	110	93	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	6	$<$1	$<$1	$<$1
Chlorides	6	4	4	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	6	8.0	7.5	8.3	Total Plate Count 20°C	6	6	5	6
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	6	2	1	5

NS = number of samples

TABLE 29. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H386 - Georgian Bay (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	9	11.9	9.7	13.9	Temperature (^oC)	9	8.5	4.5	16.5
Biochemical Oxygen Demand	9	-	<1	1	Percent Saturation	9	102	98	108
Ammonia Nitrogen	9	-	$<.05$	.13	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	9	-	$<.1$	.2	Potassium	4	.8	.8	.8
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	1	.05	-	-	Magnesium	4	7	7	7
Total Soluble Phosphate	9	-	$<.04$	.04	Sulfate	4	14	13	15
Total Solids	9	100	95	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	9	180	170	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	16
Chlorides	9	4	3	4	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	9	8.0	7.6	8.3	Total Plate Count 20^oC	9	2	1	11
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35^oC	9	2	1	12

NS = number of samples

TABLE 29. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H388 - Georgian Bay (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	12.2	9.7	13.4	Temperature (°C)	8	8.0	4.0	17.0
Biochemical Oxygen Demand	8	-	< 1	1	Percent Saturation	8	101	94	106
Ammonia Nitrogen	8	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	8	.1	.1	.2	Potassium	4	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	24	24	24
Total Phosphate	0	-	-	-	Magnesium	4	8	7	8
Total Soluble Phosphate	8	-	<.04	.07	Sulfate	4	15	15	15
Total Solids	8	100	97	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	180	170	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	17
Chlorides	8	4	3	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	8.1	7.9	8.4	Total Plate Count 20°C	8	3	1	10
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	4	1	6

NS = number of samples

TABLE 30. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H372 - Alpena

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.1	9.2	13.3	Temperature (^oC)	6	9.5	6.0	18.0
Biochemical Oxygen Demand	6	-	<1	1	Percent Saturation	6	96	74	108
Ammonia Nitrogen	6	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	6	-	$<.1$	.1	Potassium	3	.8	.8	.8
Nitrite Nitrogen	0	-	-	-	Calcium	3	25	24	25
Total Phosphate	0	-	-	-	Magnesium	3	7	6	7
Total Soluble Phosphate	6	-	$<.04$	.04	Sulfate	3	13	11	16
Total Solids	6	110	99	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	6	<1	<1	1
Chlorides	6	4	3	5	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	6	7.8	7.6	8.2	Total Plate Count 20^oC	6	8	1	37
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35^oC	6	1	1	3

NS = number of samples

TABLE 30. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H374 Alpena (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	12.5	9.6	13.5	Temperature (°C)	10	6.0	3.0	16.5
Biochemical Oxygen Demand	10	-	$\angle$1	1	Percent Saturation	10	98	93	101
Ammonia Nitrogen	10	-	$\angle$.05	$\angle$.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	5	3	3	3
Nitrate Nitrogen	10	.1	.1	.1	Potassium	5	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	5	25	24	26
Total Phosphate	0	-	-	-	Magnesium	5	7	7	7
Total Soluble Phosphate	10	-	$\angle$.04	.08	Sulfate	5	13	12	15
Total Solids	10	110	98	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	10	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	10	$\angle$1	$\angle$1	$\angle$1
Chlorides	10	5	4	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	7.9	7.6	8.1	Total Plate Count 20°C	10	2	1	18
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	10	3	1	34

NS = number of samples

TABLE 30. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H376 - Alpena (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	12.6	9.9	13.6	Temperature (°C)	10	6.0	3.0	16.0
Biochemical Oxygen Demand	10	-	< 1	1[a]	Percent Saturation	10	99	98	101
Ammonia Nitrogen	10	-	< .05	< .05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	5	3	3	3
Nitrate Nitrogen	10	-	< .1	.1	Potassium	5	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	5	25	25	25
Total Phosphate	0	-	-	-	Magnesium	5	7	7	7
Total Soluble Phosphate	10	-	< .04	.04	Sulfate	5	16	14	19
Total Solids	10	100	100	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	10	200	190	220
Vol. Susp. Solids	0	-	-	-	Total Coliform	10	< 2	< 1	5
Chlorides	10	5	4	8	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	7.8	7.6	8.3	Total Plate Count 20°C	10	2	1	55
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	10	2	1	15

a - value of 5 not used as it was a bottom sample.

NS = number of samples

TABLE 30. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H378 - Alpena (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	12.3	9.6	14.0	Temperature (^{o}C)	8	7.5	4.0	16.5
Biochemical Oxygen Demand	8	-	<1	1	Percent Saturation	8	101	96	106
Ammonia Nitrogen	8	-	<.05	<.05	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	8	.1	.1	.2	Potassium	4	.9	.9	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	26	26	26
Total Phosphate	0	-	-	-	Magnesium	4	8	7	8
Total Soluble Phosphate	8	-	<.04	.04	Sulfate	4	14	14	16
Total Solids	8	110	100	130	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	200	190	220
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	2
Chlorides	8	5	4	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	7.8	7.5	8.3	Total Plate Count 20°C	8	6	1	10
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	4	1	10

NS = number of samples

TABLE 30. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H380 - Alpena (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	9	11.9	9.6	13.3	Temperature (°C)	9	8.5	4.0	17.0
Biochemical Oxygen Demand	9	-	<1	2	Percent Saturation	9	100	94	109
Ammonia Nitrogen	9	-	<.05	.07	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	9	.1	.1	.2	Potassium	4	.9	.9	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	26	25	26
Total Phosphate	1	<.04	-	-	Magnesium	4	8	8	8
Total Soluble Phosphate	9	-	<.04	.05	Sulfate	4	11	11	11
Total Solids	9	110	100	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	9	200	190	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	9	<1	<1	<1
Chlorides	9	5	4	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	9	7.8	7.4	8.0	Total Plate Count 20°C	9	1	1	2
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	9	1	1	1

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H320 - Oscoda

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	14	11.4	9.2	13.2	Temperature (^{o}C)	14	8.5	4.5	18.5
Biochemical Oxygen Demand	8	1	1	1	Percent Saturation	14	97	87	104
Ammonia Nitrogen	12	-	< .05	1.10	Total Iron	0	-	-	-
Organic Nitrogen	4	-	<.05	.28	Sodium	4	3	3	3
Nitrate Nitrogen	14	-	< .1	.2	Potassium	4	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	25	24	26
Total Phosphate	7	-	<.04	.1	Magnesium	4	8	8	8
Total Soluble Phosphate	8	-	<.04	<.04	Sulfate	4	14	13	14
Total Solids	8	110	100	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	14	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	2
Chlorides	14	4	4	5	Fecal Coliform	0	-	-	-
Phenols	4	-	< 2	< 2	Fecal Streptococcus	0	-	-	-
pH	14	7.7	7.5	8.0	Total Plate Count 20°C	8	12	2	28
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	2	1	8

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H321 Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.3	11.1	11.5	Temperature (°C)	6	7.5	7.0	8.5
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	6	95	93	98
Ammonia Nitrogen	4	-	$<.05$	.28	Total Iron	0	-	-	-
Organic Nitrogen	4	.15	.10	.21	Sodium	0	-	-	-
Nitrate Nitrogen	6	-	$<.1$	.1	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	6	-	$<.04$	.1	Magnesium	0	-	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	0	-	-	-
Total Solids	0	-	-	-	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	190	180	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	0	-	-	-
Chlorides	6	4	4	4	Fecal Coliform	0	-	-	-
Phenols	4	-	<2	4	Fecal Streptococcus	0	-	-	-
pH	6	7.7	7.6	7.8	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H322 - Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	11.8	9.4	13.3	Temperature (^{o}C)	15	8.0	4.0	18.0
Biochemical Oxygen Demand	9	-	< 1	1	Percent Saturation	15	98	92	106
Ammonia Nitrogen	13	-	<.05	.68	Total Iron	0	-	-	-
Organic Nitrogen	4	-	<.05	.30	Sodium	4	3	3	4
Nitrate Nitrogen	15	-	<.1	.2	Potassium	4	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	26	25	26
Total Phosphate	6	-	<.04	.2	Magnesium	4	8	8	8
Total Soluble Phosphate	9	-	<.04	<.04	Sulfate	4	15	14	16
Total Solids	9	100	92	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	15	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	9	<1	<1	14
Chlorides	15	5	4	6	Fecal Coliform	0	-	-	-
Phenols	4	-	<2	6	Fecal Streptococcus	0	-	-	-
pH	15	7.8	7.5	8.2	Total Plate Count 20^{o}C	9	12	3	24
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35^{o}C	9	2	1	40

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H324 - Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	9	12.4	9.3	13.6	Temperature (^{o}C)	9	7.5	4.0	18.5
Biochemical Oxygen Demand	9	-	<1	1	Percent Saturation	9	102	95	105
Ammonia Nitrogen	5	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	3
Nitrate Nitrogen	5	.2	.2	.2	Potassium	4	.8	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	25	24	25
Total Phosphate	0	-	-	-	Magnesium	4	8	8	8
Total Soluble Phosphate	9	-	$<.04$	.04	Sulfate	4	15	14	16
Total Solids	9	110	95	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	9	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	9	<1	<1	<1
Chlorides	9	5	5	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	9	8.0	7.7	8.5	Total Plate Count $20^{o}C$	9	9	1	13
Chemical Oxygen Demand	0	-	-	-	Total Plate Count $35^{o}C$	9	1	1	38

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H326 - Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	9	12.4	9.7	13.5	Temperature (°C)	10	6.5	3.0	17.5
Biochemical Oxygen Demand	10	-	$\angle$1	1	Percent Saturation	9	99	93	102
Ammonia Nitrogen	10	-	$\angle$.05	.06	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	5	3	3	3
Nitrate Nitrogen	10	-	$\angle$.1	.2	Potassium	5	.8	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	5	25	25	25
Total Phosphate	0	-	-	-	Magnesium	5	8	8	8
Total Soluble Phosphate	10	-	$\angle$.04	.04	Sulfate	5	14	14	15
Total Solids	10	100	93	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	10	200	190	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	10	$\angle$1	$\angle$1	$\angle$1
Chlorides	10	5	5	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	9	7.9	7.7	8.1	Total Plate Count 20°C	10	5	1	25
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	10	1	1	6

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H328 - Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	11.6	9.3	13.1	Temperature (°C)	8	10.0	4.0	18.5
Biochemical Oxygen Demand	8	-	<1	1	Percent Saturation	8	100	98	104
Ammonia Nitrogen	8	-	$<.05$	.06	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	4	3	3	4
Nitrate Nitrogen	8	-	$<.1$	.2	Potassium	4	.9	.8	1.1
Nitrite Nitrogen	0	-	-	-	Calcium	4	26	25	26
Total Phosphate	0	-	-	-	Magnesium	4	8	8	8
Total Soluble Phosphate	8	-	$<.04$	.05	Sulfate	4	15	14	16
Total Solids	8	100	94	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	8	200	190	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	<1
Chlorides	8	5	5	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	8	7.9	7.7	8.3	Total Plate Count 20°C	8	7	1	16
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	8	1	13

NS = number of samples

TABLE 31. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H330 - Oscoda (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.0	9.1	13.2	Temperature (°C)	5	12.0	5.0	18.5
Biochemical Oxygen Demand	5	1	1	1	Percent Saturation	5	101	98	103
Ammonia Nitrogen	5	-	<.05	.06	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	3	3	3	3
Nitrate Nitrogen	5	.1	.1	.2	Potassium	3	.9	.9	.9
Nitrite Nitrogen	0	-	-	-	Calcium	3	26	25	26
Total Phosphate	1	<.04	-	-	Magnesium	3	8	8	8
Total Soluble Phosphate	5	-	<.04	<.04	Sulfate	3	13	12	15
Total Solids	5	100	93	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	5	200	190	210
Vol. Susp. Solids	0	-	-	-	Total Coliform	5	3	1	8
Chlorides	5	5	5	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	5	7.9	7.6	8.1	Total Plate Count 20°C	5	42	10	81
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	5	5	4	10

NS = number of samples

TABLE 32. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H200 Mouth of Saginaw Bay

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	18	10.2	8.0	11.9	Temperature (°C)	19	12.5	3.5	19.5
Biochemical Oxygen Demand	8	1	1	2	Percent Saturation	18	97	84	107
Ammonia Nitrogen	11	-	<.05	.28	Total Iron	5	500	<100	900
Organic Nitrogen	11	.14	<.05	.24	Sodium	4	4	3	4
Nitrate Nitrogen	13	.1	<.1	.5	Potassium	4	1.2	.9	1.6
Nitrite Nitrogen	4	-	<.01	<.01	Calcium	7	27	24	34
Total Phosphate	8	-	<.04	.2[a]	Magnesium	7	11	8	19
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	7	16	10	24
Total Solids	9	120	110	140	Total Hardness	5	100	90	130
Suspended Solids	5	2	0	4	Conductivity	16	200	180	220
Vol. Susp. Solids	5	2	0	4	Total Coliform	9	<1	<1	2
Chlorides	14	6	4	11	Fecal Coliform	4	<1	<1	2
Phenols	9	-	<2	3	Fecal Streptococcus	4	1	<1	5
pH	16	7.9	7.5	8.2	Total Plate Count 20°C	7	14	2	50
Chemical Oxygen Demand	4	5	3	7	Total Plate Count 35°C	9	5	1	150

a -value of .7 not used in computing data

NS = number of samples

TABLE 32. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H202 Mouth of Saginaw Bay (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	17	10.5	8.9	12.4	Temperature (°C)	19	11.9	3.0	19.0
Biochemical Oxygen Demand	8	1	1	4	Percent Saturation	17	97	84	108
Ammonia Nitrogen	8	.18	<.05	.34	Total Iron	4	200	<100	300
Organic Nitrogen	8	.18	.05	.22	Sodium	4	4	3	4
Nitrate Nitrogen	13	.2	.1	.5	Potassium	4	1.1	.9	1.5
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	6	25	22	27
Total Phosphate	8	-	<.04	<.04	Magnesium	6	10	8	13
Total Soluble Phosphate	4	-	<.04	<.04	Sulfate	6	13	10	15
Total Solids	9	110	110	130	Total Hardness	4	90	88	100
Suspended Solids	4	4	2	7	Conductivity	16	190	170	210
Vol. Susp. Solids	4	2	0	4	Total Coliform	8	<1	<1	<2
Chlorides	14	5	4	7	Fecal Coliform	3	<1	<1	<2
Phenols	8	-	<2	9	Fecal Streptococcus	3	<2	<1	4
pH	16	7.9	7.6	8.3	Total Plate Count 20°C	7	8	2	32
Chemical Oxygen Demand	3	7	3	9	Total Plate Count 35°C	9	4	1	11

NS = number of samples

TABLE 32. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H204 Mouth of Saginaw Bay (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	18	10.7	8.5	12.5	Temperature (°C)	19	11.5	3.0	19.0
Biochemical Oxygen Demand	10	1	1	2	Percent Saturation	18	99	87	110
Ammonia Nitrogen	9	.14	<.05	.48[a]	Total Iron	4	200	<100	400
Organic Nitrogen	10	.11	<.05	.16	Sodium	5	4	3	5
Nitrate Nitrogen	15	.2	<.1	.5	Potassium	5	1.2	.8	1.8
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	7	26	24	27
Total Phosphate	8	-	<.04	.1	Magnesium	7	10	8	13
Total Soluble Phosphate	4	-	<.04	.05	Sulfate	7	14	10	17
Total Solids	11	120	95	140	Total Hardness	4	97	91	100
Suspended Solids	4	3	0	5	Conductivity	17	190	160	210
Vol. Susp. Solids	4	1	0	3	Total Coliform	11	<1	<1	<2
Chlorides	15	6	4	8	Fecal Coliform	3	<1	<1	<2
Phenols	8	-	<2	<2	Fecal Streptococcus	3	<2	<1	4
pH	17	8.0	7.5	8.4	Total Plate Count 20°C	9	51	1	140
Chemical Oxygen Demand	3	7	3	11	Total Plate Count 35°C	11	11	1	76

a - value of .74 not used in computing data

NS = number of samples

TABLE 32. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H206 Mouth of Saginaw Bay(cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	17	10.3	8.7	12.5	Temperature (°C)	18	12.6	4.0	19.0
Biochemical Oxygen Demand	7	1	1	2	Percent Saturation	17	98	89	118
Ammonia Nitrogen	8	-	$<$.05	.14[a]	Total Iron	5	200	$<$100	400
Organic Nitrogen	9	.10	.07	.18	Sodium	4	5	3	7
Nitrate Nitrogen	10	.1	$<$.1	.4	Potassium	4	1.5	.8	2.2
Nitrite Nitrogen	3	-	$<$.01	$<$.01	Calcium	6	27	23	29
Total Phosphate	7	-	$<$.04	.1	Magnesium	6	10	8	14
Total Soluble Phosphate	4	-	$<$.04	.04	Sulfate	6	14	9	19
Total Solids	7	130	110	160	Total Hardness	4	100	91	110
Suspended Solids	3	2	1	3	Conductivity	15	200	120	240
Vol. Susp. Solids	3	1	0	2	Total Coliform	8	1	$<$1	5
Chlorides	15	7	1	15	Fecal Coliform	3	$<$1	$<$1	$<$2
Phenols	8	-	$<$2	2	Fecal Streptococcus	3	$<$1	$<$1	$<$1
pH	15	7.9	7.4	8.3	Total Plate Count 20°C	4	40	7	65
Chemical Oxygen Demand	3	6	2	14	Total Plate Count 35°C	8	11	2	23

a - value of 2.15 not used in computing data.
NS = number of samples

TABLE 33. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H250 - Pointe Aux Barques

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.6	11.5	11.7	Temperature (°C)	4	7.0	6.0	8.0
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	4	95	94	97
Ammonia Nitrogen	4	-	<.05	.08	Total Iron	0	-	-	-
Organic Nitrogen	4	.28	.10	.46	Sodium	0	-	-	-
Nitrate Nitrogen	4	-	<.1	.1	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	4	-	<.04	.1	Magnesium	0	-	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	0	-	-	-
Total Solids	0	-	-	-	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	4	210	190	230
Vol. Susp. Solids	0	-	-	-	Total Coliform	0	-	-	-
Chlorides	4	7	6	8	Fecal Coliform	0	-	-	-
Phenols	4	-	<2	2	Fecal Streptococcus	0	-	-	-
pH	4	7.7	7.5	7.8	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 33. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H252 - Pointe Aux Barques (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	11.3	11.6	Temperature (°C)	5	8.0	7.5	8.0
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	5	95	94	97
Ammonia Nitrogen	4	-	< .05	.13	Total Iron	0	-	-	-
Organic Nitrogen	4	.14	.07	.20	Sodium	0	-	-	-
Nitrate Nitrogen	5	-	<.1	.2	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	5	-	<.04	.6	Magnesium	0	-	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	0	-	-	-
Total Solids	0	-	-	-	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	5	190	180	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	0	-	-	-
Chlorides	5	5	4	5	Fecal Coliform	0	-	-	-
Phenols	4	-	< 2	2	Fecal Streptococcus	0	-	-	-
pH	5	7.6	7.5	7.8	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 33. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H254 - Pointe Aux Barques (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	11.2	11.5	Temperature (°C)	5	7.5	7.0	8.0
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	5	94	94	95
Ammonia Nitrogen	4	-	$<$.05	.10	Total Iron	0	-	-	-
Organic Nitrogen	4	.11	.06	.17	Sodium	0	-	-	-
Nitrate Nitrogen	5	-	$<$ .1	.1	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	5	-	$<$.04	$<$.04	Magnesium	0	-	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	0	-	-	-
Total Solids	0	-	-	-	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	5	190	180	190
Vol. Susp. Solids	0	-	-	-	Total Coliform	0	-	-	-
Chlorides	5	4	4	5	Fecal Coliform	0	-	-	-
Phenols	4	-	$<$ 2	$<$ 2	Fecal Streptococcus	0	-	-	-
pH	5	7.7	7.5	7.8	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 34. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
H130 - Harbor Beach

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	11.6	9.0	13.9	Temperature (°C)	15	8.5	4.0	19.5
Biochemical Oxygen Demand	9	-	< 1	1	Percent Saturation	15	98	92	108
Ammonia Nitrogen	13	-	<.05	.08	Total Iron	0	-	-	-
Organic Nitrogen	6	-	<.05	.27	Sodium	4	4	3	4
Nitrate Nitrogen	15	-	<.1	.4	Potassium	4	.9	.9	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	27	26	27
Total Phosphate	10	-	<.04	<.04	Magnesium	4	8	8	8
Total Soluble Phosphate	9	-	<.04	.04	Sulfate	4	15	14	15
Total Solids	9	110	100	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	15	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	9	< 1	<1	<1
Chlorides	15	5	4	7	Fecal Coliform	0	-	-	-
Phenols	6	-	<2	2	Fecal Streptococcus	0	-	-	-
pH	13	7.8	6.8	8.9	Total Plate Count 20°C	9	7	1	110
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	9	3	1	350

NS = number of samples

TABLE 34. WATER QUALITY DATA
Lake Huron Basin - Deepwater 1965
H132 - Harbor Beach (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	13	11.8	9.1	14.0	Temperature (°C)	14	8.0	4.0	19.5
Biochemical Oxygen Demand	8	1	1	1	Percent Saturation	13	98	92	106
Ammonia Nitrogen	11	-	<.05	.06	Total Iron	0	-	-	-
Organic Nitrogen	4	-	<.05	.2	Sodium	4	3	3	4
Nitrate Nitrogen	14	-	<.1	.4	Potassium	4	.9	.8	.9
Nitrite Nitrogen	0	-	-	-	Calcium	4	26	26	28
Total Phosphate	10	-	<.04	.4	Magnesium	4	8	8	8
Total Soluble Phosphate	8	-	<.04	.09	Sulfate	4	15	14	15
Total Solids	8	110	100	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	14	180	110	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	33
Chlorides	14	5	4	7	Fecal Coliform	0	-	-	-
Phenols	6	-	<2	<2	Fecal Streptococcus	0	-	-	-
pH	14	7.9	7.3	8.5	Total Plate Count 20°C	8	4	2	13
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	1	1	12

NS = number of samples

TABLE 34. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H133 Harbor Beach (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	3	14.0	13.9	14.2	Temperature (°C)	4	4.0	4.0	4.0
Biochemical Oxygen Demand	4	1	1	1	Percent Saturation	3	106	106	108
Ammonia Nitrogen	4	-	$<.05$	$<.05$	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	0	-	-	-
Nitrate Nitrogen	4	.3	.3	.4	Potassium	0	-	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	0	-	-	-
Total Phosphate	0	-	-	-	Magnesium	0	-	-	-
Total Soluble Phosphate	4	-	$<.04$	.2	Sulfate	0	-	-	-
Total Solids	4	120	100	120	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	4	190	180	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	4	<1	<1	<1
Chlorides	4	5	4	5	Fecal Coliform	0	-	-	-
Phenols	2	-	<2	3	Fecal Streptococcus	0	-	-	-
pH	4	8.2	7.6	8.5	Total Plate Count 20°C	4	8	1	11
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	4	3	12

NS = number of samples

TABLE 34. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H134 - Harbor Beach (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	14	11.7	8.8	13.9	Temperature (°C)	14	8.5	4.0	19.5
Biochemical Oxygen Demand	8	-	<1	1	Percent Saturation	14	99	90	112
Ammonia Nitrogen	12	-	$<.05$	.11	Total Iron	0	-	-	-
Organic Nitrogen	6	-	$<.05$	.45	Sodium	4	4	3	4
Nitrate Nitrogen	14	-	$<.1$	.3	Potassium	4	.9	.8	1.0
Nitrite Nitrogen	0	-	-	-	Calcium	4	31	27	35
Total Phosphate	10	-	$<.04$	$<.04$	Magnesium	4	8	8	8
Total Soluble Phosphate	8	-	$<.04$	.04	Sulfate	4	14	13	15
Total Solids	8	110	85	190	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	14	170	110	200
Vol. Susp. Solids	0	-	-	-	Total Coliform	8	<1	<1	14
Chlorides	14	5	4	7	Fecal Coliform	0	-	-	-
Phenols	4	-	<2	<2	Fecal Streptococcus	0	-	-	-
pH	14	7.8	7.3	8.5	Total Plate Count 20°C	8	16	8	86
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	9	1	33

NS = number of samples

TABLE 34. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H136 - Harbor Beach (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	8	10.8	8.4	12.1	Temperature (°C)	8	12.0	5.5	21.0
Biochemical Oxygen Demand	4	1	1	1	Percent Saturation	8	99	94	110
Ammonia Nitrogen	8	-	$<.05$	.42	Total Iron	0	-	-	-
Organic Nitrogen	6	.13	.05	.21	Sodium	2	-	4	4
Nitrate Nitrogen	8	-	$<.1$	.5	Potassium	2	-	.9	.9
Nitrite Nitrogen	0	-	-	-	Calcium	2	-	29	30
Total Phosphate	6	-	$<.04$	$<.04$[a]	Magnesium	2	-	8	8
Total Soluble Phosphate	4	-	$<.04$	.04	Sulfate	2	-	15	15
Total Solids	4	100	99	110	Total Hardness	0	-	-	-
Suspended Solids	0	-	-	-	Conductivity	6	220	200	260
Vol. Susp. Solids	0	-	-	-	Total Coliform	4	5	1	18
Chlorides	8	7	5	9	Fecal Coliform	0	-	-	-
Phenols	6	-	<2	2	Fecal Streptococcus	0	-	-	-
pH	8	8.0	7.6	8.6	Total Plate Count 20°C	4	11	5	14
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	31	23	86

a - one value of .9 not used in computing data.

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H100 Port Huron

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.1	9.9	12.2	Temperature (°C)	5	10.0	2.5	16.0
Biochemical Oxygen Demand	3	2	1	3	Percent Saturation	5	98	89	105
Ammonia Nitrogen	3	.17	.13	.24	Total Iron	5	200	∠100	600
Organic Nitrogen	3	.11	∠.05	.16	Sodium	4	5	4	6
Nitrate Nitrogen	5	.2	.1	.5	Potassium	4	-	∠.4	2.9
Nitrite Nitrogen	3	-	∠.01	.01	Calcium	5	27	26	28
Total Phosphate	5	-	∠.04	.1	Magnesium	5	9	7	13
Total Soluble Phosphate	5	-	∠.04	.1	Sulfate	5	20	18	23
Total Solids	5	120	110	130	Total Hardness	5	95	90	100
Suspended Solids	5	4	0	8	Conductivity	5	190	170	200
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	1	∠1	11
Chlorides	5	7	6	9	Fecal Coliform	2	-	∠1	∠2
Phenols	5	-	∠2	∠2	Fecal Streptococcus	2	-	∠2	∠2
pH	5	7.9	7.4	8.3	Total Plate Count 20°C	4	38	6	49
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	5	8	4	24

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H102 - Port Huron (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	11	11.1	9.0	13.2	Temperature (°C)	13	11.0	2.0	20.5
Biochemical Oxygen Demand	7	1	1	2	Percent Saturation	11	100	94	110
Ammonia Nitrogen	8	-	$<$.05	.27	Total Iron	5	200	$<$100	400
Organic Nitrogen	8	.10	.06	.18	Sodium	6	4	4	6
Nitrate Nitrogen	13	-	$<$.1	.4	Potassium	4	1.7	$<$.4	2.9
Nitrite Nitrogen	3	-	$<$.01	$<$.01	Calcium	7	26	26	27
Total Phosphate	9	-	$<$.04	.05	Magnesium	7	8	6	13
Total Soluble Phosphate	5	-	$<$.04	.04	Sulfate	7	17	15	20
Total Solids	9	110	98	130	Total Hardness	5	96	88	100
Suspended Solids	5	6	0	13	Conductivity	13	180	120	200
Vol. Susp. Solids	5	4	0	11	Total Coliform	9	1	$<$1	6
Chlorides	13	6	5	7	Fecal Coliform	2	-	$<$1	$<$2
Phenols	9	-	$<$2	5	Fecal Streptococcus	2	-	$<$2	$<$2
pH	12	7.9	7.6	8.4	Total Plate Count 20°C	8	24	3	61
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	9	13	1	53

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H104 - Port Huron (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.1	10.1	13.1	Temperature (°C)	5	9.0	1.5	15.0
Biochemical Oxygen Demand	3	2	1	2	Percent Saturation	5	96	80	105
Ammonia Nitrogen	3	.13	.05	.19	Total Iron	5	200	< 100	300
Organic Nitrogen	4	.12	.10	.14	Sodium	2	-	4	4
Nitrate Nitrogen	5	.2	.1	.5	Potassium	2	-	<.4	1.2
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	30
Total Phosphate	5	-	<.04	.2[a]	Magnesium	5	8	6	13
Total Soluble Phosphate	5	-	<.04	.2[a]	Sulfate	5	18	7	28
Total Solids	5	120	110	130	Total Hardness	5	94	86	98
Suspended Solids	5	3	0	9	Conductivity	5	190	170	210
Vol. Susp. Solids	5	2	0	3	Total Coliform	5	1	<1	3
Chlorides	5	6	5	7	Fecal Coliform	2	-	< 1	<2
Phenols	5	-	< 2	4	Fecal Streptococcus	2	-	< 2	<2
pH	5	7.9	7.6	8.2	Total Plate Count 20°C	3	23	22	47
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	5	3	1	31

a - 1.5 and 1.4 mg/l not used in computing data.

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H106 - Port Huron (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	11.1	8.7	13.3	Temperature (°C)	12	10.5	1.0	20.0
Biochemical Oxygen Demand	4	-	<1	2	Percent Saturation	10	99	91	111
Ammonia Nitrogen	11	-	<.05	.09	Total Iron	4	200	<100	400
Organic Nitrogen	7	.16	.08	.52	Sodium	5	4	4	4
Nitrate Nitrogen	12	-	<.1	.4	Potassium	5	-	<.4	2.0
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	6	26	18	29
Total Phosphate	10	-	<.04	.3	Magnesium	6	9	7	13
Total Soluble Phosphate	8	-	<.04	<.04	Sulfate	6	20	14	36
Total Solids	8	110	100	120	Total Hardness	4	94	86	100
Suspended Solids	4	2	0	3	Conductivity	12	180	110	200
Vol. Susp. Solids	4	2	0	3	Total Coliform	8	<2	<1	50
Chlorides	12	5	5	6	Fecal Coliform	2	-	<1	<2
Phenols	8	-	<2	4	Fecal Streptococcus	2	-	<2	<2
pH	12	7.9	7.5	8.5	Total Plate Count 20°C	7	45	1	75
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	8	12	1	50

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H108 - Port Huron (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	9.9	13.3	Temperature (°C)	5	9.0	0.0	15.0
Biochemical Oxygen Demand	3	1	1	1	Percent Saturation	5	98	90	103
Ammonia Nitrogen	3	.21	.11	.32	Total Iron	5	100	<100	300
Organic Nitrogen	3	.28	.09	.59	Sodium	4	4	4	4
Nitrate Nitrogen	5	.2	.1	.3	Potassium	4	-	<.4	2.3
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	27	23	32
Total Phosphate	5	-	<.04	.3	Magnesium	5	9	6	13
Total Soluble Phosphate	5	-	<.04	<.04	Sulfate	5	15	6	19
Total Solids	5	110	90	120	Total Hardness	5	93	88	96
Suspended Solids	5	2	0	7	Conductivity	5	190	170	200
Vol. Susp. Solids	5	2	0	7	Total Coliform	5	<1	<1	3
Chlorides	5	5	5	6	Fecal Coliform	2	-	<1	<2
Phenols	5	-	<2	4	Fecal Streptococcus	2	-	<2	<2
pH	5	7.9	7.6	8.2	Total Plate Count 20°C	4	53	2	79
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	5	2	1	18

NS = number of samples

TABLE 35. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1965
H110 - Port Huron (cont.)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.0	10.0	12.4	Temperature (^oC)	4	11.0	7.0	16.0
Biochemical Oxygen Demand	3	1	1	1	Percent Saturation	4	100	97	102
Ammonia Nitrogen	2	-	.05	.12	Total Iron	4	200	100	200
Organic Nitrogen	2	-	.10	.11	Sodium	2	-	4	4
Nitrate Nitrogen	4	.2	.1	.3	Potassium	2	-	1.2	2.2
Nitrite Nitrogen	2	-	$<$.01	$<$.01	Calcium	4	23	22	27
Total Phosphate	4	-	$<$.04	$<$.04	Magnesium	4	9	7	13
Total Soluble Phosphate	4	-	$<$.04	$<$.04	Sulfate	4	16	6	22
Total Solids	4	120	100	140	Total Hardness	4	95	91	100
Suspended Solids	4	8	0	18	Conductivity	4	190	170	200
Vol. Susp. Solids	4	4	0	7	Total Coliform	4	1	$<$1	16
Chlorides	4	6	6	6	Fecal Coliform	1	$<$1	-	-
Phenols	4	-	$<$2	4	Fecal Streptococcus	1	$<$2	-	-
pH	4	7.9	7.7	8.2	Total Plate Count 20^oC	4	25	4	81
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35^oC	4	17	1	44

NS = number of samples

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967

Parameters	Straits of Mackinac		Cheboygan			
	H814	H816	H530	H532	H534	H536
Temperature (°C)	15.0	19.5	19.5	17.5	15.5	17.5
Dissolved Oxygen	10.8	9.7	9.8	10.3	10.6	9.8
Conductivity	170	250	240	200	160	110
Alkalinity	68	100	90	79	61	47
Chlorides	4	7	6	5	4	2
Nitrate Nitrogen	.1	.1	.1	.1	.2	.2
Nitrite Nitrogen	$<.01$	$<.01$	$<.01$	$<.01$	$<.01$	$<.01$
Ammonia Nitrogen	$<.05$	.08	$<.05$	.06	$<.05$	.05
Organic Nitrogen	$<.05$	.09	.09	.06	.09	.11
Total Phosphate	.03	.02	.02	.01	.02	.02
Total Soluble Phosphate	-	.02	-	-	-	-
Secci Disc (ft.)	19	18	22	21	20	19
Percent Saturation	108	107	108	108	107	103

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)

	Presque Isle				
Parameters	H420	H422	H424	H426	H428
Temperature (^{o}C)	20.0	17.0	17.0	16.0	19.0
Dissolved Oxygen	9.7	10.0	10.2	10.5	10.0
Conductivity	190	180	180	160	150
Alkalinity	72	72	66	59	57
Chlorides	5	5	5	4	3
Nitrate Nitrogen	.4	.3	.3	.5	.5
Nitrite Nitrogen	∠.01	∠.01	∠.01	∠.01	.01
Ammonia Nitrogen	.11	∠.05	∠.05	∠.05	∠.05
Organic Nitrogen	.06	∠.05	.06	.12	∠.05
Total Phosphate	.02	.02	.03	.04	.03
Total Soluble Phosphate	-	-	-	-	-
Secci Disc (ft.)	18	20	21	18	19
Percent Saturation	108	104	106	107	109

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)

	North Channel				
Parameters	H808	H809	H810	H812	H430
Temperature (°C)	18.0	18.0	14.0	17.5	16.0
Dissolved Oxygen	9.6	9.5	11.0	9.9	10.2
Conductivity	160	150	160	140	150
Alkalinity	60	55	60	56	59
Chlorides	4	4	4	3	4
Nitrate Nitrogen	.5	.4	.5	.4	.4
Nitrite Nitrogen	.01	.01	.01	$<$.01	.01
Ammonia Nitrogen	.06	$<$.05	.05	$<$.05	$<$.05
Organic Nitrogen	$<$.05	$<$.05	$<$.05	.08	.07
Total Phosphate	.02	.02	.03	.01	.04
Total Soluble Phosphate	-	.02	-	-	.04
Secci Disc (ft.)	18	15	18	17	17
Percent Saturation	102	101	107	104	104

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)
Georgian Bay

Parameters	H382	H384	H386	H388	H800	H802	H804	H806
Temperature (°C)	18.0	18.0	18.5	19.0	19.0	18.0	18.0	19.0
Dissolved Oxygen	9.4	9.6	9.5	9.4	9.3	9.6	10.0	9.7
Conductivity	200	200	180	180	180	180	180	200
Alkalinity	77	77	68	70	70	70	70	75
Chlorides	5	5	5	5	4	5	4	5
Nitrate Nitrogen	.4	.4	.4	.4	.3	.4	.2	.2
Nitrite Nitrogen	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Ammonia Nitrogen	<.05	<.05	<.05	.06	<.05	<.05	.11	<.05
Organic Nitrogen	<.05	<.05	.11	<.05	<.05	.06	.06	<.05
Total Phosphate	.01	.01	.34	.01	.01	.02	.01	.01
Total Soluble Phosphate	.01	-	.33	-	-	-	-	-
Secci Disc (ft.)	30	30	-	-	-	-	15	15
Percent Saturation	100	102	102	102	101	102	106	106

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)
Alpena

Parameters	H370	H372	H374	H376	H378	H380
Temperature (^{o}C)	18.0	16.0	16.0	15.0	15.0	17.0
Dissolved Oxygen	9.7	10.0	10.4	10.8	10.5	10.0
Conductivity	200	190	200	200	200	200
Alkalinity	81	75	79	75	77	79
Chlorides	5	5	5	5	6	5
Nitrate Nitrogen	.3	.3	.4	.3	.3	.3
Nitrite Nitrogen	$<.01$	$<.01$	$<.01$	$<.01$	$<.01$	$<.01$
Ammonia Nitrogen	.11	.06	.05	$<.05$	.06	.07
Organic Nitrogen	.05	$<.05$	$<.05$	$<.05$	$<.05$	$<.05$
Total Phosphate	.01	.02	.01	.01	.01	.01
Total Soluble Phosphate	-	-	-	-	-	-
Secci Disc (ft.)	18	20	24	25	25	30
Percent Saturation	103	102	106	108	105	104

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)
Oscoda

Parameters	H320	H321	H322	H324	H326	H328	H330
Temperature (°C)	19.0	19.5	19.0	20.0	18.5	21.0	21.0
Dissolved Oxygen	9.8	10.2	9.5	9.6	9.6	9.1	9.1
Conductivity	200	200	200	200	200	200	200
Alkalinity	79	82	77	77	80	79	78
Chlorides	5	6	6	5	6	6	6
Nitrate Nitrogen	.4	.4	.4	.4	.4	.4	.4
Nitrite Nitrogen	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Ammonia Nitrogen	.06	<.05	.05	.05	<.05	<.05	<.05
Organic Nitrogen	.05	<.05	<.05	<.05	<.05	<.05	<.05
Total Phosphate	.01	.02	.02	.01	.01	.01	.02
Total Soluble Phosphate	-	-	-	-	.01	-	-
Secci Disc (ft.)	25	25	26	27	27	25	24
Percent Saturation	107	102	104	106	103	103	103

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)

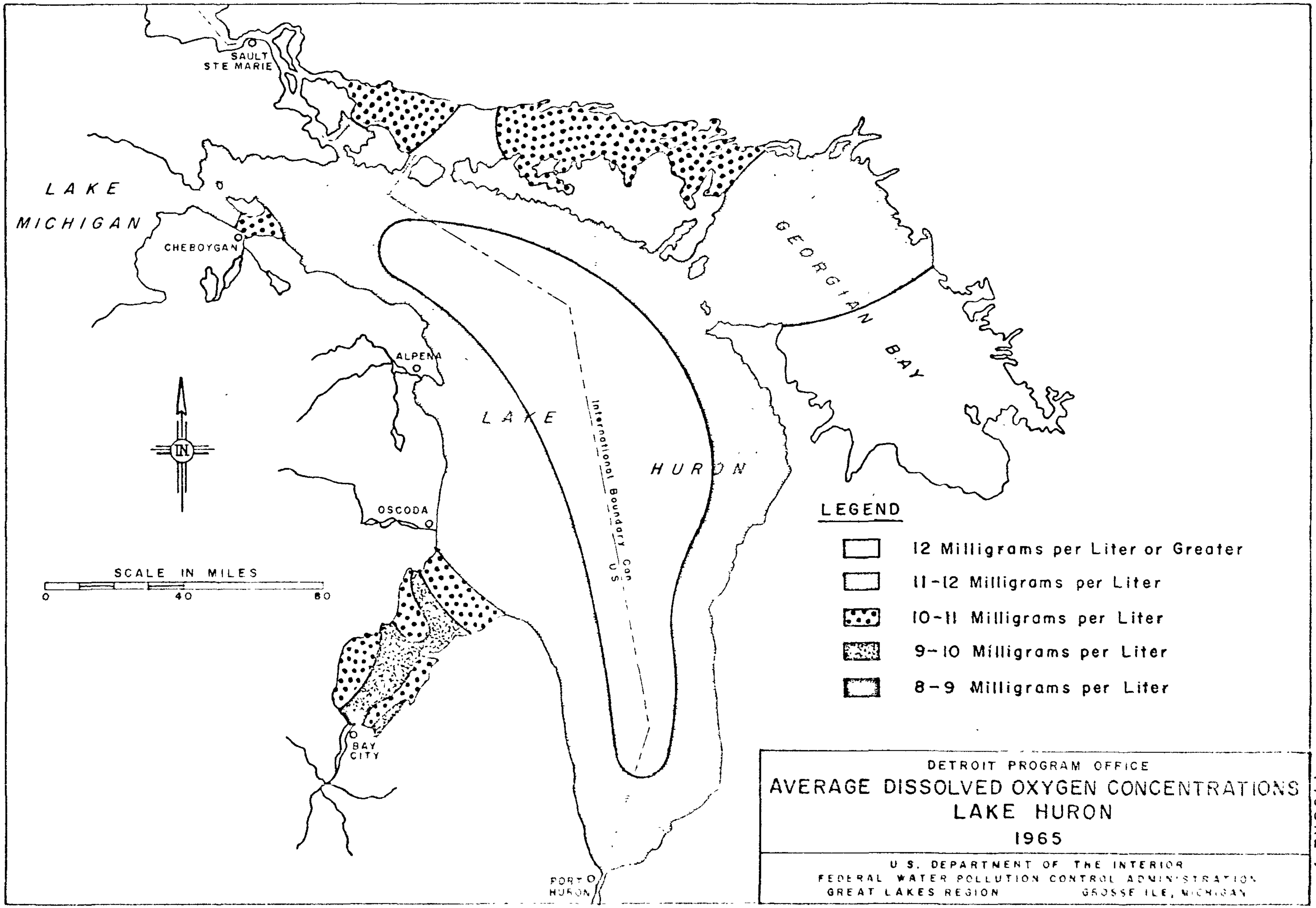
	Mouth of Saginaw Bay				Pointe Aux Barques		
	H200	H202	H204	H206	H250	H252	H254
Temperature (°C)	19.0	20.0	20.0	20.0	20.0	20.0	19.0
Dissolved Oxygen	9.2	9.3	9.3	9.0	9.3	9.2	9.4
Conductivity	200	220	210	210	210	210	200
Alkalinity	77	79	79	79	79	77	79
Chlorides	6	11	9	8	8	8	7
Nitrate Nitrogen	.4	.4	.3	.4	.4	.3	.3
Nitrite Nitrogen	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Ammonia Nitrogen	.05	.05	<.05	.07	<.05	<.05	<.05
Organic Nitrogen	.06	<.05	<.05	<.05	<.05	<.05	<.05
Total Phosphate	.03	.04	.02	.03	.02	.02	.02
Total Soluble Phosphate	-	-	-	-	.02	-	-
Secci Disc (ft.)	-	-	-	-	-	-	-
Percent Saturation	100	103	103	100	103	102	102

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967 (cont.)
Harbor Beach

Parameters	H130	H132	H133	H134	H136
Temperature (°C)	21.0	22.0	22.0	22.0	22.5
Dissolved Oxygen	9.3	9.0	9.0	9.0	8.8
Conductivity	210	210	210	200	200
Alkalinity	75	75	79	77	79
Chlorides	7	7	6	6	7
Nitrate Nitrogen	.2	.2	.3	.3	.3
Nitrite Nitrogen	<.01	<.01	<.01	<.01	<.01
Ammonia Nitrogen	<.05	<.05	<.05	<.05	<.05
Organic Nitrogen	<.05	.05	.07	<.05	.06
Total Phosphate	.02	.02	.02	.02	.02
Total Soluble Phosphate	-	-	-	.02	-
Secci Disc (ft.)	30	27	29	30	12
Percent Saturation	105	104	104	104	103

TABLE 36. WATER QUALITY DATA
Lake Huron Basin - Deepwater - 1967
Port Huron

Parameters	H100	H102	H104	H106	H108	H110
Temperature (°C)	21.0	21.0	20.5	21.5	22.0	22.0
Dissolved Oxygen	9.0	9.1	9.2	9.0	9.0	8.8
Conductivity	210	210	210	210	210	200
Alkalinity	77	79	77	79	79	77
Chlorides	7	7	7	7	8	7
Nitrate Nitrogen	.4	.4	.2	.4	.3	.4
Nitrite Nitrogen	<.01	<.01	<.01	<.01	<.01	<.01
Ammonia Nitrogen	<.05	<.05	<.05	<.05	.07	<.05
Organic Nitrogen	.11	.05	.06	.06	.05	.07
Total Phosphate	.01	.01	.01	.01	.01	.02
Total Soluble Phosphate	-	-	-	-	-	-
Secci Disc (ft.)	-	-	-	-	-	-
Percent Saturation	102	103	103	103	104	101


SAULT STE MARIE
LAKE MICHIGAN
CHEBOYGAN
ALPENA
OSCODA
BAY CITY
PORT HURON
LAKE HURON
GEORGIAN BAY
International Boundary
Can
US
N
SCALE IN MILES
0
40
80
LEGEND
12 Milligrams per Liter or Greater
11-12 Milligrams per Liter
10-11 Milligrams per Liter
9-10 Milligrams per Liter
8-9 Milligrams per Liter
DETROIT PROGRAM OFFICE
AVERAGE DISSOLVED OXYGEN CONCENTRATIONS
LAKE HURON
1965
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION
GROSSE ILE, MICHIGAN
FIGURE 9

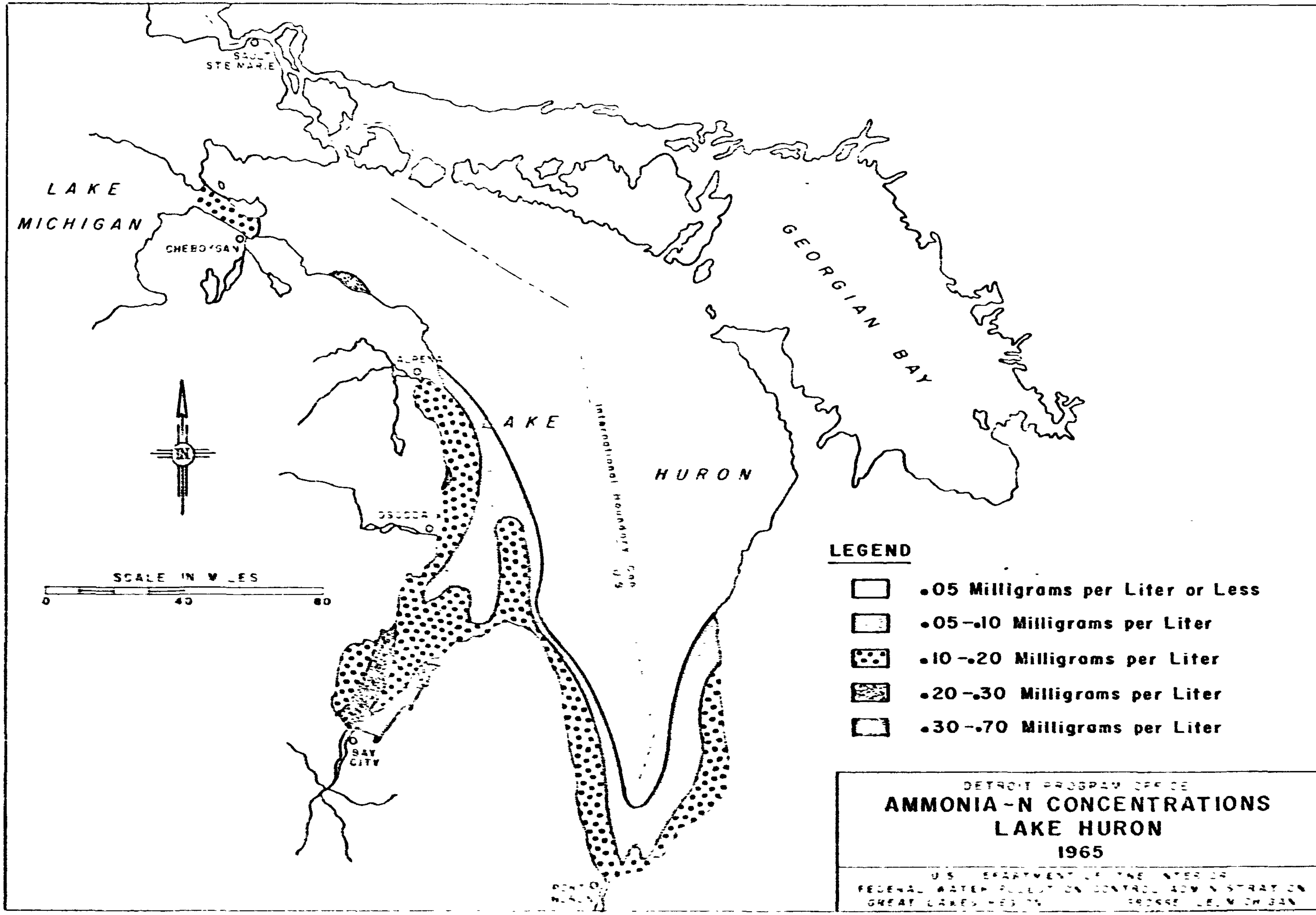
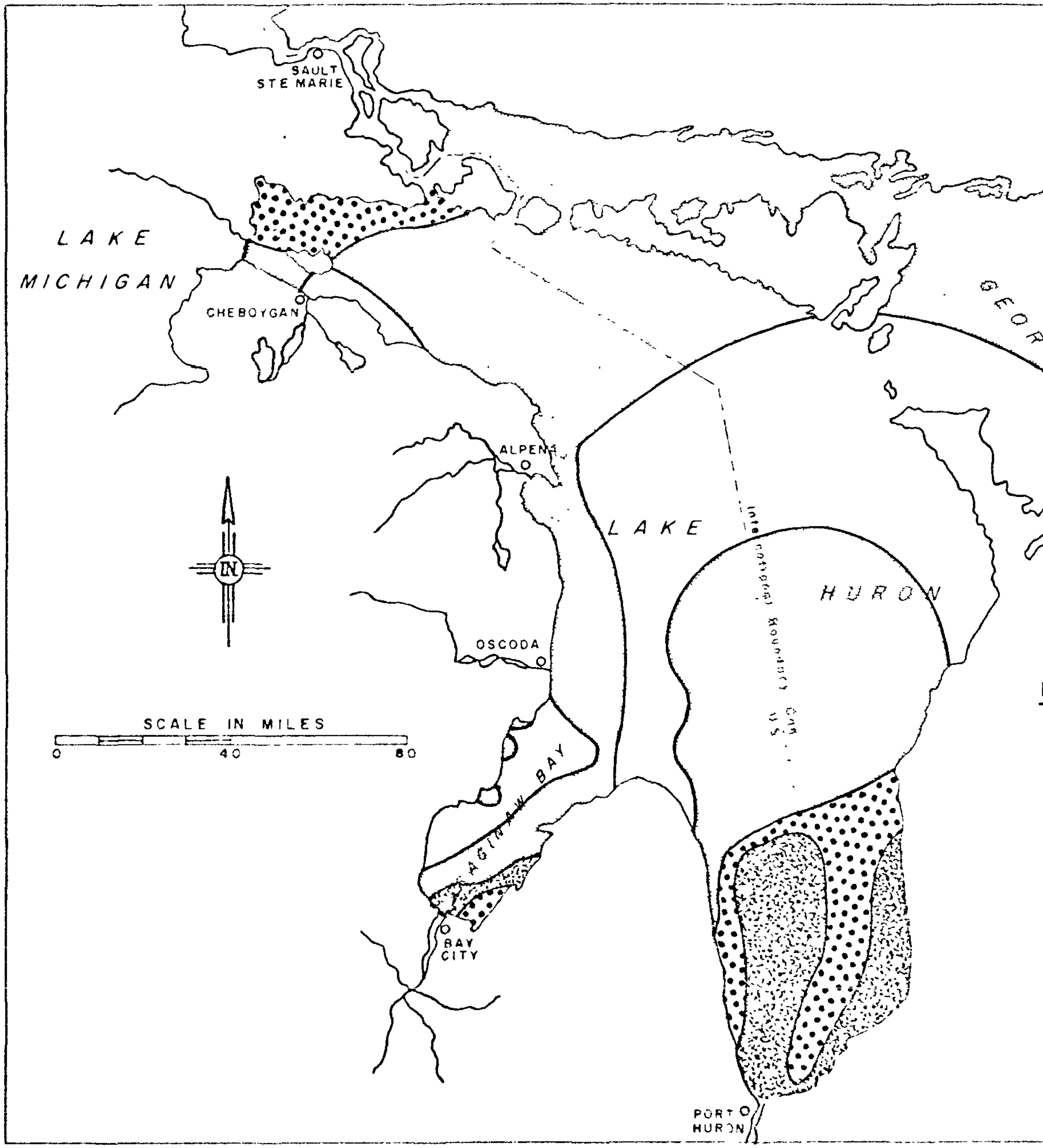

LAKE MICHIGAN
CHEBOYGAN
ALPENA
OSCODA
BAY CITY
LAKE HURON
GEORGIAN BAY
International Boundary
SCALE IN MILES
0
40
80
LEGEND
.05 Milligrams per Liter or Less
.05 -.10 Milligrams per Liter
.10 -.20 Milligrams per Liter
.20 -.30 Milligrams per Liter
.30 -.70 Milligrams per Liter
DETROIT PROGRAM OFFICE
AMMONIA-N CONCENTRATIONS
LAKE HURON
1965

FIGURE 10

FIGURE 11

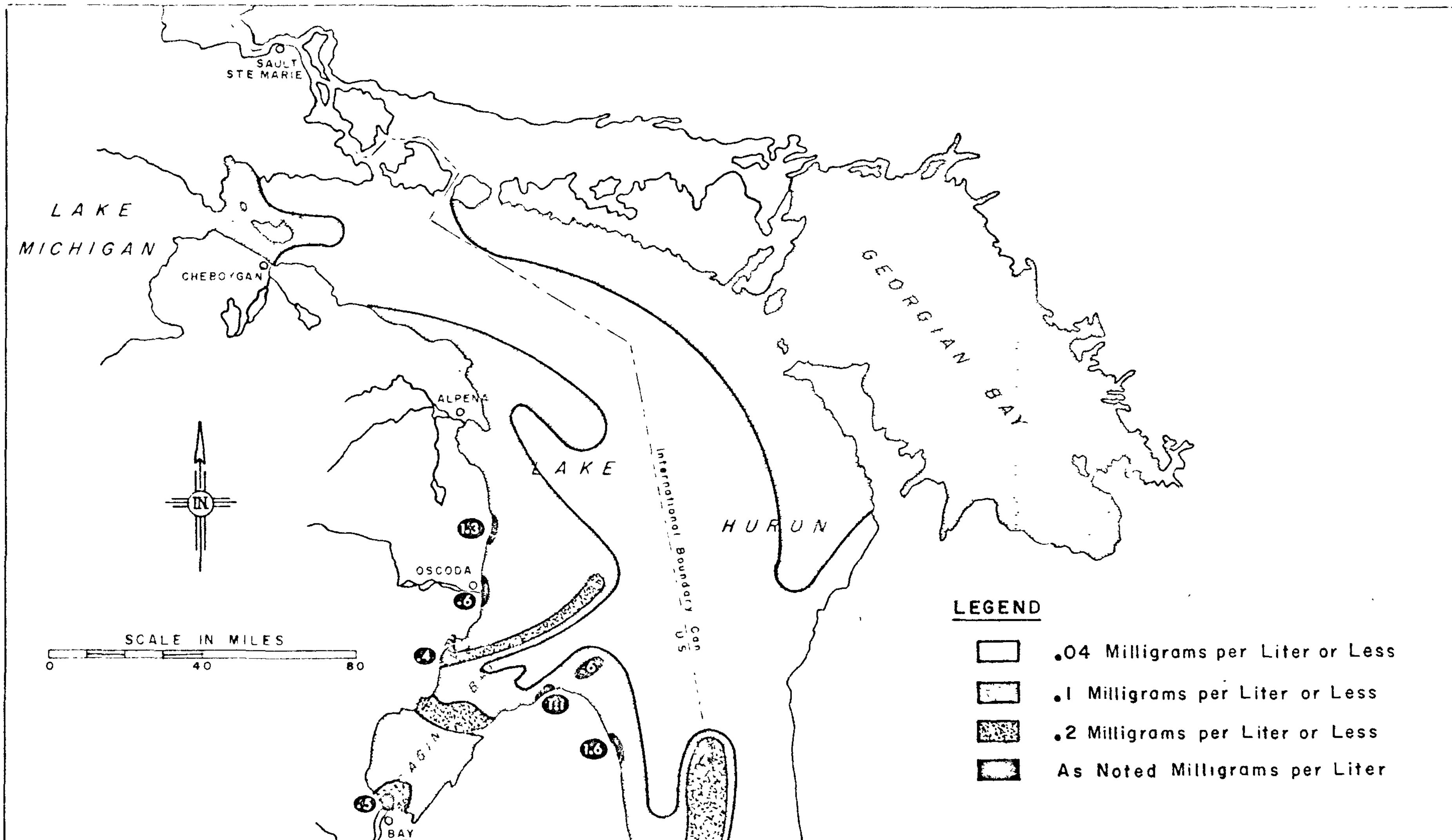


DETROIT PROGRAM OFFICE

NITRATE-N CONCENTRATIONS
LAKE HURON
1965

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

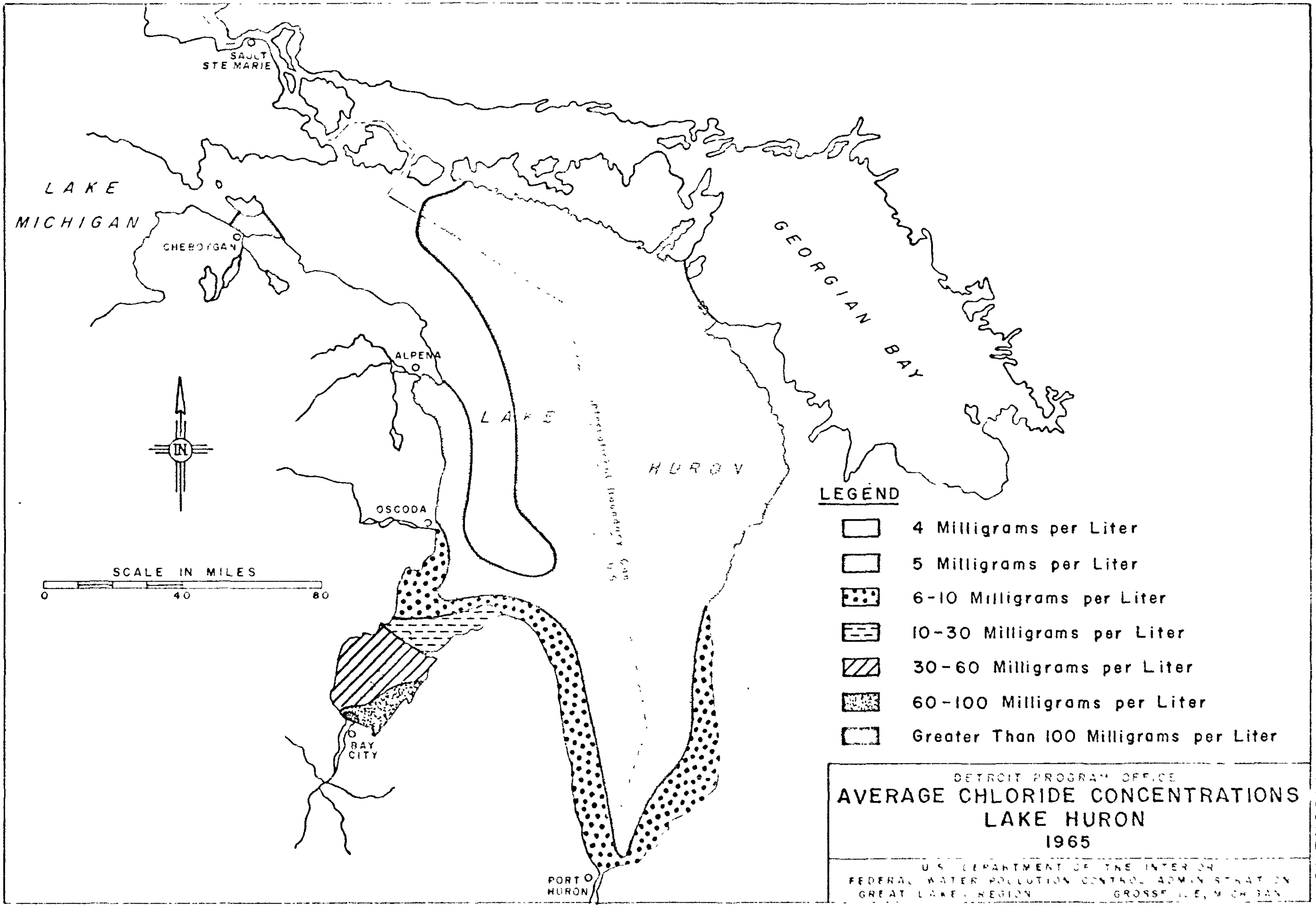
FIGURE 12



DETROIT PROGRAM OFFICE

TOTAL SOLUBLE PHOSPHATE CONCENTRATIONS
LAKE HURON
1965

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICH.



DETROIT PROGRAM OFFICE

AVERAGE CHLORIDE CONCENTRATIONS
LAKE HURON
1965

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

FIGURE 13

TABLE 37. DEPTH AT DEEPWATER STATIONS
Lake Huron Basin - 1965

Station No.	Depth (ft.)	Station No.	Depth (ft.)
H130	180	H380	245
H132	185	H382	90
H133	255	H384	80
H134	200	H386	175
H136	27	H388	190
H200	60	H420	100
H202	80	H422	290
H204	85	H424	450
H206	60	H426	200
		H428	170
H320	165	H432	95
H322	210		
H324	255	H530	27
H326	500	H532	115
H328	180	H534	300
H330	60	H536	85
H370	60		
H372	100	H808	120
H374	525	H809	90
H376	635	H810	40
H378	290	H812	125
		H814	135

TABLE 38. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 1 (H500,H502,H504)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	11.2	9.8	13.2	Temperature (°C)	15	9.5	3.0	15.5
Biochemical Oxygen Demand	15	2	1	3	Percent Saturation	15	98	93	102
Ammonia Nitrogen	15	.19	<.05	.53	Total Iron	15	300	<100	500
Organic Nitrogen	14	.16	<.05	.30	Sodium	9	4	4	5
Nitrate Nitrogen	15	.2	<.1	.3	Potassium	9	1.8	.5	2.7
Nitrite Nitrogen	9	-	<.01	<.01	Calcium	15	29	24	33
Total Phosphate	15	-	<.04	.2	Magnesium	15	11	9	19
Total Soluble Phosphate	15	-	<.04	.2	Sulfate	15	19	10	32
Total Solids	15	140	130	160	Total Hardness	15	110	92	130
Suspended Solids	15	2	0	4	Conductivity	15	210	180	230
Vol. Susp. Solids	15	2	0	4	Total Coliform	15	<2	<1	25
Chlorides	15	6	5	6	Fecal Coliform	8	<1	<1	<2
Phenols	9	-	<2	6	Fecal Streptococcus	6	<2	<1	<2
pH	15	8.0	7.6	8.4	Total Plate Count 20°C	12	36	2	74
Chemical Oxygen Demand	6	5	4	7	Total Plate Count 35°C	12	3	1	25

NS = number of samples

TABLE 38. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 2 (H506,H508,H510,H512)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	20	11.4	10.0	13.2	Temperature (°C)	20	9.0	2.5	14.5
Biochemical Oxygen Demand	20	1	1	2	Percent Saturation	20	98	95	102
Ammonia Nitrogen	20	.13	<.05	.21	Total Iron	20	-	<100	1,000
Organic Nitrogen	19	.17	.06	.30	Sodium	12	4	3	6
Nitrate Nitrogen	20	.2	.1	.9	Potassium	12	2.1	1.2	3.9
Nitrite Nitrogen	12	-	<.01	<.01	Calcium	20	28	24	31
Total Phosphate	20	-	<.04	1.2	Magnesium	20	9	8	11
Total Soluble Phosphate	20	-	<.04	1.0	Sulfate	20	16	10	20
Total Solids	19	130	110	140	Total Hardness	19	100	92	200
Suspended Solids	20	5	0	12	Conductivity	20	200	170	280
Vol. Susp. Solids	20	3	0	12	Total Coliform	20	<5	<1	77
Chlorides	20	5	4	6	Fecal Coliform	9	<2	<1	<5
Phenols	12	-	<2	3	Fecal Streptococcus	8	<2	<1	<2
pH	20	8.0	7.6	8.2	Total Plate Count 20°C	16	28	1	330
Chemical Oxygen Demand	8	5	3	7	Total Plate Count 35°C	16	5	1	18

NS = number of samples

TABLE 38. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 3 (H514,H516,H518)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	11.2	9.7	13.2	Temperature (°C)	15	10.0	2.5	15.0
Biochemical Oxygen Demand	15	1	1	2	Percent Saturation	15	99	95	102
Ammonia Nitrogen	13	.14	<.05	.28	Total Iron	15	-	<100	600
Organic Nitrogen	12	.14	.05	.24	Sodium	10	5	4	5
Nitrate Nitrogen	15	.2	<.1	.3	Potassium	10	2.1	1.4	3.0
Nitrite Nitrogen	9	-	<.01	<.01	Calcium	15	29	26	32
Total Phosphate	15	-	<.04	.2	Magnesium	15	10	9	11
Total Soluble Phosphate	15	-	<.04	.2	Sulfate	15	17	15	20
Total Solids	15	140	130	170	Total Hardness	15	110	96	120
Suspended Solids	15	5	0	13	Conductivity	15	210	180	230
Vol. Susp. Solids	15	2	0	5	Total Coliform	15	2	<1	66
Chlorides	15	6	5	6	Fecal Coliform	6	<2	<1	<5
Phenols	9	-	<2	3	Fecal Streptococcus	6	<2	<1	<5
pH	15	8.0	7.8	8.2	Total Plate Count 20°C	12	50	1	180
Chemical Oxygen Demand	6	5	4	6	Total Plate Count 35°C	12	4	1	300

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 1 - H500

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.3	9.8	13.2	Temperature (°C)	5	9.5	3.0	15.5
Biochemical Oxygen Demand	5	2	1	3	Percent Saturation	5	98	94	102
Ammonia Nitrogen	5	.16	.08	.29	Total Iron	5	300	100	500
Organic Nitrogen	5	.18	.09	.30	Sodium	3	4	4	4
Nitrate Nitrogen	5	.2	<.1	.2	Potassium	3	2.3	.6	2.6
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	29	27	33
Total Phosphate	5	-	<.04	.2	Magnesium	5	10	10	11
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	20	12	32
Total Solids	5	130	130	150	Total Hardness	5	120	110	130
Suspended Solids	5	2	1	3	Conductivity	5	210	180	230
Vol. Susp. Solids	5	1	0	1	Total Coliform	5	<2	<1	3
Chlorides	5	6	5	6	Fecal Coliform	3	<1	<1	<2
Phenols	3	-	<2	5	Fecal Streptococcus	2	-	<1	<2
pH	5	8.1	8.0	8.4	Total Plate Count 20°C	4	32	6	40
Chemical Oxygen Demand	2	-	5	6	Total Plate Count 35°C	4	2	1	40

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 1 - H502

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.2	9.8	13.1	Temperature (°C)	5	9.5	3.0	15.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	98	95	101
Ammonia Nitrogen	5	.20	.05	.42	Total Iron	4	300	<100	500
Organic Nitrogen	4	.18	.11	.22	Sodium	3	4	4	5
Nitrate Nitrogen	5	.2	.1	.3	Potassium	3	1.8	.5	2.7
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	24	31
Total Phosphate	5	-	<.04	.2	Magnesium	5	12	9	19
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	20	10	40
Total Solids	5	140	130	160	Total Hardness	5	110	96	130
Suspended Solids	5	2	0	3	Conductivity	5	210	170	230
Vol. Susp. Solids	5	2	0	3	Total Coliform	5	<2	<1	25
Chlorides	5	5	5	6	Fecal Coliform	3	1	<1	<2
Phenols	3	-	<2	6	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.7	8.2	Total Plate Count 20°C	4	31	2	74
Chemical Oxygen Demand	2	-	4	6	Total Plate Count 35°C	4	13	1	25

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 1 - H504

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.2	10.0	13.1	Temperature (°C)	5	9.5	3.5	14.5
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	98	93	101
Ammonia Nitrogen	5	.22	<.05	.53	Total Iron	5	200	100	500
Organic Nitrogen	5	.12	<.05	.26	Sodium	3	4	4	5
Nitrate Nitrogen	5	.2	.1	.2	Potassium	3	1.8	.6	2.6
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	29	26	32
Total Phosphate	5	-	<.04	.2	Magnesium	5	10	8	11
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	17	12	20
Total Solids	5	130	130	140	Total Hardness	5	110	92	120
Suspended Solids	5	3	1	4	Conductivity	5	200	170	230
Vol. Susp. Solids	5	3	1	4	Total Coliform	5	1	< 1	11
Chlorides	5	6	5	6	Fecal Coliform	2	-	< 1	< 2
Phenols	3	-	< 2	3	Fecal Streptococcus	2	-	< 1	< 2
pH	5	8.0	7.6	8.3	Total Plate Count 20°C	4	40	4	50
Chemical Oxygen Demand	2	-	4	7	Total Plate Count 35°C	4	3	1	4

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 2 - H506

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	10.6	13.0	Temperature (°C)	5	9.0	3.5	13.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	98	95	101
Ammonia Nitrogen	5	.11	.05	.18	Total Iron	5	-	< 100	1,000
Organic Nitrogen	5	.15	.08	.22	Sodium	3	4	3	4
Nitrate Nitrogen	5	.3	.1	.9	Potassium	3	2.5	1.2	3.9
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	31
Total Phosphate	5	-	<.04	.4	Magnesium	5	9	8	9
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	14	10	18
Total Solids	5	130	120	140	Total Hardness	5	100	96	110
Suspended Solids	5	4	0	7	Conductivity	5	190	170	210
Vol. Susp. Solids	5	3	0	7	Total Coliform	5	8	<1	77
Chlorides	5	5	4	6	Fecal Coliform	2	-	<1	<5
Phenols	3	-	<2	3	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.7	8.2	Total Plate Count 20°C	4	76	20	330
Chemical Oxygen Demand	2	-	4	5	Total Plate Count 35°C	4	13	4	14

NS = number os samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 2 - H508

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	10.6	12.9	Temperature (°C)	5	9.0	4.0	12.5
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	99	96	101
Ammonia Nitrogen	5	.12	<.05	.18	Total Iron	5	-	<100	400
Organic Nitrogen	5	.18	.07	.24	Sodium	3	4	4	4
Nitrate Nitrogen	5	.3	.2	.4	Potassium	3	1.9	1.4	2.3
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	26	24	27
Total Phosphate	5	-	<.04	.1	Magnesium	5	9	9	10
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	16	14	20
Total Solids	4	130	120	140	Total Hardness	5	98	92	100
Suspended Solids	5	6	0	10	Conductivity	5	200	170	210
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	<1	<1	4
Chlorides	5	5	5	5	Fecal Coliform	2	-	<1	<2
Phenols	3	-	<2	<2	Fecal Streptococcus	2	-	<1	<2
pH	5	7.9	7.7	8.1	Total Plate Count 20°C	4	25	3	45
Chemical Oxygen Demand	2	-	6	6	Total Plate Count 35°C	4	4	1	6

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 2 - H510

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	10.5	13.2	Temperature (°C)	5	9.0	2.5	13.5
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	98	96	102
Ammonia Nitrogen	5	.12	<.05	.16	Total Iron	5	-	<100	500
Organic Nitrogen	4	.18	.08	.30	Sodium	3	4	4	5
Nitrate Nitrogen	5	.2	.1	.3	Potassium	3	1.9	1.4	2.4
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	27	29
Total Phosphate	5	-	<.04	.2	Magnesium	5	9	8	10
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	16	13	20
Total Solids	5	120	110	130	Total Hardness	5	120	96	200
Suspended Solids	5	6	2	12	Conductivity	5	210	170	280
Vol. Susp. Solids	5	5	2	12	Total Coliform	5	<5	<1	12
Chlorides	5	5	5	6	Fecal Coliform	2	-	<1	<2
Phenols	3	-	<2	3	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.6	8.1	Total Plate Count 20°C	4	28	1	53
Chemical Oxygen Demand	2	-	3	6	Total Plate Count 35°C	4	5	1	10

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 2 - H512

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.3	10.0	13.2	Temperature (°C)	5	9.5	3.0	14.5
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	98	97	101
Ammonia Nitrogen	5	.15	<.05	.21	Total Iron	5	300	<100	500
Organic Nitrogen	5	.15	.06	.24	Sodium	3	5	4	6
Nitrate Nitrogen	5	.2	.1	.3	Potassium	3	2.4	1.4	3.4
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	31
Total Phosphate	5	-	<.04	1.2	Magnesium	5	10	8	11
Total Soluble Phosphate	5	-	<.04	1.0	Sulfate	5	17	15	20
Total Solids	5	130	120	140	Total Hardness	4	100	96	110
Suspended Solids	5	3	0	10	Conductivity	5	210	170	230
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	5	2	16
Chlorides	5	5	5	6	Fecal Coliform	3	<2	<1	3
Phenols	3	-	<2	2	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.9	8.1	Total Plate Count 20°C	4	24	6	37
Chemical Oxygen Demand	2	-	5	7	Total Plate Count 35°C	4	4	1	18

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 3 - H514

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.3	10.2	13.1	Temperature (°C)	5	9.5	2.5	15.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	99	96	102
Ammonia Nitrogen	5	.16	.08	.28	Total Iron	5	200	<100	400
Organic Nitrogen	5	.16	.09	.24	Sodium	3	4	4	5
Nitrate Nitrogen	5	.2	<.1	.3	Potassium	3	1.9	1.4	2.4
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	31
Total Phosphate	5	-	<.04	.2	Magnesium	5	10	9	11
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	18	16	20
Total Solids	5	140	130	170	Total Hardness	5	110	98	110
Suspended Solids	5	5	1	8	Conductivity	5	200	180	220
Vol. Susp. Solids	5	2	1	4	Total Coliform	5	<2	<1	4
Chlorides	5	6	5	6	Fecal Coliform	2	-	<1	<2
Phenols	3	-	<2	<2	Fecal Streptococcus	2	-	<1	<2
pH	5	8.1	8.0	8.2	Total Plate Count 20°C	4	51	3	57
Chemical Oxygen Demand	2	-	4	5	Total Plate Count 35°C	4	4	1	16

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 3 - H516

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.2	10.1	13.2	Temperature (°C)	5	10.0	4.5	15.0
Biochemical Oxygen Demand	5	1	1	1	Percent Saturation	5	99	95	102
Ammonia Nitrogen	4	.12	<.05	.24	Total Iron	5	300	100	500
Organic Nitrogen	4	.13	.07	.19	Sodium	3	5	4	5
Nitrate Nitrogen	5	.2	.1	.2	Potassium	3	2.0	1.5	2.6
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	29	27	30
Total Phosphate	5	-	<.04	.2	Magnesium	5	10	10	11
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	17	15	20
Total Solids	5	140	130	150	Total Hardness	5	110	96	120
Suspended Solids	5	4	0	13	Conductivity	5	210	190	220
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	<2	<1	15
Chlorides	5	5	5	6	Fecal Coliform	2	-	<1	<2
Phenols	3	-	<2	2	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.9	8.2	Total Plate Count 20°C	4	13	1	59
Chemical Oxygen Demand	2	-	5	5	Total Plate Count 35°C	4	2	1	11

NS = number of samples

TABLE 39. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Straits of Mackinac - Range 3 - H518

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.2	9.7	12.8	Temperature (°C)	5	10.5	5.0	15.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	100	97	102
Ammonia Nitrogen	4	.15	.13	.18	Total Iron	5	300	100	600
Organic Nitrogen	3	.13	.05	.18	Sodium	4	5	4	5
Nitrate Nitrogen	5	.2	.1	.2	Potassium	4	2.2	1.4	3.0
Nitrite Nitrogen	3	-	$\angle$.01	<.01	Calcium	5	29	26	32
Total Phosphate	5	-	<.04	.1	Magnesium	5	10	10	11
Total Soluble Phosphate	5	-	<.04	.07	Sulfate	5	18	15	20
Total Solids	5	140	130	160	Total Hardness	5	110	110	120
Suspended Solids	5	5	0	13	Conductivity	5	210	180	230
Vol. Susp. Solids	5	2	0	3	Total Coliform	5	8	1	66
Chlorides	5	6	5	6	Fecal Coliform	2	-	$\angle$1	<5
Phenols	3	-	<2	3	Fecal Streptococcus	2	-	$\angle$1	<5
pH	5	8.0	7.8	8.2	Total Plate Count 20°C	4	85	36	180
Chemical Oxygen Demand	2	-	5	6	Total Plate Count 35°C	4	18	3	300

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan River Y500

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	7	9.6	6.5	12.1	Temperature (°C)	10	8.0	0.0	20.0
Biochemical Oxygen Demand	5	2	1	3	Percent Saturation	7	87	46	100
Ammonia Nitrogen	9	.14	.05	.26	Total Iron	10	200	<100	600
Organic Nitrogen	9	.15	.07	.30	Sodium	9	5	3	11
Nitrate Nitrogen	10	.1	<.1	.2	Potassium	9	1.9	.5	3.6
Nitrite Nitrogen	7	-	<.01	<.01	Calcium	10	42	38	48
Total Phosphate	10	-	<.04	.08	Magnesium	10	15	11	20
Total Soluble Phosphate	10	-	<.04	.08	Sulfate	10	16	2	50
Total Solids	10	190	170	220	Total Hardness	10	160	120	190
Suspended Solids	10	9	0	44	Conductivity	10	270	230	290
Vol. Susp. Solids	8	3	0	5	Total Coliform	10	270	38	1,400
Chlorides	10	3	2	6	Fecal Coliform	10	20	2	460
Phenols	7	-	<2	8	Fecal Streptococcus	10	21	<2	110
pH	10	8.1	7.8	8.5	Total Plate Count 20°C	3	480	140	1,400
Chemical Oxygen Demand	2	-	0	17	Total Plate Count 35°C	3	2,100	130	2,200

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan River - 16-CHE (MWRC)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	11.6	8.4	13.2	Temperature (°C)	10	7.0	0.0	23.0
Biochemical Oxygen Demand	7	2.3	.8	3.0	Percent Saturation	10	94	85	104
Ammonia Nitrogen	8	.0	.0	.0	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	1	3.2	-	-
Nitrate Nitrogen	9	.07	.07	.20	Potassium	1	.6	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	1	40	-	-
Total Phosphate	9	.0	.0	.0	Magnesium	1	11	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	1	12	-	-
Total Solids	0	-	-	-	Total Hardness	1	145	-	-
Suspended Solids	8	9	5	11	Conductivity	9	300	250	340
Vol. Susp. Solids	0	-	-	-	Total Coliform	7	2,300	360	15,000
Chlorides	9	-	0	2	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	8.2	7.9	8.4	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	8	10	5	6	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan Harbor - H525

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	10.9	9.5	12.7	Temperature (°C)	5	11.5	6.0	17.5
Biochemical Oxygen Demand	4	2	1	2	Percent Saturation	5	100	96	104
Ammonia Nitrogen	5	.14	.05	.25	Total Iron	5	200	100	500
Organic Nitrogen	5	.13	.08	.21	Sodium	4	5	4	5
Nitrate Nitrogen	5	.1	<.1	.2	Potassium	4	2.3	1.5	2.9
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	32	26	37
Total Phosphate	5	-	<.04	.2	Magnesium	5	13	10	17
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	18	13	22
Total Solids	5	140	120	160	Total Hardness	5	120	110	130
Suspended Solids	4	6	3	10[a]	Conductivity	5	230	200	250
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	48	10	790
Chlorides	5	5	4	5	Fecal Coliform	5	11	<2	120
Phenols	3	-	<2	3	Fecal Streptococcus	5	9	<1	52
pH	5	8.1	8.0	8.1	Total Plate Count 20°C	4	430	100	780
Chemical Oxygen Demand	2	-	7	9	Total Plate Count 35°C	4	265	60	1,400

a - one value of 46 not used in computing data.

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan Harbor - H526

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.3	10.0	13.1	Temperature (°C)	5	11.0	5.0	16.5
Biochemical Oxygen Demand	4	2	1	2	Percent Saturation	5	101	97	103
Ammonia Nitrogen	5	.12	<.05	.21	Total Iron	5	200	<100	400
Organic Nitrogen	5	.14	.09	.22	Sodium	4	4	4	5
Nitrate Nitrogen	5	.1	.1	.2	Potassium	4	2.3	1.4	2.7
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	29	26	32
Total Phosphate	5	-	<.04	.9	Magnesium	4	10	9	11
Total Soluble Phosphate	5	-	<.04	.8	Sulfate	5	17	15	20
Total Solids	5	130	110	140	Total Hardness	5	110	100	130
Suspended Solids	5	3	0	7	Conductivity	5	210	190	220
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	8	<1	27
Chlorides	5	5	4	6	Fecal Coliform	3	<2	<1	4
Phenols	3	-	<2	4	Fecal Streptococcus	2	-	<1	<2
pH	5	8.1	8.0	8.2	Total Plate Count 20°C	4	120	8	350
Chemical Oxygen Demand	2	-	5	6	Total Plate Count 35°C	4	12	3	130

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan Harbor - H527

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.3	9.9	13.1	Temperature (°C)	5	10.0	3.0	16.0
Biochemical Oxygen Demand	4	1	1	2	Percent Saturation	5	100	96	104
Ammonia Nitrogen	4	.09	.06	.15	Total Iron	5	200	$<$100	500
Organic Nitrogen	3	.15	.12	.20	Sodium	4	4	4	5
Nitrate Nitrogen	5	.2	.1	.4	Potassium	4	2.2	1.4	2.6
Nitrite Nitrogen	3	-	$<$.01	$<$.01	Calcium	5	29	26	30
Total Phosphate	5	-	$<$.04	.2	Magnesium	5	10	9	11
Total Soluble Phosphate	5	-	$<$.04	.2	Sulfate	5	20	15	34
Total Solids	5	130	120	130	Total Hardness	5	110	98	120
Suspended Solids	5	3	0	9	Conductivity	5	200	190	220
Vol. Susp. Solids	5	3	0	5	Total Coliform	5	1	$<$1	2
Chlorides	5	5	5	6	Fecal Coliform	2	-	$<$1	$<$2
Phenols	3	3	$<$2	5	Fecal Streptococcus	2	-	$<$1	$<$2
pH	5	8.1	8.0	8.2	Total Plate Count 20°C	4	18	8	60
Chemical Oxygen Demand	2	-	6	8	Total Plate Count 35°C	4	4	1	7

NS = number of samples

TABLE 40. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Cheboygan Harbor - H528

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	10.4	12.8	Temperature (°C)	5	10.5	5.0	15.0
Biochemical Oxygen Demand	4	1	1	2	Percent Saturation	5	101	99	104
Ammonia Nitrogen	4	.09	<.05	.12[a]	Total Iron	5	100	<100	100
Organic Nitrogen	5	.10	.06	.18	Sodium	4	4	3	5
Nitrate Nitrogen	5	.2	.1	.4	Potassium	4	2.1	1.5	2.6
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	27	26	28
Total Phosphate	4	.09	.04	.2[b]	Magnesium	5	9	7	10
Total Soluble Phosphate	4	-	<.04	.2[b]	Sulfate	4	17	14	20[c]
Total Solids	5	110	100	120	Total Hardness	5	98	74	120
Suspended Solids	5	3	0	9	Conductivity	5	190	160	210
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	<2	<1	4
Chlorides	5	5	3	6	Fecal Coliform	2	-	<1	<2
Phenols	3	3	<2	4	Fecal Streptococcus	2	-	<1	<2
pH	5	8.0	7.9	8.1	Total Plate Count 20°C	4	62	25	250
Chemical Oxygen Demand	2	-	6	7	Total Plate Count 35°C	4	5	1	37

a - value of .51 not used in computing data.
b - total phosphate of 3.8 and total soluble phosphate 3.4 not used. c - value of 56 not used in computing data.
NS = number of samples

TABLE 41. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Rogers City - H400

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	1	13.0	-	-	Temperature (°C)	1	5.0	-	-
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	1	101	-	-
Ammonia Nitrogen	1	.28	-	-	Total Iron	1	300	-	-
Organic Nitrogen	1	.16	-	-	Sodium	1	4	-	-
Nitrate Nitrogen	1	.2	-	-	Potassium	1	2.1	-	-
Nitrite Nitrogen	1	$<.01$	-	-	Calcium	1	25	-	-
Total Phosphate	1	.2	-	-	Magnesium	1	9	-	-
Total Soluble Phosphate	1	.1	-	-	Sulfate	1	18	-	-
Total Solids	1	120	-	-	Total Hardness	1	96	-	-
Suspended Solids	1	3	-	-	Conductivity	1	190	-	-
Vol. Susp. Solids	1	2	-	-	Total Coliform	1	<2	-	-
Chlorides	1	5	-	-	Fecal Coliform	1	<2	-	-
Phenols	1	<2	-	-	Fecal Streptococcus	1	<2	-	-
pH	1	7.9	-	-	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 41. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Rogers City - H401

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	1	12.1	-	-	Temperature (°C)	1	6.5	-	-
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	1	98	-	-
Ammonia Nitrogen	1	.22	-	-	Total Iron	1	400	-	-
Organic Nitrogen	1	.19	-	-	Sodium	1	4	-	-
Nitrate Nitrogen	1	.1	-	-	Potassium	1	2.1	-	-
Nitrite Nitrogen	1	<.01	-	-	Calcium	1	26	-	-
Total Phosphate	1	.1	-	-	Magnesium	1	9	-	-
Total Soluble Phosphate	1	.1	-	-	Sulfate	1	17	-	-
Total Solids	1	130	-	-	Total Hardness	1	100	-	-
Suspended Solids	1	7	-	-	Conductivity	1	200	-	-
Vol. Susp. Solids	1	4	-	-	Total Coliform	1	260	-	-
Chlorides	1	5	-	-	Fecal Coliform	1	74	-	-
Phenols	1	<2	-	-	Fecal Streptococcus	1	30	-	-
pH	1	8.0	-	-	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 41. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Rogers City - H402

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	1	13.1	-	-	Temperature (°C)	1	4.5	-	-
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	1	101	-	-
Ammonia Nitrogen	1	.26	-	-	Total Iron	1	500	-	-
Organic Nitrogen	1	.18	-	-	Sodium	1	4	-	-
Nitrate Nitrogen	1	.2	-	-	Potassium	1	2.1	-	-
Nitrite Nitrogen	1	<.01	-	-	Calcium	1	30	-	-
Total Phosphate	1	.08	-	-	Magnesium	1	9	-	-
Total Soluble Phosphate	1	.06	-	-	Sulfate	1	18	-	-
Total Solids	1	140	-	-	Total Hardness	1	96	-	-
Suspended Solids	1	6	-	-	Conductivity	1	200	-	-
Vol. Susp. Solids	1	5	-	-	Total Coliform	1	68	-	-
Chlorides	1	4	-	-	Fecal Coliform	1	16	-	-
Phenols	1	2	-	-	Fecal Streptococcus	1	4	-	-
pH	1	8.0	-	-	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 41. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Rogers City - H403

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	1	13.0	-	-	Temperature (°C)	1	6.0	-	-
Biochemical Oxygen Demand	0	-	-	-	Percent Saturation	1	101	-	-
Ammonia Nitrogen	1	.23	-	-	Total Iron	1	300	-	-
Organic Nitrogen	1	.12	-	-	Sodium	1	4	-	-
Nitrate Nitrogen	1	.1	-	-	Potassium	1	2.1	-	-
Nitrite Nitrogen	1	.01	-	-	Calcium	1	27	-	-
Total Phosphate	1	.1	-	-	Magnesium	1	9	-	-
Total Soluble Phosphate	1	.1	-	-	Sulfate	1	18	-	-
Total Solids	1	120	-	-	Total Hardness	1	100	-	-
Suspended Solids	0	-	-	-	Conductivity	1	200	-	-
Vol. Susp. Solids	0	-	-	-	Total Coliform	1	34	-	-
Chlorides	1	5	-	-	Fecal Coliform	1	20	-	-
Phenols	1	2	-	-	Fecal Streptococcus	1	<2	-	-
pH	1	8.0	-	-	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 42. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 1 - Y200

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	9.4	7.4	13.8	Temperature (°C)	10	7.0	0.0	22.0
Biochemical Oxygen Demand	3	2	2	3	Percent Saturation	5	82	58	94
Ammonia Nitrogen	2	-	.05	.15	Total Iron	2	-	<100	300
Organic Nitrogen	2	-	.21	.83	Sodium	3	5	4	7
Nitrate Nitrogen	3	.1	.1	.2	Potassium	3	2.0	.8	2.9
Nitrite Nitrogen	2	-	<.01	.01	Calcium	2	-	57	59
Total Phosphate	2	-	<.04	.04	Magnesium	2	-	15	17
Total Soluble Phosphate	2	-	<.04	.04	Sulfate	2	-	5	19
Total Solids	3	240	210	260	Total Hardness	2	-	200	200
Suspended Solids	2	-	3	4	Conductivity	2	-	290	350
Vol. Susp. Solids	2	-	3	4	Total Coliform	10	510	90	2,700
Chlorides	2	-	6	7	Fecal Coliform	10	100	10	>500
Phenols	2	-	4	4	Fecal Streptococcus	10	32	12	170
pH	2	-	7.6	8.2	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	2	-	21	33	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 42. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 1 - 15-TB (MWRC)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	10.3	7.4	12.4	Temperature (°C)	10	7.5	0.0	23.0
Biochemical Oxygen Demand	7	3.7	2.4	5.4	Percent Saturation	10	84	65	97
Ammonia Nitrogen	9	.06	.02	.33	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	1	5	-	-
Nitrate Nitrogen	9	.11	.0	.30	Potassium	1	.8	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	1	48	-	-
Total Phosphate	9	.11	.0	.30	Magnesium	1	15	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	1	.4	-	-
Total Solids	0	-	-	-	Total Hardness	1	180	-	-
Suspended Solids	7	16	6	29	Conductivity	9	370	270	500
Vol. Susp. Solids	3	9	4	12	Total Coliform	7	4,300	360	43,000
Chlorides	9	3	0	6	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	7.9	7.5	8.3	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	8	23	14	35	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 42. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 2 (H361,H362,H366)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	9.6	8.2	11.0	Temperature (°C)	15	14.5	10.5	20.0
Biochemical Oxygen Demand	12	2	1	3	Percent Saturation	15	94	88	100
Ammonia Nitrogen	15	.18	<.05	.38	Total Iron	15	-	<100	800
Organic Nitrogen	15	.17	.10	.36	Sodium	10	5	4	5
Nitrate Nitrogen	15	-	<.1	.2	Potassium	10	2.4	1.4	4.7
Nitrite Nitrogen	9	-	<.01	<.01	Calcium	15	31	22	42
Total Phosphate	15	-	<.04	.2	Magnesium	15	10	8	14
Total Soluble Phosphate	15	-	<.04	.2	Sulfate	15	20	14	35
Total Solids	15	150	110	200	Total Hardness	15	110	88	140
Suspended Solids	15	5	0	11	Conductivity	15	220	190	270
Vol. Susp. Solids	15	2	0	6	Total Coliform	15	180	< 5	3,400
Chlorides	15	5	4	7	Fecal Coliform	15	10	<1	270
Phenols	7	-	<2	6	Fecal Streptococcus	15	4	<1	51
pH	15	7.8	7.3	8.1	Total Plate Count 20°C	11	310	140	10,000
Chemical Oxygen Demand	6	19	10	23	Total Plate Count 35°C	13	120	4	3,400

NS = number of samples

TABLE 42. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 3 (H363,H364,H365,H370)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	18	11.1	9.3	12.6	Temperature (°C)	18	10.5	6.0	17.0
Biochemical Oxygen Demand	14	1	1	2	Percent Saturation	18	100	94	106
Ammonia Nitrogen	16	.14	<.05	.39	Total Iron	16	-	<100	800
Organic Nitrogen	16	.12	<.05	.29	Sodium	17	4	3	5
Nitrate Nitrogen	18	.2	.1	.5	Potassium	17	1.6	.8	2.4
Nitrite Nitrogen	8	-	<.01	<.01	Calcium	17	26	24	30
Total Phosphate	16	-	<.04	.2	Magnesium	17	8	7	10
Total Soluble Phosphate	18	-	<.04	.1	Sulfate	17	17	12	25
Total Solids	18	120	100	140	Total Hardness	16	94	86	100
Suspended Solids	16	3	0	8	Conductivity	17	190	180	210
Vol. Susp. Solids	15	2	0	5	Total Coliform	18	1	<1	6
Chlorides	19	5	4	6	Fecal Coliform	8	<2	<1	<2
Phenols	9	-	<2	3	Fecal Streptococcus	8	<2	<1	<2
pH	18	7.9	7.4	8.2	Total Plate Count 20°C	15	24	7	140
Chemical Oxygen Demand	4	6	4	9	Total Plate Count 35°C	17	5	1	460

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 2 - H361

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	9.5	9.0	10.8	Temperature (°C)	5	14.5	11.0	20.0
Biochemical Oxygen Demand	4	2	1	2	Percent Saturation	5	94	88	100
Ammonia Nitrogen	5	.18	<.05	.27	Total Iron	5	-	<100	800
Organic Nitrogen	5	.16	.11	.20	Sodium	4	4	4	5
Nitrate Nitrogen	5	-	<.1	.2	Potassium	4	2.2	1.7	2.8
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	33	23	42
Total Phosphate	5	-	<.04	.2	Magnesium	5	11	8	14
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	17	14	22
Total Solids	5	160	120	200	Total Hardness	5	120	100	140
Suspended Solids	5	6	0	11	Conductivity	5	220	200	270
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	500	30	3,400
Chlorides	5	6	5	7	Fecal Coliform	5	150	5	270
Phenols	3	-	<2	6	Fecal Streptococcus	5	14	4	51
pH	5	7.7	7.3	8.0	Total Plate Count 20°C	4	1,300	140	5,300
Chemical Oxygen Demand	2	-	10	20	Total Plate Count 35°C	4	330	32	3,400

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 2 - H362

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	9.8	8.9	10.8	Temperature (°C)	5	14.0	11.0	19.0
Biochemical Oxygen Demand	4	2	1	2	Percent Saturation	5	96	92	100
Ammonia Nitrogen	5	.15	<.05	.22	Total Iron	5	-	<100	500
Organic Nitrogen	5	.17	.11	.24	Sodium	3	5	4	5
Nitrate Nitrogen	5	-	<.1	.2	Potassium	3	2.3	1.7	3.0
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	30	22	37
Total Phosphate	5	-	<.04	.08	Magnesium	5	10	8	13
Total Soluble Phosphate	5	-	<.04	.08	Sulfate	5	18	16	20
Total Solids	5	140	110	180	Total Hardness	5	110	94	130
Suspended Solids	5	4	2	6	Conductivity	5	220	190	260
Vol. Susp. Solids	5	2	0	3	Total Coliform	5	84	<5	840
Chlorides	5	5	4	6	Fecal Coliform	5	10	<1	190
Phenols	2	-	<2	3	Fecal Streptococcus	5	<2	<1	33
pH	5	7.9	7.7	8.0	Total Plate Count 20°C	4	1,900	140	4,600
Chemical Oxygen Demand	2	-	10	21	Total Plate Count 35°C	4	190	4	500

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 2 - H366

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	9.4	8.2	11.0	Temperature (°C)	5	14.0	10.5	20.0
Biochemical Oxygen Demand	4	2	1	3	Percent Saturation	5	92	89	100
Ammonia Nitrogen	5	.21	<.05	.38	Total Iron	5	-	<100	1,400
Organic Nitrogen	5	.18	.10	.36	Sodium	3	5	4	5
Nitrate Nitrogen	5	-	<.1	.2	Potassium	3	2.7	1.4	4.7
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	30	23	38
Total Phosphate	5	-	<.04	.1	Magnesium	5	10	9	11
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	24	19	35
Total Solids	5	140	120	180	Total Hardness	5	110	88	120
Suspended Solids	5	5	2	10	Conductivity	5	220	190	260
Vol. Susp. Solids	5	3	0	6	Total Coliform	5	60	15	340
Chlorides	5	5	5	6	Fecal Coliform	5	7	<1	19
Phenols	2	-	2	3	Fecal Streptococcus	5	2	<1	4
pH	5	7.8	7.5	8.1	Total Plate Count 20°C	3	310	200	10,000
Chemical Oxygen Demand	2	-	20	23	Total Plate Count 35°C	5	100	23	2,800

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 3 - H363

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.1	10.1	11.8	Temperature (°C)	4	9.5	8.0	12.0
Biochemical Oxygen Demand	3	1	1	1	Percent Saturation	4	98	94	101
Ammonia Nitrogen	4	-	<.05	.23	Total Iron	4	-	<100	600
Organic Nitrogen	3	.13	.08	.19	Sodium	4	4	4	4
Nitrate Nitrogen	4	.3	.2	.5	Potassium	4	1.8	1.2	2.4
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	4	27	26	28
Total Phosphate	4	.09	.08	.1	Magnesium	4	9	8	9
Total Soluble Phosphate	4	.08	.04	.1	Sulfate	4	16	15	17
Total Solids	4	120	100	140	Total Hardness	4	96	90	100
Suspended Solids	4	5	1	8	Conductivity	4	190	180	210
Vol. Susp. Solids	4	3	1	5	Total Coliform	4	2	<1	3
Chlorides	5	5	4	6	Fecal Coliform	2	-	<1	<2
Phenols	3	-	<2	3	Fecal Streptococcus	2	-	<1	<2
pH	4	7.8	7.4	8.1	Total Plate Count 20°C	3	40	10	69
Chemical Oxygen Demand	1	6	-	-	Total Plate Count 35°C	4	15	10	460

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 3 - H364

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.4	10.3	12.6	Temperature (°C)	4	9.5	6.0	12.0
Biochemical Oxygen Demand	3	1	1	1	Percent Saturation	4	100	96	102
Ammonia Nitrogen	4	.18	.08	.35	Total Iron	4	-	<100	400
Organic Nitrogen	4	.14	<.05	.24	Sodium	4	4	4	5
Nitrate Nitrogen	4	.2	.1	.2	Potassium	4	1.8	1.2	2.1
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	4	26	24	28
Total Phosphate	4	.09	<.04	.2	Magnesium	4	9	8	10
Total Soluble Phosphate	4	-	<.04	.1	Sulfate	4	17	13	20
Total Solids	4	120	110	140	Total Hardness	4	93	86	98
Suspended Solids	4	3	0	5	Conductivity	4	190	180	200
Vol. Susp. Solids	4	1	0	4	Total Coliform	4	1	<1	2
Chlorides	4	5	4	5	Fecal Coliform	2	-	<1	<2
Phenols	2	-	<2	3	Fecal Streptococcus	2	-	<1	<2
pH	4	7.9	7.8	8.1	Total Plate Count 20°C	3	24	9	32
Chemical Oxygen Demand	1	4	-	-	Total Plate Count 35°C	4	9	4	16

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 3 - H365

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.1	10.3	11.7	Temperature (°C)	4	10.5	8.5	12.0
Biochemical Oxygen Demand	3	1	1	2	Percent Saturation	4	99	96	104
Ammonia Nitrogen	4	-	<.05	.39	Total Iron	4	400	100	800
Organic Nitrogen	4	.09	.06	.14	Sodium	4	4	4	5
Nitrate Nitrogen	4	.2	.1	.2	Potassium	4	1.7	1.2	2.3
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	4	27	24	30
Total Phosphate	4	.06	<.04	.1	Magnesium	4	9	8	9
Total Soluble Phosphate	4	-	<.04	.1	Sulfate	4	18	15	22
Total Solids	4	120	110	130	Total Hardness	4	95	90	100
Suspended Solids	4	4	1	7	Conductivity	4	190	180	210
Vol. Susp. Solids	3	2	0	3	Total Coliform	4	<2	<1	3
Chlorides	4	5	5	5	Fecal Coliform	2	-	<1	<2
Phenols	2	-	<2	3	Fecal Streptococcus	2	-	<1	<2
pH	4	7.9	7.8	8.1	Total Plate Count 20°C	3	40	34	62
Chemical Oxygen Demand	1	6	-	-	Total Plate Count 35°C	4	11	2	26

NS = number of samples

TABLE 43. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Alpena - Range 3 - H370

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	6	11.1	9.3	12.6	Temperature (°C)	6	11.2	6.0	17.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	6	101	95	106
Ammonia Nitrogen	4	.10	<.05	.23	Total Iron	4	-	<100	300
Organic Nitrogen	4	.18	.11	.29	Sodium	5	4	3	4
Nitrate Nitrogen	6	.2	.1	.3	Potassium	5	1.5	.8	2.4
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	5	26	24	30
Total Phosphate	4	-	<.04	.1	Magnesium	5	8	7	9
Total Soluble Phosphate	6	-	<.04	.1	Sulfate	5	20	12	25
Total Solids	6	120	100	130	Total Hardness	4	95	88	100
Suspended Solids	4	3	1	5	Conductivity	5	180	180	200
Vol. Susp. Solids	4	2	0	4	Total Coliform	6	1	<1	6
Chlorides	6	5	4	5	Fecal Coliform	2	-	<1	<2
Phenols	2	-	<2	2	Fecal Streptococcus	2	-	<1	<2
pH	6	7.9	7.6	8.2	Total Plate Count 20°C	6	12	7	140
Chemical Oxygen Demand	1	9	-	-	Total Plate Count 35°C	5	2	1	44

NS = number os samples

TABLE 44. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harrisville - H350

Parameter	NS	Avg.	Low	High	Parameter	NS	Avg.	Low	High
Dissolved Oxygen	4	10.3	8.8	11.7	Temperature (°C)	4	13.0	10.5	19.0
Biochemical Oxygen Demand	4	2	1	2	Percent Saturation	4	98	92	109
Ammonia Nitrogen	3	.17	.14	.19[a]	Total Iron	4	-	<100	300
Organic Nitrogen	4	.21	.11	.30	Sodium	3	4	4	5
Nitrate Nitrogen	4	.2	.1	.3	Potassium	3	1.9	1.4	2.4
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	4	28	26	30
Total Phosphate	4	-	<.04	.08	Magnesium	4	9	9	9
Total Sol. Phosphate	4	-	<.04	.08	Sulfate	4	18	13	21
Total Solids	4	130	130	140	Total Hardness	4	100	92	110
Suspended Solids	4	10	6	16	Conductivity	4	200	180	210
Vol. Susp. Solids	4	2	2	2	Total Coliform	4	90	< 2	290
Chloride	4	5	5	6	Fecal Coliform	4	12	<2	150
Phenol	1	<2	-	-	Fecal Streptococcus	4	7	4	100
pH	4	8.0	7.8	8.1	Total Plate Count 20°C	3	3,800	1,600	4,300
Chemical Oxygen Demand	2	-	6	9	Total Plate Count 35°C	3	380	89	550

a - value of 2.20 mg/l not used in computing data.
NS = number of samples

TABLE 44. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harrisville H 351

Parameter	NS	Avg.	Low	High	Parameter	NS	Avg.	Low	High
Dissolved Oxygen	4	11.0	9.8	11.9	Temperature (°C)	4	12.5	10.0	18.0
Biochemical Oxygen Demand	4	2	1	2	% Saturation	4	104	97	[illegible]
Ammonia Nitrogen	4	.12	.05	.18	Total Iron	4	200	<100	[illegible]
Organic Nitrogen	4	.19	[illegible]	28	Sodium	[illegible]	-	4	[illegible]
Nitrate Nitrogen	4	[illegible]	[illegible]	[illegible]	Potassium	[illegible]	-	2.0	[illegible]
Nitrite Nitrogen	2	-	[illegible]	[illegible]	Calcium	[illegible]	30	27	36
Total Phosphate	4	-	<.04	[illegible]	Magnesium	4	9	8	[illegible]
Total Sol Phosphate	4	-	<.04	.06	Sulfate	4	[illegible]	8	[illegible]
Total Solids	4	[illegible]	120	120	Total Hardness	4	98	94	[illegible]
Suspended Solids	4	[illegible]	[illegible]	10	Conductivity	4	190	170	200
Vol. Susp. Solids	4	[illegible]	0	4	Total Coliform	4	3	<2	7
Chloride	4	5	5	[illegible]	Fecal Coliform	4	<1	<1	<2
Phenol	1	<2	-	-	Fecal Strep	3	<2	<1	<2
pH	4	7.9	7.7	8.1	Total Plate Count 20°C	3	100	52	220
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	3	57	7	90

NS = Number of Samples

TABLE 44. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harrisville - H352

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	10.9	9.7	11.8	Temperature (°)	4	12.0	10.0	18.0
Biochemical Oxygen Demand	4	1	1	2	Percent Saturation	4	102	96	105
Ammonia Nitrogen	4	-	<.05	.17	Total Iron	4	-	<100	800
Organic Nitrogen	4	.15	.06	.30	Sodium	3	4	3	4
Nitrate Nitrogen	4	.2	.1	.3	Potassium	3	1.6	1.0	2.0
Nitrite Nitrogen	2	-	<.01	<.01	Calcium	4	27	26	29
Total Phosphate	4	-	<.04	.06	Magnesium	4	9	8	9
Total Sol. Phosphate	4	-	<.04	.06	Sulfate	4	21	10	40
Total Solids	4	120	110	130	Total Hardness	4	97	94	100
Suspended Solids	4	5	2	8	Conductivity	4	190	170	200
Vol. Susp. Solids	4	4	0	7	Total Coliform	4	<2	<1	3
Chloride	4	5	5	6	Fecal Coliform	2	-	<1	<2
Phenol	2	-	2	4	Fecal Streptococcus	2	-	<1	<2
pH	4	7.9	7.8	8.0	Total Plate Count 20°C	3	80	29	150
Chemical Oxygen Demand	2	-	6	7	Total Plate Count 35°C	3	7	1	40

TABLE 44. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harrisville - H353

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	11.0	9.7	11.9	Temperature (°C)	4	12.5	10.0	18.0
Biochemical Oxygen Demand	4	1	1	2	% Saturation	4	103	97	108
Ammonia Nitrogen	4	.20	.06	.38	Total Iron	4	200	<100	500
Organic Nitrogen	4	.16	.06	.24	Sodium	3	4	4	5
Nitrate Nitrogen	4	.1	.1	.1	Potassium	3	2.3	1.3	3.4
Nitrite Nitrogen	1	-	<.01	<.01	Calcium	4	27	24	30
Total Phosphate	4	-	<.04	1.6	Magnesium	4	9	8	9
Total Sol. Phosphate	4	-	.04	1.3	Sulfate	4	14	11	17
Total Solids	4	120	110	130	Total Hardness	4	94	90	100
Suspended Solids	4	7	5	10	Conductivity	4	190	170	200
Vol. Susp. Solids	4	3	1	4	Total Coliform	4	<2	<1	3
Chloride	4	5	5	5	Fecal Coliform	2	-	<1	<2
Phenol	2	-	<2	3	Fecal Strep	2	-	<1	<2
pH	4	7.9	7.8	8.1	Total Plate Count 20°C	3	140	72	540
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35 °C	2	12	5	54

TABLE 44. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harrisville - H354

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	4	10.5	9.3	11.8	Temperature (°C)	4	13.5	10.0	20.0
Biochemical Oxygen Demand	4	3	2	6	Percent Saturation	4	101	92	112
Ammonia Nitrogen	4	.25	.18	.38	Total Iron	4	-	<100	1,000
Organic Nitrogen	4	.25	.15	.38	Sodium	3	4	4	5
Nitrate Nitrogen	4	.2	.1	.3	Potassium	3	1.8	1.4	2.1
Nitrite Nitrogen	2	-	<.01	.01	Calcium	4	28	24	32
Total Phosphate	4	.2	.04	.6	Magnesium	4	9	9	10
Total Sol. Phosphate	4	-	<.04	.4	Sulfate	4	16	12	19
Total Solids	4	170	140	220	Total Hardness	4	100	100	110
Suspended Solids	4	35	10	94	Conductivity	4	210	180	220
Vol. Susp. Solids	4	6	0	15	Total Coliform	4	19	<1	350
Chloride	4	5	5	5	Fecal Coliform	3	16	<2	131
Phenol	2	-	<2	4	Fecal Streptococcus	3	18	2	64
pH	4	8.0	7.7	8.3	Total Plate Count 20°C	3	2,000	1,500	2,600
Chemical Oxygen Demand	2	-	11	25	Total Plate Count 35°C	3	270	190	580

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - H301

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.0	9.0	12.4	Temperature (°C)	5	12.5	8.0	20.0
Biochemical Oxygen Demand	5	2	1	2	% Saturation	5	102	100	104
Ammonia Nitrogen	5	.12	<.05	.21	Total Iron	5	-	<100	300
Organic Nitrogen	5	.17	.10	.34	Sodium	4	4	4	4
Nitrate Nitrogen	5	-	<.1	.2	Potassium	4	1.8	1.2	2.3
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	27	30
Total Phosphate	5	-	<.04	.2	Magnesium	5	10	9	12
Total Sol. Phosphate	5	-	.04	.1	Sulfate	5	15	12	20
Total Solids	5	140	120	150	Total Hardness	5	100	92	110
Suspended Solids	5	5	3	10	Conductivity	5	200	170	230
Vol. Susp. Solids	5	2	0	5	Total Coliform	5	69	<1	290
Chloride	5	7	5	18	Fecal Coliform	2	-	<1	<2
Phenol	3	5	<2	10	Fecal Strep	2	-	1	2
pH	5	8.0	7.6	8.3	Total Plate Count 20°C	4	160	110	200
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	77	38	170

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - H302

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	8.7	6.9	10.1	Temperature (°C)	5	16.5	12.0	22.5
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	88	72	98
Ammonia Nitrogen	5	.20	.14	.32	Total Iron	5	-	< 100	1,000
Organic Nitrogen	5	.13	.06	.19	Sodium	4	4	4	5
Nitrate Nitrogen	5	-	<.1	.1	Potassium	4	1.6	1.2	2.0
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	40	35	46
Total Phosphate	5	-	<.04	.1	Magnesium	5	14	13	17
Total Sol. Phosphate	5	-	<.04	.1	Sulfate	5	10	2	18
Total Solids	5	180	170	200	Total Hardness	5	140	120	150
Suspended Solids	5	8	2	19	Conductivity	5	260	200	290
Vol. Susp. Solids	5	3	1	8	Total Coliform	5	460	190	3,500
Chloride	5	4	3	5	Fecal Coliform	5	26	4	130
Phenol	2	-	2	3	Fecal Streptococcus	5	36	10	51
pH	5	8.1	7.9	8.4	Total Plate Count 20°C	4	2,000	1,500	2,700
Chemical Oxygen Demand	3	20	13	29	Total Plate Count 35°C	4	950	620	1,400

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - H303

Paramaters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	10.8	9.2	11.9	Temperature (°C)	5	13.0	10.0	20.0
Biochemical Oxygen Demand	5	1	1	2	% Saturation	5	102	96	105
Ammonia Nitrogen	5	.19	.06	.43	Total Iron	5	-	<100	800
Organic Nitrogen	5	.20	.05	.51	Sodium	4	4	4	5
Nitrate Nitrogen	5	.1	.1	.2	Potassium	4	1.7	1.2	2.0
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	24	35
Total Phosphate	5	-	<.04	.6	Magnesium	5	10	8	12
Total Sol. Phosphate	5	-	<.04	.6	Sulfate	5	17	7	36
Total Solids	5	150	130	170	Total Hardness	5	110	93	140
Suspended Solids	5	1	0	9	Conductivity	5	220	180	260
Vol. Susp. Solids	5	1	0	3	Total Coliform	5	18	<1	130
Chloride	5	6	4	10	Fecal Coliform	2	-	<1	2
Phenol	2	-	<2	4	Fecal Strep	2	-	1	2
pH	5	8.0	7.8	8.1	Total Plate Count 20°C	4	510	140	2,800
Chemical Oxygen Demand	0	-	-	-	Total Plate Count 35°C	4	210		600

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - H304

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	10.9	9.1	11.8	Temperature (°C)	5	13.0	9.5	20.0
Biochemical Oxygen Demand	5	1	1	2	Percent Saturation	5	102	101	104
Ammonia Nitrogen	5	.19	.10	.30	Total Iron	5	-	<100	200
Organic Nitrogen	5	.15	<.05	.26	Sodium	4	4	4	5
Nitrate Nitrogen	5	-	<.1	.2	Potassium	4	1.7	1.1	2.1
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	29
Total Phosphate	5	-	<.04	.2	Magnesium	5	9	8	10
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	17	12	24
Total Solids	5	130	110	140	Total Hardness	5	100	96	100
Suspended Solids	5	5	1	11	Conductivity	5	200	170	220
Vol. Susp. Solids	5	2	1	4	Total Coliform	5	11	<2	49
Chlorides	5	7	5	11	Fecal Coliform	3	<2	<1	3
Phenols	3	-	<2	3	Fecal Streptococcus	3	<2	<1	5
pH	5	8.0	7.8	8.2	Total Plate Count 20°C	4	290	100	550
Chemical Oxygen Demand	3	9	6	14	Total Plate Count 35°C	4	23	10	290

NS = number os samples

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - Y010

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	9.3	7.3	11.4	Temperature (°C)	11	9.0	0.0	22.0
Biochemical Oxygen Demand	4	1	1	2	Percent Saturation	5	87	76	95
Ammonia Nitrogen	2	-	.14	.17	Total Iron	2	-	$<$100	500
Organic Nitrogen	2	-	.10	.16	Sodium	2	-	4	5
Nitrate Nitrogen	2	-	.1	.3	Potassium	2	-	.8	1.7
Nitrite Nitrogen	1	.01	-	-	Calcium	2	-	46	48
Total Phosphate	2	-	.08	.1	Magnesium	2	-	10	13
Total Soluble Phosphate	2	-	.08	.1	Sulfate	2	-	1	11
Total Solids	2	-	180	190	Total Hardness	2	-	140	160
Suspended Solids	2	-	7	11	Conductivity	2	-	260	290
Vol. Susp. Solids	2	-	4	6	Total Coliform	11	6,000	460	45,000
Chlorides	2	-	4	6	Fecal Coliform	11	200	12	7,200
Phenols	2	-	3	4	Fecal Streptococcus	11	46	10	400
pH	2	-	7.8	8.0	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	2	-	25	29	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 45. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Oscoda - 14-AuS (MWRC)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	10	10.8	7.2	13.0	Temperature (°C)	10	7.5	0.0	23.0
Biochemical Oxygen Demand	7	2.2	.8	3.0	Percent Saturation	10	88	71	103
Ammonia Nitrogen	9	0.0	0.0	0.0	Total Iron	0	-	-	-
Organic Nitrogen	0	-	-	-	Sodium	1	16	-	-
Nitrate Nitrogen	9	.09	.02	.25	Potassium	1	1.8	-	-
Nitrite Nitrogen	0	-	-	-	Calcium	1	44	-	-
Total Phosphate	9	.03	.00	.10	Magnesium	1	12	-	-
Total Soluble Phosphate	0	-	-	-	Sulfate	1	8	-	-
Total Solids	0	-	-	-	Total Hardness	1	160	-	-
Suspended Solids	7	8	3	15	Conductivity	9	290	220	350
Vol. Susp. Solids	1	2	-	-	Total Coliform	7	15,000	4,300	39,000
Chlorides	9	1	0	3	Fecal Coliform	0	-	-	-
Phenols	0	-	-	-	Fecal Streptococcus	0	-	-	-
pH	10	8.1	7.9	8.3	Total Plate Count 20°C	0	-	-	-
Chemical Oxygen Demand	8	10	9	13	Total Plate Count 35°C	0	-	-	-

NS = number of samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Outer Harbor Area - H121

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.6	10.1	12.8	Temperature (°C)	5	8.5	3.5	12.5
Biochemical Oxygen Demand	3	2	1	2	Percent Saturation	5	99	95	105
Ammonia Nitrogen	4	.19	.06	.40	Total Iron	5	300	100	500
Organic Nitrogen	4	.18	.05	.37	Sodium	4	5	4	6
Nitrate Nitrogen	5	.2	.1	.4	Potassium	4	-	<.4	1.7
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	26	22	30
Total Phosphate	5	-	<.04	.7	Magnesium	5	9	7	13
Total Soluble Phosphate	5	-	<.04	.7	Sulfate	5	14	10	18
Total Solids	5	130	110	160	Total Hardness	5	100	90	120
Suspended Solids	5	5	2	10	Conductivity	5	200	150	220
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	11	<1	22
Chlorides	5	8	6	12	Fecal Coliform	2	-	<1	<2
Phenols	5	-	<2	4	Fecal Streptococcus	2	-	<1	<2
pH	5	7.9	7.7	8.1	Total Plate Count 20°C	4	1,400	180	2,900
Chemical Oxygen Demand	1	4	-	-	Total Plate Count 35°C	5	31	18	130

NS = number of samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Breakwater Area - H122

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.1	9.7	12.1	Temperature (°C)	5	8.0	5.0	12.5
Biochemical Oxygen Demand	3	2	1	4	Percent Saturation	5	93	76	101
Ammonia Nitrogen	5	.16	.08	.24	Total Iron	5	400	100	1,000
Organic Nitrogen	5	.28	.20	.38	Sodium	4	6	5	7
Nitrate Nitrogen	5	.3	.1	.4	Potassium	4	-	<.4	1.9
Nitrite Nitrogen	3	-	<.01	.02	Calcium	5	29	26	33
Total Phosphate	5	-	<.04	.3	Magnesium	5	9	7	13
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	17	10	26
Total Solids	5	150	130	180	Total Hardness	5	100	94	110
Suspended Solids	5	8	3	16	Conductivity	5	210	180	240
Vol. Susp. Solids	5	4	1	9	Total Coliform	4	37	> 2	150
Chlorides	5	9	7	13	Fecal Coliform	5	32	> 2	1,400
Phenols	5	-	< 2	2	Fecal Streptococcus	5	52	6	730
pH	5	7.7	7.4	8.1	Total Plate Count 20°C	4	5,750	900	130,000
Chemical Oxygen Demand	1	5	-	-	Total Plate Count 35°C	5	700	97	6,100

NS = number of samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Outer Harbor Area - H123

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.7	10.4	13.3	Temperature (°C)	5	8.5	2.5	12.5
Biochemical Oxygen Demand	3	1	1	2	Percent Saturation	5	98	95	102
Ammonia Nitrogen	5	.14	.06	.28	Total Iron	5	200	100	500
Organic Nitrogen	5	.20	.11	.41	Sodium	4	5	4	6
Nitrate Nitrogen	5	.2	.1	.3	Potassium	4	-	<.4	2.5
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	30
Total Phosphate	5	-	<.04	.1	Magnesium	5	9	8	13
Total Soluble Phosphate	5	-	<.04	.1	Sulfate	5	16	9	20
Total Solids	5	130	120	150	Total Hardness	5	96	90	100
Suspended Solids	5	4	0	7	Conductivity	5	200	180	220
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	<1	<1	3
Chlorides	5	9	6	13	Fecal Coliform	2	-	<1	<2
Phenols	5	-	<2	4	Fecal Streptococcus	2	-	<1	<2
pH	5	7.8	7.6	8.1	Total Plate Count 20°C	4	380	170	820
Chemical Oxygen Demand	1	5	-	-	Total Plate Count 35°C	5	35	14	140

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Breakwater Area - H124

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.4	10.6	12.4	Temperature (°C)	5	6.5	4.0	12.0
Biochemical Oxygen Demand	3	2	1	2	Percent Saturation	5	96	94	98
Ammonia Nitrogen	5	.10	$<$.05	.15	Total Iron	5	300	100	500
Organic Nitrogen	5	.16	.06	.30	Sodium	4	5	4	7
Nitrate Nitrogen	5	.2	.1	.4	Potassium	4	-	$<$.4	1.7
Nitrite Nitrogen	3	-	$<$.01	.01	Calcium	5	27	24	29
Total Phosphate	5	-	$<$.04	1.9	Magnesium	5	9	8	13
Total Soluble Phosphate	5	-	$<$.04	1.6	Sulfate	5	17	9	20
Total Solids	5	140	130	160	Total Hardness	5	98	92	100
Suspended Solids	5	6	2	12	Conductivity	5	200	180	230
Vol. Susp. Solids	5	3	0	6	Total Coliform	5	66	$<$2	180
Chlorides	5	8	7	11	Fecal Coliform	5	8	$>$1	24
Phenols	5	-	$<$2	8	Fecal Streptococcus	5	14	$<$2	400
pH	5	7.8	7.6	8.0	Total Plate Count 20°C	4	20,000	$<$10	44,000
Chemical Oxygen Demand	1	7	-	-	Total Plate Count 35°C	5	800	160	4,500

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Outer Harbor Area - H125

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.6	10.3	13.7	Temperature (°C)	5	8.5	2.0	13.0
Biochemical Oxygen Demand	3	1	1	2	Percent Saturation	5	98	93	101
Ammonia Nitrogen	5	.13	.07	.21	Total Iron	5	300	<100	500
Organic Nitrogen	5	.25	.06	.80	Sodium	4	7	4	12
Nitrate Nitrogen	5	.2	.1	.4	Potassium	3	-	<.4	1.7
Nitrite Nitrogen	3	-	<.01	.01	Calcium	5	26	24	28
Total Phosphate	5	-	<.04	.07	Magnesium	5	9	7	13
Total Soluble Phosphate	5	-	<.04	.07	Sulfate	5	17	13	20
Total Solids	5	130	110	140	Total Hardness	5	97	88	100
Suspended Solids	5	3	0	7	Conductivity	5	200	180	210
Vol. Susp. Solids	5	3	0	6	Total Coliform	5	1	<1	2
Chlorides	5	8	5	9	Fecal Coliform	2	-	<1	<2
Phenols	5	-	<2	8	Fecal Streptococcus	2	-	<1	<2
pH	5	7.8	7.5	8.2	Total Plate Count 20°C	4	750	160	2,100
Chemical Oxygen Demand	1	4	-	-	Total Plate Count 35°C	5	26	8	1,200

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Breakwater Area - H126

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.2	10.3	12.1	Temperature (°C)	5	8.5	4.5	13.0
Biochemical Oxygen Demand	3	2	1	2	Percent Saturation	5	95	91	104
Ammonia Nitrogen	5	.14	.06	.26	Total Iron	5	400	100	700
Organic Nitrogen	5	.14	.07	.31	Sodium	4	5	4	6
Nitrate Nitrogen	5	.3	.1	.4	Potassium	4	-	<.4	1.5
Nitrite Nitrogen	3	-	.01	.01	Calcium	5	27	26	30
Total Phosphate	5	-	<.04	1.4	Magnesium	5	9	7	13
Total Soluble Phosphate	5	-	<.04	.2	Sulfate	5	17	11	21
Total Solids	5	140	130	160	Total Hardness	5	100	98	110
Suspended Solids	5	8	0	13	Conductivity	5	200	180	220
Vol. Susp. Solids	5	3	0	7	Total Coliform	5	90	58	190
Chlorides	5	9	7	11	Fecal Coliform	5	36	12	66
Phenols	4	-	<2	3	Fecal Streptococcus	5	8	4	490
pH	5	7.8	7.7	8.1	Total Plate Count 20°C	4	15,550	10	39,000
Chemical Oxygen Demand	1	8	-	-	Total Plate Count 35°C	5	990	220	2,500

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Outer Harbor Area - H127

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.8	10.8	13.2	Temperature ($^{\circ}$C)	5	8.5	2.5	13.0
Biochemical Oxygen Demand	3	2	1	2	Percent Saturation	5	101	96	103
Ammonia Nitrogen	5	.09	.05	.14	Total Iron	5	500	$<$100	1,300
Organic Nitrogen	4	.13	$<$.05	.24	Sodium	4	5	4	6
Nitrate Nitrogen	5	.2	.1	.4	Potassium	4	-	$<$.4	1.5
Nitrite Nitrogen	3	-	$<$.01	.01	Calcium	5	26	24	28
Total Phosphate	5	-	$<$.04	.1	Magnesium	5	8	6	13
Total Soluble Phosphate	5	-	$<$.04	.1	Sulfate	4	14	8	20
Total Solids	5	130	110	150	Total Hardness	5	98	86	100
Suspended Solids	5	5	3	11	Conductivity	5	200	180	220
Vol. Susp. Solids	5	3	0	9	Total Coliform	5	$<$2	$<$1	12
Chlorides	5	7	5	9	Fecal Coliform	3	1	$<$1	$<$2
Phenols	5	-	$<$2	6	Fecal Streptococcus	3	$<$1	$<$1	$<$2
pH	5	7.9	7.6	8.2	Total Plate Count 20°C	4	3,450	500	46,000
Chemical Oxygen Demand	1	6	-	-	Total Plate Count 35°C	5	30	8	4,400

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Breakwater Area (H122,H124,H126)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	15	11.2	9.7	12.4	Temperature (°C)	15	7.7	4.0	13.0
Biochemical Oxygen Demand	9	2	1	4	Percent Saturation	15	95	76	104
Ammonia Nitrogen	15	.13	<.05	.26	Total Iron	15	400	100	1,000
Organic Nitrogen	15	.19	.06	.38	Sodium	12	6	4	7
Nitrate Nitrogen	15	.2	.1	.4	Potassium	12	-	<.4	1.9
Nitrite Nitrogen	9	-	<.01	.02	Calcium	15	28	24	33
Total Phosphate	15	-	<.04	1.9	Magnesium	15	9	7	13
Total Soluble Phosphate	15	-	<.04	1.6	Sulfate	15	17	9	26
Total Solids	15	140	130	180	Total Hardness	15	100	94	110
Suspended Solids	15	7	0	16	Conductivity	15	200	180	240
Vol. Susp. Solids	15	3	0	7	Total Coliform	14	65	<2	190
Chlorides	15	8	7	13	Fecal Coliform	15	22	>1	1,400
Phenols	14	-	<2	8	Fecal Streptococcus	15	32	<2	730
pH	15	7.8	7.4	8.1	Total Plate Count 20°C	12	8,300	<10	130,000
Chemical Oxygen Demand	3	7	5	8	Total Plate Count 35°C	15	800	97	6,100

NS = number os samples

TABLE 46. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Harbor Beach - Outer Harbor Area (H121,H123,H125,H127)

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	19	11.6	10.1	13.7	Temperature (°C)	20	8.5	2.0	13.0
Biochemical Oxygen Demand	12	2	1	2	Percent Saturation	20	99	93	105
Ammonia Nitrogen	18	.12	.05	.28[a]	Total Iron	20	300	<100	1,300
Organic Nitrogen	17	.16	<.05	.37[b]	Sodium	16	6	4	12
Nitrate Nitrogen	20	.2	.1	.4	Potassium	15	-	<.4	2.5
Nitrite Nitrogen	12	-	<.01	.01	Calcium	20	27	22	30
Total Phosphate	20	-	<.04	.7	Magnesium	20	9	6	13
Total Soluble Phosphate	20	-	<.04	.7	Sulfate	19	15	8	20
Total Solids	20	130	120	160	Total Hardness	20	99	86	120
Suspended Solids	20	4	0	11	Conductivity	20	200	150	230
Vol. Susp. Solids	20	3	0	6	Total Coliform	20	<2	<1	22
Chlorides	20	8	5	13	Fecal Coliform	9	1	<1	<2
Phenols	20	-	<2	8	Fecal Streptococcus	9	<1	<1	<2
pH	20	7.8	7.5	8.2	Total Plate Count 20°C	16	810	160	46,000
Chemical Oxygen Demand	4	5	4	6	Total Plate Count 35°C	20	30	8	4,400

a - value of .40 not used in calculating data.
b - value of .80 not used in calculating data.
NS = number os samples

TABLE 47. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Port Sanilac - H111

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.5	10.1	12.6	Temperature (°C)	5	9.0	3.5	16.0
Biochemical Oxygen Demand	3	1	1	2	Percent Saturation	5	99	94	103
Ammonia Nitrogen	5	.18	.08	.21	Total Iron	5	-	<100	1,000
Organic Nitrogen	5	.15	.08	.26	Sodium	4	4	4	4
Nitrate Nitrogen	5	.3	.1	.5	Potassium	4	-	<.4	1.5
Nitrite Nitrogen	3	-	<.01	<.01	Calcium	5	28	26	32
Total Phosphate	5	-	<.04	.3	Magnesium	5	8	6	13
Total Soluble Phosphate	5	-	<.04	.3	Sulfate	5	16	8	20
Total Solids	5	130	110	160	Total Hardness	5	100	90	110
Suspended Solids	5	13	3	22	Conductivity	5	200	170	210
Vol. Susp. Solids	5	3	0	7	Total Coliform	5	66	<2	154
Chlorides	5	7	6	8	Fecal Coliform	3	10	2	18
Phenols	5	-	<2	8	Fecal Streptococcus	3	2	2	8
pH	5	7.7	7.2	8.2	Total Plate Count 20°C	4	445	4	760
Chemical Oxygen Demand	1	8	-	-	Total Plate Count 35°C	5	160	12	390

NS = number os samples

TABLE 47. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Port Sanilac - H112

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.8	10.4	13.3	Temperature (°C)	5	8.5	2.0	13.5
Biochemical Oxygen Demand	3	-	<1	1	Percent Saturation	5	101	96	105
Ammonia Nitrogen	5	.18	.06	.27	Total Iron	5	-	<100	500
Organic Nitrogen	5	.14	<.05	.25	Sodium	4	4	4	4
Nitrate Nitrogen	5	.3	.1	.4	Potassium	4	-	<.4	1.2
Nitrite Nitrogen	3	-	<.01	.01	Calcium	5	25	21	27
Total Phosphate	5	-	<.04	.1	Magnesium	5	9	6	13
Total Soluble Phosphate	5	-	<.04	.05	Sulfate	5	16	8	20
Total Solids	4	130	120	130	Total Hardness	5	98	94	100
Suspended Solids	5	5	1	9	Conductivity	5	190	170	200
Vol. Susp. Solids	5	1	0	2	Total Coliform	5	1	<1	2
Chlorides	5	6	5	8	Fecal Coliform	2	-	<2	<2
Phenols	5	-	<2	4	Fecal Streptococcus	2	-	<2	<2
pH	5	7.8	7.3	8.2	Total Plate Count 20°C	4	63	16	100
Chemical Oxygen Demand	1	7	-	-	Total Plate Count 35°C	5	11	2	380

NS = number os samples

TABLE 47. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Port Sanilac - H113

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.8	10.3	13.4	Temperature (°C)	5	9.5	2.0	15.5
Biochemical Oxygen Demand	3	1	1	1	Percent Saturation	5	102	96	107
Ammonia Nitrogen	4	.14	.08	.23	Total Iron	5	-	<100	400
Organic Nitrogen	4	.13	.09	.21	Sodium	4	4	4	4
Nitrate Nitrogen	5	.2	<.1	.3	Potassium	4	-	<.4	1.4
Nitrite Nitrogen	3	-	<.01	.01	Calcium	5	28	23	30
Total Phosphate	5	-	<.04	.06	Magnesium	5	9	6	13
Total Soluble Phosphate	5	-	<.04	.06	Sulfate	3	14	6	20
Total Solids	5	120	120	140	Total Hardness	5	97	90	100
Suspended Solids	4	3	0	5	Conductivity	5	190	170	210
Vol. Susp. Solids	4	3	0	5	Total Coliform	5	1	<1	<2
Chlorides	5	6	5	8	Fecal Coliform	2	-	<2	<2
Phenols	5	-	<2	5	Fecal Streptococcus	2	-	<2	<2
pH	5	7.9	7.7	8.3	Total Plate Count 20°C	4	69	27	92
Chemical Oxygen Demand	1	7	-	-	Total Plate Count 35°C	5	17	5	270

NS = number os samples

TABLE 47. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Port Sanilac - H114

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.8	10.4	13.6	Temperature (°C)	5	9.0	1.0	14.0
Biochemical Oxygen Demand	3	-	<1	1	Percent Saturation	5	100	95	104
Ammonia Nitrogen	4	.13	<.05	.29	Total Iron	5	-	<100	300
Organic Nitrogen	4	.16	.12	.18	Sodium	3	4	4	5
Nitrate Nitrogen	5	.2	.1	.3	Potassium	3	1.3	1.1	1.5
Nitrite Nitrogen	3	-	<.01	.01	Calcium	5	26	23	29
Total Phosphate	5	-	<.04	.05	Magnesium	5	8	6	13
Total Soluble Phosphate	5	-	<.04	<.04	Sulfate	5	13	7	19
Total Solids	5	120	110	140	Total Hardness	5	98	88	110
Suspended Solids	5	4	1	9	Conductivity	5	190	170	200
Vol. Susp. Solids	5	4	0	6	Total Coliform	5	1	<1	2
Chlorides	5	6	5	8	Fecal Coliform	2	-	<2	<2
Phenols	5	-	<2	3*	Fecal Streptococcus	2	-	<2	<2
pH	5	7.7	7.0	8.2	Total Plate Count 20°C	4	23	4	31
Chemical Oxygen Demand	1	6	-	-	Total Plate Count 35°C	5	10	2	70

*value of 46 not used in computing the data.

NS = number os samples

TABLE 47. WATER QUALITY DATA
Lake Huron Basin - Nearshore - 1965
Port Sanilac - H115

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved Oxygen	5	11.6	10.3	13.0	Temperature (°C)	5	9.0	2.5	14.0
Biochemical Oxygen Demand	3	-	<1	1	Percent Saturation	5	100	95	104
Ammonia Nitrogen	4	.14	.06	.20	Total Iron	5	-	<100	500
Organic Nitrogen	4	.13	.07	.23	Sodium	4	3	1	4
Nitrate Nitrogen	5	.3	.1	.5	Potassium	4	-	$<.4$	1.2
Nitrite Nitrogen	3	-	$<.01$	.01	Calcium	5	26	23	30
Total Phosphate	5	-	$<.04$	.2	Magnesium	5	8	6	13
Total Soluble Phosphate	5	-	$<.04$	.07	Sulfate	5	16	9	20
Total Solids	5	120	110	130	Total Hardness	5	100	96	110
Suspended Solids	5	4	1	7	Conductivity	5	190	170	200
Vol. Susp. Solids	5	2	0	4	Total Coliform	5	<1	<1	3
Chlorides	5	6	5	8	Fecal Coliform	2	-	<2	<2
Phenols	5	-	<2	8	Fecal Streptococcus	2	-	<2	<2
pH	5	7.8	7.4	8.2	Total Plate Count 20°C	4	47	13	75
Chemical Oxygen Demand	1	8	-	-	Total Plate Count 35°C	5	21	8	190

NS = number os samples

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
North Channel Range

Parameters	H808				H809				H810			
	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	3	<0.05	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	3	0.3	0.2	0.5	2	-	0.2	0.4	2	-	0.4	0.4
BETA	3	4.5	2.8	5.8	2	-	4.7	5.4	2	-	3.0	3.6
Error	3	1.4	1.2	1.5	2	-	1.4	1.4	2	-	1.2	1.3
Suspended												
ALPHA	3	<0.05	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	3	0.1	0.1	0.2	2	-	0.1	0.1	2	-	0.1	0.2
BETA	3	0.22	<0.05	0.50	2	-	<0.05	0.80	2	-	<0.05	0.40
Error	3	0.7	0.7	0.8	2	-	0.7	0.8	2	-	0.7	0.7

TABLE 48 WATER QUALITY DATA
Lake Huron Basin Deepwater Radiochemistry - 1965
North Channel Range (cont.)

	H808				H809				H810			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	2	-	22.0	26.0	2	-	20.0	21.0	2	-	1.8	7.9
Error	2	-	7.8	12.0	2	-	7.8	8.8	2	-	0.7	5.3
BETA	2	-	32.0	39.0	2	-	36.0	40.0	2	-	18.0	28.0
Error	2	-	5.4	18.0	2	-	7.2	8.3	2	-	4.1	5.9
Plankton												
ALPHA	1	7.0	-	-	1	6.3	-	-	1	<0.05	-	-
Error	1	6.1	-	-	1	6.1	-	-	1	4.0	-	-
BETA	1	67.0	-	-	1	44.0	-	-	1	33.0	-	-
Error	1	17.0	-	-	1	16.0	-	-	1	14.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
North Channel Range (cont.)
H812

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved					Sediment				
ALPHA	4	<0.05	<0.05	<0.05	ALPHA	2	-	16.0	26.0
Error	4	0.4	0.3	0.5	Error	2	-	8.0	8.9
BETA	4	4.1	3.8	4.5	BETA	2	-	27.0	41.0
Error	4	1.4	1.3	1.4	Error	2	-	6.4	11.0
Suspended					Plankton				
ALPHA	4	0.09	<0.05	0.20	ALPHA	1	3.7	-	-
Error	4	0.2	0.2	0.3	Error	1	4.1	-	-
BETA	4	0.63	<0.05	0.70	BETA	1	42.0	-	-
Error	4	0.8	0.7	0.8	Error	1	7.8	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Straits of Mackinac - H814

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved					Sediment				
ALPHA	7	0.11	<0.05	0.50	ALPHA	2	-	14.0	14.0
Error	7	0.3	0.2	0.6	Error	2	-	6.6	7.4
BETA	7	3.6	2.8	4.3	BETA	2	-	39.0	54.0
Error	7	1.4	1.3	1.5	Error	2	-	6.4	11.0
Suspended					Plankton				
ALPHA	7	<0.05	<0.05	<0.05	ALPHA	1	5.3	-	-
Error	7	0.2	0.1	0.2	Error	1	4.7	-	-
BETA	7	0.21	<0.05	0.80	BETA	1	26.0	-	-
Error	7	0.8	0.7	0.8	Error	1	7.3	-	-

TABLE 48 WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Georgian Bay Range

	H382				H384				H386			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	6	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05
Error	6	0.5	0.3	0.8	6	0.5	0.3	0.7	9	0.5	0.2	0.7
BETA	6	4.4	3.6	5.3	6	4.4	3.1	5.7	9	4.8	3.8	5.6
Error	6	1.4	1.3	1.5	6	1.4	1.3	1.5	9	1.4	1.3	1.5
Suspended												
ALPHA	6	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05
Error	6	0.2	0.2	0.2	6	0.2	0.1	0.2	9	0.2	0.1	0.3
BETA	6	0.40	<0.05	0.60	6	0.41	<0.05	0.90	9	0.44	<0.05	0.90
Error	6	0.7	0.4	0.8	6	0.8	0.7	0.8	9	0.7	0.7	0.8

TABLE 48 WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Georgian Bay Range (cont.)

	H382				H384				H386			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	0	-	-	-	2	-	∠0.05	12.0	2	-	14.0	16.0
Error	0	-	-	-	2	-	4.8	6.8	2	-	6.6	8.1
BETA	0	-	-	-	2	-	17.0	60.0	2	-	32.0	40.0
Error	0	-	-	-	2	-	8.8	13.0	2	-	6.8	12.0
Plankton												
ALPHA	1	8.6	-	-	1	5.0	-	-	1	9.2	-	-
Error	1	7.5	-	-	1	4.8	-	-	1	5.6	-	-
BETA	1	70.0	-	-	1	83.0	-	-	1	21.0	-	-
Error	1	21.0	-	-	1	14.0	-	-	1	4.4	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Georgian Bay Range (cont.)

H388

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved					Sediment				
ALPHA	8	<0.05	<0.05	<0.05	ALPHA	1	4.9	-	-
Error	8	0.5	0.4	0.7	Error	1	5.3	-	-
BETA	8	4.7	3.3	5.3	BETA	1	41.0	-	-
Error	8	1.4	1.3	1.5	Error	1	14.0	-	-
Suspended					Plankton				
ALPHA	8	<0.05	<0.05	<0.05	ALPHA	1	6.8	-	-
Error	8	0.2	0.1	0.2	Error	1	5.1	-	-
BETA	8	0.23	<0.05	0.80	BETA	1	52.0	-	-
Error	8	0.7	0.6	0.8	Error	1	11.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Cheboygan Range

Parameters	H530 NS	H530 Avg.	H530 Low	H530 High	H532 NS	H532 Avg.	H532 Low	H532 High	H534 NS	H534 Avg.	H534 Low	H534 High
Dissolved												
ALPHA	4	<0.05	<0.05	<0.05	7	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	4	0.5	0.3	0.6	7	0.4	0.2	0.7	4	0.4	0.1	0.5
BETA	4	3.5	2.6	4.3	7	3.6	2.7	4.3	4	3.4	2.6	4.0
Error	4	1.4	1.3	1.5	7	1.3	1.3	1.5	4	1.3	1.2	1.3
Suspended												
ALPHA	4	<0.05	<0.05	<0.05	7	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	4	0.1	0.1	0.2	7	0.2	0.1	0.2	4	0.2	0.1	0.2
BETA	4	0.41	<0.05	1.50	7	0.46	<0.05	1.50	4	0.4	0.1	0.6
Error	4	0.8	0.7	0.8	7	0.7	0.7	0.8	4	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Cheboygan Range (cont.)

	H530				H532				H534			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	0	-	-	-	1	8.2	-	-	2	-	15.0	18.0
Error	0	-	-	-	1	5.8	-	-	2	-	7.0	8.4
BETA	0	-	-	-	1	38.0	-	-	2	-	32.0	53.0
Error	0	-	-	-	1	7.1	-	-	2	-	12.0	12.0
Plankton												
ALPHA	1	<0.05	-	-	1	<0.05	-	-	0	-	-	-
Error	1	2.6	-	-	1	3.2	-	-	0	-	-	-
BETA	1	25.0	-	-	1	27.0	-	-	0	-	-	-
Error	1	13.0	-	-	1	7.7	-	-	0	-	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Cheboygan Range (cont.)

H536

Parameters	NS	Avg.	Low	High	Parameters	NS	Avg.	Low	High
Dissolved					Sediment				
ALPHA	4	<0.05	<0.05	<0.05	ALPHA	1	11.0	-	-
Error	4	0.4	0.3	0.6	Error	1	7.2	-	-
BETA	4	4.1	2.8	4.7	BETA	1	100	-	-
Error	4	1.4	1.3	1.4	Error	1	18.0	-	-
Suspended					Plankton				
ALPHA	4	<0.05	<0.05	<0.05	ALPHA	1	4.2	-	-
Error	4	0.2	0.1	0.2	Error	1	5.2	-	-
BETA	4	0.39	<0.05	0.70	BETA	1	19.0	-	-
Error	4	0.8	0.8	0.8	Error	1	13.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry 1965
Presque Isle Range (cont.)

	H420				H422				H424			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	6	<0.05	<0.05	<0.05	5	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05
Error	6	0.5	0.4	0.6	5	0.4	0.3	0.5	6	0.5	0.3	0.7
BETA	6	3.7	3.0	3.9	5	3.9	3.4	4.5	6	3.3	2.7	3.9
Error	6	1.3	1.3	1.4	5	1.3	1.3	1.4	6	1.4	1.3	1.4
Suspended												
ALPHA	6	<0.05	<0.05	<0.05	5	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05
Error	6	0.2	0.1	0.2	5	0.2	0.1	0.2	6	0.2	0.2	0.3
BETA	6	0.41	<0.05	0.80	5	0.43	<0.05	0.80	6	0.08	<0.05	0.20
Error	6	0.8	0.7	0.8	5	0.7	0.7	0.8	6	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Presque Isle Range (cont.)

	H420				H422				H424			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	0	-	-	-	2	-	9.9	10.0	2	-	21.0	29.0
Error	0	-	-	-	2	-	5.7	6.6	2	-	8.2	11.0
BETA	0	-	-	-	2	-	49.0	51.0	2	-	49.0	88.0
Error	0	-	-	-	2	-	8.6	12.0	2	-	12.0	19.0
Plankton												
ALPHA	0	-	-	-	0	-	-	-	1	4.6	-	-
Error	0	-	-	-	0	-	-	-	1	4.5	-	-
BETA	0	-	-	-	0	-	-	-	1	44.5	-	-
Error	0	-	-	-	0	-	-	-	1	10.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Presque Isle Range (cont.)

Parameters	NS	H426 Avg.	H426 Low	H426 High	NS	H428 Avg.	H428 Low	H428 High	NS	H432 Avg.	H432 Low	H432 High
Dissolved												
ALPHA	7	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05	2	-	<0.05	<0.05
Error	7	0.6	0.3	0.8	4	0.4	0.3	0.4	2	-	0.3	0.3
BETA	7	3.6	3.0	4.0	4	4.5	3.1	5.4	2	-	3.9	4.0
Error	7	1.5	1.4	1.5	4	1.4	1.3	1.4	2	-	1.3	1.3
Suspended												
ALPHA	7	<0.05	<0.05	<0.05	4	0.09	<0.05	0.20	2	-	<0.05	<0.05
Error	7	0.2	0.1	0.2	4	0.2	0.1	0.3	2	-	0.1	0.2
BETA	7	0.20	<0.05	0.50	4	0.29	<0.05	0.50	2	-	0.5	0.6
Error	7	0.8	0.7	0.8	4	0.7	0.7	0.8	2	-	0.8	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Presque Isle Range (cont.)

Parameters	H426				H428				H432			
	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	2	-	12.0	25.0	2	-	7.3	18.0	1	5.4	-	-
Error	2	-	6.8	8.3	2	-	5.1	8.1	1	4.8	-	-
BETA	2	-	29.0	52.0	2	-	43.0	47.0	1	26.0	-	-
Error	2	-	6.2	6.9	2	-	6.4	7.3	1	6.7	-	-
Plankton												
ALPHA	1	6.1	-	-	1	< 0.05	-	-	1	< 0.05	-	-
Error	1	4.9	-	-	1	3.2	-	-	1	4.2	-	-
BETA	1	62.0	-	-	1	55.0	-	-	1	47.0	-	-
Error	1	10.0	-	-	1	7.0	-	-	1	14.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Alpena Range

	H370*				H372				H374			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	6	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05	10	<0.05	<0.05	<0.05
Error	6	0.5	0.2	0.6	6	0.5	0.4	0.6	10	0.5	0.2	0.7
BETA	6	3.6	1.6	5.4	6	4.3	3.5	4.6	10	3.8	2.4	4.8
Error	6	1.4	1.2	1.5	6	1.4	1.3	1.5	10	1.4	1.3	1.5
Suspended												
ALPHA	6	<0.05	<0.05	<0.05	6	<0.05	<0.05	<0.05	10	<0.05	<0.05	<0.05
Error	6	0.2	0.1	0.3	6	0.1	0.1	0.2	10	0.1	0.1	0.2
BETA	6	0.43	<0.05	1.50	6	0.25	<0.05	0.70	10	0.13	<0.05	0.70
Error	6	0.8	0.7	0.9	6	0.7	0.7	0.8	10	0.7	0.6	0.8

* dissolved and suspended data are 6 composites of 8 samples.

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Alpena Range (cont.)

	H370				H372				H374			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	2	-	<0.05	2.70	0	-	-	-	2	-	24.0	36.0
Error	2	-	3.7	3.8	0	-	-	-	2	-	11.0	11.0
BETA	2	-	<0.05	4.90	0	-	-	-	2	-	50.0	98.0
Error	2	-	4.4	6.1	0	-	-	-	2	-	13.0	20.0
Plankton												
ALPHA	1	< 0.05	-	-	1	7.9	-	-	1	0.2	-	-
Error	1	3.4	-	-	1	5.5	-	-	1	0.2	-	-
BETA	1	31.0	-	-	1	83.0	-	-	1	18.0	-	-
Error	1	7.8	-	-	1	14.0	-	-	1	2.7	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Alpena Range (cont.)

Parameters	H376 NS	H376 Avg.	H376 Low	H376 High	H378 NS	H378 Avg.	H378 Low	H378 High	H380 NS	H380 Avg.	H380 Low	H380 High
Dissolved												
ALPHA	10	<0.05	<0.05	<0.05	8	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05
Error	10	0.5	0.2	0.7	8	0.5	0.3	0.6	9	5.0	0.1	0.9
BETA	10	3.5	3.0	4.1	8	3.7	2.7	5.2	9	3.8	2.7	4.9
Error	10	1.4	1.3	1.4	8	1.4	1.3	1.6	9	1.3	1.3	1.4
Suspended												
ALPHA	10	<0.05	<0.05	<0.05	8	<0.05	<0.05	<0.05	9	0.09	<0.05	0.30
Error	10	0.2	0.1	0.3	8	0.1	0.1	0.2	9	0.2	0.1	0.3
BETA	10	0.24	<0.05	0.70	8	0.19	<0.05	0.50	9	0.53	<0.05	1.4
Error	10	0.8	0.7	0.8	8	0.8	0.7	0.9	9	0.7	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Alpena Range (cont.)

Parameters	H376 NS	H376 Avg.	H376 Low	H376 High	H378 NS	H378 Avg.	H378 Low	H378 High	H380 NS	H380 Avg.	H380 Low	H380 High
Sediment												
ALPHA	1	15.0	-	-	2	-	5.9	24.0	2	-	19.0	22.0
Error	1	7.9	-	-	2	-	5.3	8.2	2	-	7.8	9.2
BETA	1	36.0	-	-	2	-	30.0	78.0	2	-	41.0	51.0
Error	1	13.0	-	-	2	-	8.1	12.0	2	-	9.4	10.0
Plankton												
ALPHA	1	0.4	-	-	1	6.6	-	-	1	8.2	-	-
Error	1	0.2	-	-	1	4.9	-	-	1	5.2	-	-
BETA	1	14.0	-	-	1	37.0	-	-	1	37.0	-	-
Error	1	2.1	-	-	1	7.5	-	-	1	5.2	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Oscoda Range

Parameters	H320				H322				H324			
	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	8	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05
Error	8	0.5	0.4	0.7	9	0.5	0.3	0.8	9	0.5	0.3	0.6
BETA	8	3.7	2.7	4.6	9	3.3	2.1	4.7	9	3.6	3.0	4.3
Error	8	1.4	1.3	1.4	9	1.3	1.2	1.4	9	1.3	1.3	1.4
Suspended												
ALPHA	8	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05	9	<0.05	<0.05	<0.05
Error	8	0.3	0.2	0.3	9	0.2	0.2	0.3	9	0.2	0.1	0.3
BETA	8	0.21	<0.05	0.80	9	0.34	<0.05	0.80	9	0.32	<0.05	0.80
Error	8	0.8	0.7	0.8	9	0.8	0.7	0.8	9	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radiochemistry - 1965
Oscoda Range (cont.)

Parameters	H320 NS	H320 Avg.	H320 Low	H320 High	H322 NS	H322 Avg.	H322 Low	H322 High	H324 NS	H324 Avg.	H324 Low	H324 High
Sediment												
ALPHA	2	-	4.4	9.0	2	-	8.7	15.0	2	-	10.0	13.0
Error	2	-	4.4	5.4	2	-	5.5	7.8	2	-	5.8	7.2
BETA	2	-	9.0	21.0	2	-	27.0	31.0	2	-	30.0	33.0
Error	2	-	4.6	5.0	2	-	7.1	9.0	2	-	5.5	8.3

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Oscoda Range (cont.)

	H326				H328				H330			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	10	<0.05	<0.05	<0.05	8	<0.05	<0.05	<0.05	5	<0.05	<0.05	<0.05
Error	10	0.4	0.3	0.6	8	0.5	0.2	0.8	5	0.5	0.3	0.7
BETA	10	3.7	2.8	4.5	8	3.8	2.6	4.8	5	3.9	3.1	4.7
Error	10	1.3	1.3	1.4	8	1.4	1.3	1.4	5	1.4	1.3	1.4
Suspended												
ALPHA	10	<0.05	<0.05	<0.05	8	0.07	<0.05	0.20	5	<0.05	<0.05	<0.05
Error	10	0.2	0.1	0.3	8	0.2	0.1	0.4	5	0.1	0.1	0.2
BETA	10	0.47	<0.05	1.40	8	0.56	<0.05	2.10	5	0.30	<0.05	0.60
Error	10	0.8	0.7	0.8	8	0.8	0.7	0.9	5	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Oscoda Range (cont.)

	H326				H328				H330			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	2	-	5.7	8.5	2	-	7.9	18.0	0	-	-	-
Error	2	-	5.1	6.0	2	-	5.2	8.2	0	-	-	-
BETA	2	-	31.0	33.0	2	-	19.0	19.0	0	-	-	-
Error	2	-	9.5	12.0	2	-	3.7	5.7	0	-	-	-
Plankton												
ALPHA	1	7.6	-	-	1	5.1	-	-	1	6.0	-	-
Error	1	5.1	-	-	1	4.5	-	-	1	4.9	-	-
BETA	1	31.0	-	-	1	30.0	-	-	1	54.0	-	-
Error	1	4.8	-	-	1	3.8	-	-	1	9.6	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Harbor Beach Range

	H130				H132				H133			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	9	<0.05	<0.05	<0.05	8	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	9	0.4	0.3	0.6	8	0.5	0.4	0.6	4	0.6	0.4	0.8
BETA	9	3.2	2.3	4.4	8	3.3	2.4	4.6	4	3.0	1.9	4.1
Error	9	1.4	1.3	1.5	8	1.4	1.2	1.5	4	1.4	1.3	1.5
Suspended												
ALPHA	9	<0.05	<0.05	<0.05	8	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	9	0.2	0.1	0.2	8	0.2	0.1	0.2	4	0.2	0.1	0.2
BETA	9	0.17	<0.05	0.60	8	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	9	0.8	0.7	0.8	8	0.7	0.7	0.8	4	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Harbor Beach Range (cont.)

	H130				H132				H133			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment												
ALPHA	1	12.0	-	-	1	13.0	-	-	0	-	-	-
Error	1	6.7	-	-	1	6.9	-	-	0	-	-	-
BETA	1	30.0	-	-	1	13.0	-	-	0	-	-	-
Error	1	7.2	-	-	1	3.8	-	-	0	-	-	-
Plankton												
ALPHA	1	6.0	-	-	1	5.0	-	-	0	-	-	-
Error	1	4.5	-	-	1	4.4	-	-	0	-	-	-
BETA	1	18.0	-	-	1	41.0	-	-	0	-	-	-
Error	1	3.8	-	-	1	6.4	-	-	0	-	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Harbor Beach Range (cont.)

Parameters	H134 NS	H134 Avg.	H134 Low	H134 High	H136 NS	H136 Avg.	H136 Low	H136 High
Dissolved								
ALPHA	8	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05
Error	8	0.5	0.3	0.7	4	0.5	0.4	0.6
BETA	8	2.8	2.0	3.6	4	3.3	2.3	4.9
Error	8	1.4	1.3	1.4	4	1.4	1.3	1.5
Suspended								
ALPHA	8	<0.05	<0.05	<0.05	4	0.09	<0.05	0.20
Error	8	0.2	0.1	0.3	4	0.2	0.2	0.3
BETA	8	0.06	<0.05	0.10	4	<0.05	<0.05	<0.05
Error	8	0.8	0.7	0.8	4	0.8	0.7	0.8

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Harbor Beach Range (cont.)

	H134				H136			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High
Sediment								
ALPHA	2	-	10.0	13.0	0	-	-	-
Error	2	-	6.1	6.4	0	-	-	-
BETA	2	-	18.0	28.0	0	-	-	-
Error	2	-	4.8	5.6	0	-	-	-
Plankton								
ALPHA	1	4.4	-	-	1	$\angle$ 0.05	-	-
Error	1	4.3	-	-	1	4.1	-	-
BETA	1	40.0	-	-	1	36.0	-	-
Error	1	6.5	-	-	1	12.0	-	-

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Port Huron Range

Parameters	H100 NS	H100 Avg.	H100 Low	H100 High	H102 NS	H102 Avg.	H102 Low	H102 High	H104 NS	H104 Avg.	H104 Low	H104 High
Dissolved												
ALPHA	2	-	<0.05	<0.05	6	<0.05	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.6	0.6	6	0.5	0.3	0.7	2	-	0.5	0.7
BETA	2	-	4.1	4.4	6	3.4	1.9	4.6	2	-	2.6	5.0
Error	2	-	1.5	1.5	6	1.4	1.3	1.5	2	-	1.2	1.6
Suspended												
ALPHA	2	-	<0.05	<0.05	6	0.09	<0.05	0.30	2	-	<0.05	<0.05
Error	2	-	0.2	0.3	6	0.2	0.1	0.4	2	-	0.2	0.3
BETA	2	-	0.3	1.3	6	0.18	<0.05	0.50	2	-	0.4	0.5
Error	2	-	0.9	1.0	6	0.8	0.7	1.0	2	-	0.9	0.9

Note: H100 and H104 - data from 2 composites of 5 samples.
H102 - data from 6 composites of 9 samples.

TABLE 48. WATER QUALITY DATA
Lake Huron Basin - Deepwater Radioactivity - 1965
Port Huron Range (cont.)

Parameters	H106 NS	H106 Avg.	H106 Low	H106 High	H108 NS	H108 Avg.	H108 Low	H108 High	H110 NS	H110 Avg.	H110 Low	H110 High
Dissolved												
ALPHA	6	<0.05	<0.05	<0.05	3	<0.05	<0.05	<0.05	1	<0.05	-	-
Error	6	0.5	0.3	0.7	3	0.5	0.4	0.7	1	0.7	-	-
BETA	6	2.9	1.4	3.8	3	3.0	2.5	3.3	1	3.5	-	-
Error	6	1.4	1.3	1.5	3	1.4	1.4	1.5	1	1.5	-	-
Suspended												
ALPHA	6	0.08	<0.05	0.20	3	0.25	<0.05	0.50	1	<0.05	-	-
Error	6	0.2	0.1	0.3	3	0.3	0.2	0.4	1	0.3	-	-
BETA	6	0.11	<0.05	0.40	3	0.20	<0.05	0.50	1	1.2	-	-
Error	6	0.8	0.7	0.9	3	0.9	0.8	0.9	1	0.9	-	-

Note: H106 - data from 6 composites of 8 samples
H108 - data from 3 composites of 5 samples
H110 - data from 1 composite of 3 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Straits of Mackinac

	H500				H502				H504			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	2	-	<0.05	<0.05	3	<0.05	<0.05	<0.05	2	-	<0.05	0.70
Error	2	-	0.4	0.7	3	0.6	0.4	0.8	2	-	0.9	2.0
BETA	2	-	2.5	5.0	3	5.0	3.4	7.1	2	-	5.1	15.0
Error	2	-	1.4	1.4	3	1.6	1.4	1.9	2	-	1.5	5.8
Suspended												
ALPHA	2	-	<0.05	0.20	3	<0.05	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.2	0.3	3	0.2	0.1	0.2	2	-	0.3	1.3
BETA	2	-	<0.05	2.90	3	0.50	<0.50	1.40	2	-	0.2	1.5
Error	2	-	0.8	1.1	3	0.8	0.8	0.9	2	-	0.8	4.3

Note: H500 and 504 - data from 2 composites of 5 samples
H502 - data from 3 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Straits of Mackinac (cont.)

	H506				H508				H510			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.6	0.7	2	-	0.5	0.5	2	-	0.6	0.8
BETA	2	-	4.5	5.9	2	-	3.1	4.2	2	-	3.1	4.4
Error	2	-	1.5	1.5	2	-	1.4	1.4	2	-	1.3	1.4
Suspended												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.2	0.2	2	-	0.2	0.3	2	-	0.2	0.3
BETA	2	-	2.2	2.4	2	-	<0.05	0.80	2	-	0.5	0.8
Error	2	-	1.0	1.1	2	-	0.8	0.8	2	-	0.8	0.9

Note: H506 - data from 2 composites of 4 samples
H508 and H510 - data from 2 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Straits of Mackinac (cont.)

Parameters	H512 NS	H512 Avg.	H512 Low	H512 High	H514 NS	H514 Avg.	H514 Low	H514 High	H516 NS	H516 Avg.	H516 Low	H516 High
Dissolved												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.3	0.6	2	-	0.7	0.8	2	-	0.7	0.8
BETA	2	-	3.2	6.8	2	-	2.2	3.9	2	-	3.2	5.8
Error	2	-	1.5	1.6	2	-	1.4	1.4	2	-	1.3	1.5
Suspended												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	0.20	2	-	<0.05	<0.05
Error	2	-	0.1	0.3	2	-	0.2	0.3	2	-	0.2	0.2
BETA	2	-	<0.05	2.20	2	-	<0.05	1.20	2	-	<0.05	0.90
Error	2	-	0.8	1.0	2	-	0.8	0.9	2	-	0.8	0.9

Note: above data from 2 composites of 5 samples at each station

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Straits of Mackinac (cont.)

H518

Parameters	NS	Avg.	Low	High
Dissolved				
ALPHA	2	-	<0.05	<0.05
Error	2	-	0.5	0.9
BETA	2	-	3.3	3.9
Error	2	-	1.4	1.6
Suspended				
ALPHA	2	-	<0.05	<0.05
Error	2	-	0.2	0.3
BETA	2	-	<0.05	0.90
Error	2	-	0.8	0.9

Note: data from 2 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Harbor Beach Range

Parameters	H121				H122				H123			
	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.5	0.8	2	-	0.7	0.7	2	-	0.6	0.7
BETA	2	-	4.8	5.6	2	-	4.1	4.6	2	-	2.1	6.5
Error	2	-	1.6	1.7	2	-	1.7	1.7	2	-	1.4	1.8
Suspended												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	0.20	2	-	<0.05	<0.05
Error	2	-	0.3	0.3	2	-	0.3	0.3	2	-	0.1	0.2
BETA	2	-	0.6	0.8	2	-	<0.05	2.20	2	-	<0.05	0.80
Error	2	-	0.9	1.1	2	-	0.9	1.2	2	-	0.8	1.1

Note: H121 - data from 2 composites of 4 samples
H122, H123 - data from 2 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Harbor Beach Range (cont.)

Parameters	H124				H125				H126			
	NS	Avg.	Low	High	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.3	0.4	2	-	0.7	0.7	2	-	0.4	0.7
BETA	2	-	1.6	2.9	2	-	4.3	6.2	2	-	2.9	4.5
Error	2	-	1.4	1.4	2	-	1.5	1.8	2	-	1.5	1.5
Suspended												
ALPHA	2	-	<0.05	<0.05	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	2	-	0.2	0.3	2	-	0.2	0.2	2	-	0.3	0.3
BETA	2	-	<0.05	0.40	2	-	<0.05	0.70	2	-	<0.05	1.20
Error	2	-	0.9	1.0	2	-	0.9	1.1	2	-	0.9	1.0

Note: H124 and H126- data from 2 composites of 5 samples
H125 - data from 2 composites of 4 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Harbor Beach Range (cont.)

	H127			
Parameters	NS	Avg.	Low	High
Dissolved				
ALPHA	2	-	<0.05	<0.05
Error	2	-	0.6	0.9
BETA	2	-	2.7	4.0
Error	2	-	1.5	1.5
Suspended				
ALPHA	2	-	<0.05	<0.05
Error	2	-	0.2	0.3
BETA	2	-	<0.05	0.70
Error	2	-	0.9	1.0

Note: H127 - data from 2 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Port Sanilac Range

Parameters	H111 NS	H111 Avg.	H111 Low	H111 High	H112 NS	H112 Avg.	H112 Low	H112 High	H113 NS	H113 Avg.	H113 Low	H113 High
Dissolved												
ALPHA	1	<0.05	-	-	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	1	0.8	-	-	2	-	0.5	0.6	2	-	0.5	0.8
BETA	1	4.5	-	-	2	-	4.2	4.4	2	-	2.9	5.0
Error	1	1.6	-	-	2	-	1.4	1.4	2	-	1.4	1.7
Suspended												
ALPHA	1	<0.05	-	-	2	-	<0.05	<0.05	2	-	<0.05	<0.05
Error	1	0.3	-	-	2	-	0.3	0.3	2	-	0.3	0.3
BETA	1	1.6	-	-	2	-	0.5	3.2	2	-	0.5	1.1
Error	1	1.0	-	-	2	-	0.8	1.1	2	-	0.9	1.1

Note: H111 - data from one composite of 3 samples
H112 and H113 - data from 2 composites of 5 samples

TABLE 49. WATER QUALITY DATA
Lake Huron Basin - Nearshore Radioactivity - 1965
Port Sanilac Range (cont.)

	H114				H115			
Parameters	NS	Avg.	Low	High	NS	Avg.	Low	High
Dissolved								
ALPHA	3	<0.05	<0.05	<0.05	3	<0.05	<0.05	<0.05
Error	3	0.6	0.5	0.8	3	1.2	0.5	2.1
BETA	3	3.8	2.3	4.8	3	4.6	1.8	8.0
Error	3	1.5	1.5	1.5	3	2.0	1.4	3.1
Suspended								
ALPHA	3	<0.05	<0.05	<0.05	3	<0.05	<0.05	<0.05
Error	3	0.3	0.3	0.4	3	0.4	0.3	0.7
BETA	3	1.15	<0.05	2.10	3	1.62	<0.05	3.00
Error	3	1.0	1.0	1.1	3	1.3	0.9	2.0

Note: H114 and H115 - data from 3 composites of 5 samples

BIOLOGICAL RESULTS

Introduction

A study of the biological conditions in Lake Huron was initiated in 1965 by the FWPCA. Major surveys were made in June and August of the deepwater areas of Lake Huron, and three surveys of the nearshore areas and Saginaw Bay were made in the summer of 1965. A November deepwater survey of southern Lake Huron sampled the phytoplankton of that area. In all, 76 different stations were sampled for biology data during the 1965 studies. The following samples were collected in the biological study of Lake Huron: benthic macroinvertebrate samples - 157; phytoplankton population counts - 214; and chlorophyll concentration analyses - 94. Field observations on the water transparencies and bottom characteristics were also routinely noted.

The purpose of this study was to obtain information on general biological conditions of the lake; locate areas of biological degradation; and supplement bacteriological, physical, and chemical data collected during the same period of study.

For comparative and descriptive purposes, Lake Huron was divided into six areas: North Channel, Georgian Bay, Northern Lake Huron, Saginaw Bay, the mouth of Saginaw Bay, and southern Lake Huron. The range of stations that extended from Tawas Bay to Port Austin was considered the mouth of Saginaw Bay. The stations located in the main body of Lake Huron, north of and including the stations in the AuSable range, were considered as northern

Lake Huron. Stations below this range in Lake Huron were listed as southern Lake Huron.

Benthic Macroinvertebrates

Three zones of biological activity characterize the floor of lakes. These include the littoral zone from the edge of the water to the limit of rooted aquatic vegetation; the sub-littoral zone from the littoral zone to the upper boundary of the hypolimnion; the profundal zone all of the lake bottom up to the hypolimnion. The region of the lake where there is a rapid change in temperature per unit of depth is known as the thermocline.

Factors such as the characteristics of the substratum, the quality of the water, and certain physical features such as depth, light, currents, wave action, temperature, and morphometry of the basin determine the kinds and numbers of benthic fauna. The littoral zone generally contains a variety of species, whereas the profundal zone supports only a few species. The number of species and individuals decreases with increasing depth. The benthic fauna of the profundal zone in the Great Lakes is usually composed of sludgeworms (Oligochaeta), fingernail clams (Sphaeriidae), scuds (Amphipoda), bloodworms (Tendipedidae), and opposum shrimp (*Mysis relicta*).

Benthos preferring organic sediments are known as pollution-tolerant; those which require an unpolluted habitat are considered pollution-sensitive. Pollution-tolerant benthic fauna include aquatic sow bugs(Isopoda), lung-breathing snails (Pulmonata), leeches (Hirudinea), sludgeworms, fingernail clams and bloodworms.

Pollution-sensitive benthos include scuds, opposum shrimp, gill-breathing snails (Prosobranchia), pearl button clams (Unionidae), mayfly larvae (Ephemeroptera) caddisfly larvae (Trichoptera), and aquatic beetles (Coleptera).

Phytoplankton

Phytoplankton are suspended or slightly motile microscopic plants existing near natural buoyancy. Under suitable conditions of water movement, temperature, and light, phytoplankton populations increase, with an increase in nutrients. For cell growth, algae need phosphorus, nitrogen, potassium, iron, calcium, and organic substances such as vitamin B12 and thiamine. Algal growth is stimulated as phosphorus increases, however, nitrogen and other nutrients must also be present if algal production is to continue. Phosphorus can be recycled within a lake for several years without being replenished, enabling crops of algae to succeed themselves.

The kinds of algae that inhabit a body of water are important indices of the general water quality. In nutrient-poor lakes such as Lakes Michigan and Superior, the diatoms - Tabellaria, Asterionella, Synedra, and Fragilaria - are predominant. In contrast, other diatoms, blue-greens and euglenoids, prefer nutrient-enriched waters of eutrophic lakes. Anacystis, Oscillatoria, Stephanodiscus, Cyclotella, and Melosira are often the dominant genera. Plankton algae rarely exceed 500 organisms/ml in oligotrophic waters. Standing crops in excess of 1,000 organisms/ml are considered indicative of enrichment.

The attached algae Cladophora is also encouraged by nutrients, especially phosphates. Where sufficient light and turbulence are available, it can cover all suitable substrates. The long filaments of Cladophora often break off and litter beaches, clog water intakes, and foul fishing nets. Dense growths are not common to the oligotrophic Great Lakes.

Light Penetration

Water transparencies of less than ten feet in lakes often occur as a result of algal blooms or excessive turbidities. Oligotrophic lakes are characterized by their exceptionally clean waters. Secchi disc transparencies of over 20 feet are common in the Great Lakes, and readings of over 50 feet have been found in many areas. The light penetration characteristics of a lake usually dictate the production and distribution of the phytoplankton. The availability of light energy is important for plant growth and the primary productivity of a lake.

Chlorophyll

The amount and type of chlorophyll present in the water is an indicator of the predominant kind of algae and an estimate of the relative productivity. Chlorophyll pigments can be separated into different types. The most common are chlorophylls a, b, and c. All types of algae contain chlorophyll a. The green algae have, in addition to chlorophyll a, chlorophyll b. The diatoms and brown flagellated algae contain the pigments a and c. Blue-green algae contain only chlorophyll a.

Discussion and Results

Physical Observations

Lake Huron is considered to be geologically young and biologically unproductive. The lake basin is deep (average depth - 196 feet) and becomes thermally stratified during the summer and winter. Its clear waters offer little interference to light penetration. The lake basin has an unusually long and irregular shoreline caused by many large islands, peninsulas, and bays.

Water transparency measurements were made by both Secchi disc and submarine photometric methods. The Secchi disc extinction depths and one percent surface light penetration depths (euphotic zone) for the deepwater and nearshore areas are reported in Tables 50 and 51 along with observations on sampling depths and bottom compositions. Table 52 summarized the Lake Huron Basin physical observations and noted the mean euphotic zone to be 78 feet in the deepwater areas. Secchi disc readings averaged between one-half and one-fifth of the euphotic zone depth during these surveys, or approximately 22 feet. The August cruise had an average Secchi disc reading of 27 feet, while June had an average of 20 feet. Saginaw Bay and the nearshore areas of Lake Huron had much shallower waters and more turbid conditions (Figure 14). The average Secchi disc extinction depth for Saginaw Bay was eight feet, while the nearshore areas averaged twelve feet. Georgian Bay and northern Lake Huron had the deepest euphotic zones and Secchi disc readings (Figure 16).

The submarine photometer readings are reportedly more indicative of the actual water transparency because of the various human errors involved in Secchi disc interpretations.

Silt, sand, and clay were the most often reported bottom types in deep water Lake Huron. The main body of Lake Huron was sampled between depths of 30 to 700 feet. The average sampling depth for bottom organism collections was 170 feet in deepwater areas. Nearshore sampling ranged from 5 to 66 feet and averaged 24 feet. Saginaw Bay was sampled at an average depth of 33 feet.

Benthic Macroinvertebrates

The benthic macroinvertebrates from Lake Huron and Saginaw Bay were identified and listed in Table 53. Twenty major taxonomic groups of organisms were found.

At the Lake Huron deepwater stations, the predominant benthic organism was the scud (*Pontoporeia affinis*). Sludgeworms, fingernail clams and bloodworms were the most numerous organisms, in the order named. This assemblege of aquatic fauna is characteristic of oligotrophic conditions in the Great Lakes. Scuds comprised 58 percent of the total benthic population in the main body of the lake. They were also predominant in the deepest areas (> 200 feet) where they made up 69 percent of the population. Table 54 contains the depth distribution data.

Average benthic population for the 1965 lake surveys was found to be 78 organisms per square foot (Table 55). Georgian Bay and southern Lake Huron were the least populous areas for benthic macroinvertebrates, while the mouth of Saginaw Bay supported over twice the average number found throughout the lake. Table 56 contains the individual deepwater station information for the various areas. Samples collected in August averaged 17 more individuals per square foot than those collected in June.

Saginaw Bay contained the highest standing crops of benthic organisms. The average population was over five times as numerous as those found in Lake Huron and almost three times as great as the nearshore areas.

Sludgeworms were the most common organisms in Saginaw Bay, averaging over 300 per square foot. Scud populations were comparitively small and comprised only eight percent of the benthic organisms in Saginaw Bay. A small area immediately adjacent to the Saginaw River mouth had an average sludgeworm population of 2,500 per square foot. The pollution-sensitive scuds were restricted to less than ten per square foot for a distance of fifteen miles from the Saginaw River mouth.

Sandy bottom areas supported twice the average benthic organism populations, while clay bottom substrates had one-half the average number of benthic macroinvertebrates. Silty and rocky areas of Lake Huron supported approximately the same numbers of organisms.

The higher numbers of scuds and sludgeworms, found in the North Channel and the channels leading out of the North Channel into Lake Huron, are of interest. The increase in macroinvertebrate populations may have been due to the close proximity of productive nearshore areas and favorable bottom compositions. Scuds numbered less than ten per square foot in a narrow zone in the middle of the lake, extending southward from about Rogers City to Port Huron (Figure 17). Sludgeworm populations of less than ten per square foot were found in the middle of the lake, in Georgian Bay, and the northwestern part of the lake (Figure 18).

At the nearshore stations, scuds comprised only 4 percent and oligochaetes 64 percent of the total organisms. Table 57 contains this data. The most populous sample, collected near Rogers City, contained over 750 organisms per square foot, mostly sludgeworms and fingernail clams. Hyalella and Gammarus were the predominant scuds at the majority of stations. Caddisflies or mayflies were collected in nearly every nearshore area.

A greater variety of organisms was found in the harbor and nearshore areas than in either the main body of the lake or in Saginaw Bay, reflecting the shallower waters and increased nutrient availability. The greatest variety in any of the harbor or near-shore areas was found near Cheboygan, Rogers City and Alpena where over ten major taxonomic groups were identified. The least variety, only three major taxonomic groups, was found in the Straits of Mackinac and near Au Sable.

The highest scud concentrations, averaging 48 per square foot, were collected near Cheboygan, while Harbor Beach exhibited none at all. Sludgeworm concentrations averaging over 620 per square foot were found near Port Sanilac. Benthic populations increased slightly at the harbor and nearshore stations in the summertime, and averaged 153 per square foot for all seasons.

Phytoplankton

Data from the deepwater phytoplankton samples at the surface, top of the thermocline, euphotic zone, and near the bottom are in Tables 58, 59, 60 and 61. The standing crops of phytoplankton in the deepwater areas of Lake Huron were relatively low, ranging from 70 to 1,930 organisms/ml at the surface (Table 58) and averaging 650 organisms/ml throughout the lake. The average phytoplankton populations were listed according to water depth areas on Table 62.

Nearshore stations averaged 1,480 phytoplankters per milliliter, or over twice that of the deepwater stations. Population increases between June and August were noted at most nearshore stations, as well as the deepwater areas. However, population pulses were found at Rogers City (5,740/ml), Harrisville (4,550/ml), and Oscoda (11,780/ml). Rogers City had a bloom of green flagellates; Harrisville had a bloom of *Navicula* near the harbor entrance; and Oscoda had a spring pulse of green flagellates (Table 63).

The mean number of deepwater phytoplankton taken in June was 520/ml. An increase in the populations was noted during the August and November surveys. Mean populations in August and November were 760/ml and 720/ml, respectively. In June, the predominant genera found, in order of abundance, were: *Rhizosolenia*, *Synedra*, *Cyclotella*-*Stephanodiscus*, various green flagellates, and *Tabellaria*. Predominant species in the November samples were mainly Cyclotella-Stephanodiscus, with fewer numbers of Oscillatoria, Synedra, and Navicula.

Surface phytoplankton sampled in June found standing crops in excess of 1,000/ml throughout most of Saginaw Bay and in one small area of the North Channel (Figure 19). The average density for all of Lake Huron was only 520/ml. By August, the area of excessive algal growth had extended to surround the Thumb area of Michigan and parts of the North Channel and Mackinac Straits area. Isolated areas around Goodrich, Ontario, the northern part of Georgian Bay, and northeast Lake Huron also had standing crops in excess of 1,000/ml (Figure 20). Huge open water areas in northern and central Lake Huron had less than 500 organisms/ml during both surveys, and averaged only 380 organisms/ml. Mean southern Lake Huron phytoplankton densities ranged between 170 and 310 organisms higher per milliliter than those in northern Lake Huron. Stations across the mouth of the Saginaw Bay had average counts of over 1,000 organisms/ml, while Saginaw Bay proper supported mean populations in excess of 7,000 organisms/ml. Blooms of blue-greens were found to occur in the late summer in Saginaw Bay; however, no excessive numbers were discovered in Lake Huron.

Samples taken near the top of the thermocline, one percent surface light zone, and near the bottom showed very little change in the population densities (Table 62). Nuisance forms of algae were never predominant and population blooms were not detected in the deepwater areas.

Chlorophyll

Chlorophyll analyses in June and August of the surface and near bottom waters of Lake Huron are presented in Tables 64 and 65. Average chlorophyll values are presented by area in Table 66.

Contrary to phytoplankton population counts, the June sampling survey showed higher average chlorophyll concentrations than the August survey. However, the lake-wide distribution of chlorophyll and phytoplankton concentrations showed a definite correlation (Figure 15). Highest values were found in Saginaw Bay, while Georgian Bay and northern Lake Huron had the two lowest concentrations. There was a slight increase in the amount of chlorophyll in the bottom-most samples, compared with the surface samples. The phytoplankton analyses also showed slight population increases near the bottom. In clear water, it is not uncommon for the highest chlorophyll and phytoplankton densities to occur in shaded areas well below the surface. Figure 16 shows that the light penetration in Lake Huron is closely related to the density of the algal populations.

The summary data tables and figures have shown that different areas of Lake Huron have varying degrees of biological activity. Phytoplankton and benthic organisms are more dense, chlorophyll higher, and light penetrations lower in the bay and inshore areas. Although shallow areas are normally much more productive, pollution-tolerant organisms are not usually predominant. The effects of water quality degradation on the biota are first noted in areas of relatively small water volumes.

Saginaw Bay supported the highest populations of both algae and bottom-dwelling organisms found during this study. Pollution tolerant sludgeworms and blue-green algae were often the predominant community forms in Saginaw Bay. Nearshore areas that supported pollution-tolerant communities include parts of Thunder Bay near Alpena and Harbor Beach.

The biota of the deepwater areas reflects upon the true oligotrophic nature of most of Lake Huron. Low numbers of pollution-sensitive organisms inhabited the deep mid-lake areas.

Accelerated eutrophication is beginning in some major bays and harbors of Lake Huron. These areas are much more important to the great mass of aquatic life in Lake Huron, and therefore should be protected from degradation.

Pesticides

Pesticides, necessary to our mass production economy, have been indicated as despoilers of the environment. Improper use of pesticides are well documented causes of fish kills. Not so well documented are the long-term effects of residual low level pesticide concentrations which have been observed in waters, plants and fish. The universality of the pesticide problem is evidenced by the fact that residues of DDT, in extensive use only since the end of World War II, have been found in the flesh of animals in the polar regions many thousands of miles from the nearest known point of use.

The danger from pesticides lies not in the spectacular fish kills which make headlines but in subtle long-term changes to the total environment. A silent spring is faced by Michigan's ambitious Coho salmon planting program. Pesticides have been discovered in the eggs stripped from salmon migrating upstream after their return from the waters of Lake Michigan. Although pesticide application rates on land may result in low levels in the surface waters, the various parts of the aquatic food chain from the once-celled plants and animals up to man have the ability to concentrate and retain in their systems the pesticides. Eagle and osprey nests in parts of the country lie barren because the fish consumed by the majestic predators contained levels of pesticide sufficient to cause sterility, if not death. Ducks, too, in eating aquatic plants ingest pesticides which are taken up in the fatty tissues - at harmless concentrations - until a cold winter snap requires the utilization of stored fat creating toxic levels in the blood stream and sudden death.

Much information is needed. Most critical is an accurate inventory of pesticide use in the basin - both by commercial users and individuals. Research is needed on the effects of pesticides particularly in such a complex situation as the aquatic food chain. Lethal levels of pesticides are reasonably well defined, but sub-lethal levels which permit lethargic survival or cause genetic malfunctions or sterility eliminating the species are not as well known. Synergistic effects of other pesticides, pollutants, or a variety of water quality indices should be determined to more adequately predict the effect of pesticide applications in the basin.

Table 50. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS
Lake Huron Deepwater - 1965

Station	Date	Depth Feet	Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
North Channel					
H808	6-23	116	13	40	Silt, clay, ooze
	8-30	132	23	56	
H809	6-23	66	15	45	Silt, clay, ooze, sand
	8-30	96	23	56	
H810	6-23	40	15	To Bottom	Sand
	8-29	43	18	To Bottom	
H812	6-23	122	13	46	Silt, ooze
	8-29	125	21	66	
Georgian Bay					
H382	6-16	99	30	82	Rock, gravel
	8-23	83	33	To Bottom	
H384	6-16	86	25	82	Silt, clay, gravel
	8-23	86	31	82	
H386	6-17	168	26	96	Soft brown clay, sand
	8-24	178	28	99	
H388	6-17	205	23	82	Silt, clay
	8-24	195	31	99	
Northern Lake Huron					
H814	6-21	116	15	66	Silt, ooze
	8-29	149	20	86	
H530	6-21	33	16	To Bottom	Rock
	8-27	30	20	To Bottom	
H532	6-21	106	18	76	Clay, rock, gravel
	8-27	125	26	76	
H534	6-22	320	15	63	Silt, clay, ooze
	8-29	277	25	82	

Table 50. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS (cont'd)
Lake Huron Deepwater - 1965

Station	Date	Depth Feet	Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Northern Lake Huron (cont'd)					
H536	6-22	73	13	66	Silt, rock
	8-29	92	13	54	
H420	6-20	106	16	86	
	8-27	99	28	79	
H422	6-24	287	21	89	Silt, clay, ooze
	8-27	310	26	74	
H424	6-24	479	21	76	Silt, ooze
	8-30	396	26	99	
H426	6-22	211	15	76	Silt, ooze
	8-30	218	26	109	
H428	6-22	182	12	56	Silt, sand, gravel
	8-30	188	21	76	
H432	6-22	106	14	50	Clay, sand, rock, gravel
	8-29	76	25	-	
H370	6-20	66	16	To Bottom	Sand
	8-26	73	30	66	
H372	6-19	109	28	76	Rock
	8-26	102	31	82	
H374	6-19	545	33	102	Silt, ooze
	8-26	578	41	99	
H376	6-19	627	25	99	Silt, hard clay
	8-26	700	35	99	
H378	6-19	317	20	86	Silt, clay, ooze
	8-26	300	38	82	
H380	6-19	238	20	86	Silt
	8-23	257	31	99	

Table 50. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS (cont'd)
Lake Huron Deepwater - 1965

Station	Date	Depth Feet	Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Northern Lake Huron (cont'd)					
H320	6-15	175	21	82	Silt, sand
	8-21	175	31	82	
	11-11	-	20	73	
	11-18	-	17	73	
H321	11-11	-	20	73	-
	11-18	-	21	79	
H322	6-15	221	26	86	Silt, clay, sand
	8-22	224	31	82	
	11-11	-	21	79	
	11-18	-	16	73	
H324	6-15	248	26	86	Silt, clay
	8-22	280	41	132	
H326	6-15	545	30	92	Silt, soft brown clay
	8-22	548	46	132	
H328	6-15	185	21	82	Silt, clay, sand
	8-22	191	31	-	
H330	6-16	59	20	To Bottom	Sand, rock, gravel
	8-25	66	23	To Bottom	
Mouth of Saginaw Bay					
H200	6-14	66	17	To Bottom	Silt, sand
	8-21	66	17	To Bottom	
	11-16	-	20	To Bottom	
	11-23	63	17	To Bottom	
H202	6-14	86	18	76	Silt, sand
	8-21	82	17	To Bottom	
	11-16	79	20	To Bottom	
	11-22	86	18	To Bottom	

TABLE 50. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS (cont'd)
Lake Huron Deepwater - 1965.

Station	Date	Depth Feet	Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Mouth of Saginaw Bay (cont'd)					
H204	6-14	106	18	63	Silt, sand
	8-21	102	23	76	
	11-16	82	21	To Bottom	
	11-22	-	17	86	
H206	6-14	66	18	63	Silt, sand, gravel
	8-21	63	17	To Bottom	
	11-16	63	17	To Bottom	
	11-22	63	20	To Bottom	
Southern Lake Huron					
H250	11-11	-	12	To Bottom	-
	11-18	-	7	40	
H252	11-11	-	21	99	-
	11-18	-	-	-	
H254	11-11	-	25	89	-
	11-18	-	-	-	
H130	6-11	201	22	79	Silt, clay
	8-20	191	28	-	
	11-19	-	15	99	
H132	6-11	182	28	73	Silt, hard clay, sand
	8-20	204	40	-	
	11-10	-	26	99	
	11-19	-	20	82	
H133	6-11	280	23	66	Silt
H134	6-10	206	18	66	Silt, clay, sand
	8-20	221	33	-	
	11-10	-	20	82	
	11-21	-	10	56	

Table 50. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS (cont'd)
Lake Huron Deepwater - 1965

Station	Date	Depth Feet	Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Southern Lake Huron (cont'd)					
H136	6-10	33	12	To Bottom	Rock
	8-20	31	12	-	
	11-10	-	2	7	
	11-20	-	1	-	
H102	6-10	36	25	To Bottom	Sand, rock, gravel
	8-19	38	23	To Bottom	
	11-9	-	16	To Bottom	
	11-21	36	13	To Bottom	
H106	6-10	36	25	To Bottom	Silt, sand, rock, gravel
	8-19	37	20	To Bottom	
	11-9	-	15	To Bottom	
	11-21	53	11	To Bottom	

Table 51. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS
Lake Huron Nearshore - 1965

Station	Mean Depth Feet	Mean Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Straits of Mackinac				
H500	66	20	-	Clay, rock
Cheboygan				
H523	13	10	To Bottom	Silt, clay, sand, gravel
H524	23	10	-	Silt, clay, sand, detritus
H525	10	10	To Bottom	Silt, clay, sand, gravel
Rogers City				
H400	37	27	To Bottom	Clay, rock
H401	9	9	To Bottom	Fine sand
H402	28	24	To Bottom	Clay, sand
H403	27	10	To Bottom	Silt, clay, gravel
H404	25	9	To Bottom	Fine sand
Thunder Bay				
H361	23	7	To Bottom	Ooze, sand, paper fibers
H362	13	11	To Bottom	Silt, sand
H366	18	7	To Bottom	Silt, sand
Harrisville				
H351	20	13	To Bottom	Sand
H352	31	15	To Bottom	Silt, sand
H353	21	15	To Bottom	Rock
Oscoda				
H301	20	3	-	Sand
H303	15	3	-	Sand
H304	14	4	-	Sand

Table 51. BIOLOGICAL DATA - PHYSICAL OBSERVATIONS (cont'd)
Lake Huron Nearshore - 1965

Station	Mean Depth Feet	Mean Secchi Disc Feet	Euphotic Zone Depth Feet	Bottom Types
Harbor Beach				
ST-1*	5	3	-	Silt, ooze, sand
ST-2**	8	3	-	Silt, ooze
H121	25	13	-	Rock, gravel
H123	40	17	-	Rock, gravel
H125	43	17	-	Sand, rock, gravel
H127	33	14	-	Silt, clay, rock
Port Sanilac				
H112	18	14	To Bottom	Sand, rock, gravel
H113	46	15	To Bottom	Sand, rock, gravel
H115	18	13	To Bottom	Silt, sand, rock

*ST-1 500 feet south of Coast Guard Station
**ST-2 2000 feet south of Coast Guard Station

Table 52. SUMMARY OF AVERAGE PHYSICAL OBSERVATIONS
Lake Huron Basin - 1965

Area	No. of Samples	Depth (feet)	Secchi Disc (feet)	Euphotic Zone (feet)
Deepwater				
North Channel	8	138	18	58
Georgian Bay	10	100	28	89
Northern Lake Huron	50	240	24	83
Southern Lake Huron	28	119	19	72
Mouth of Saginaw Bay	8	77	18	73
Average Total	104	170	22	78
Nearshore	30	24	12	-
Saginaw Bay	47	33	8	30

FIGURE 14

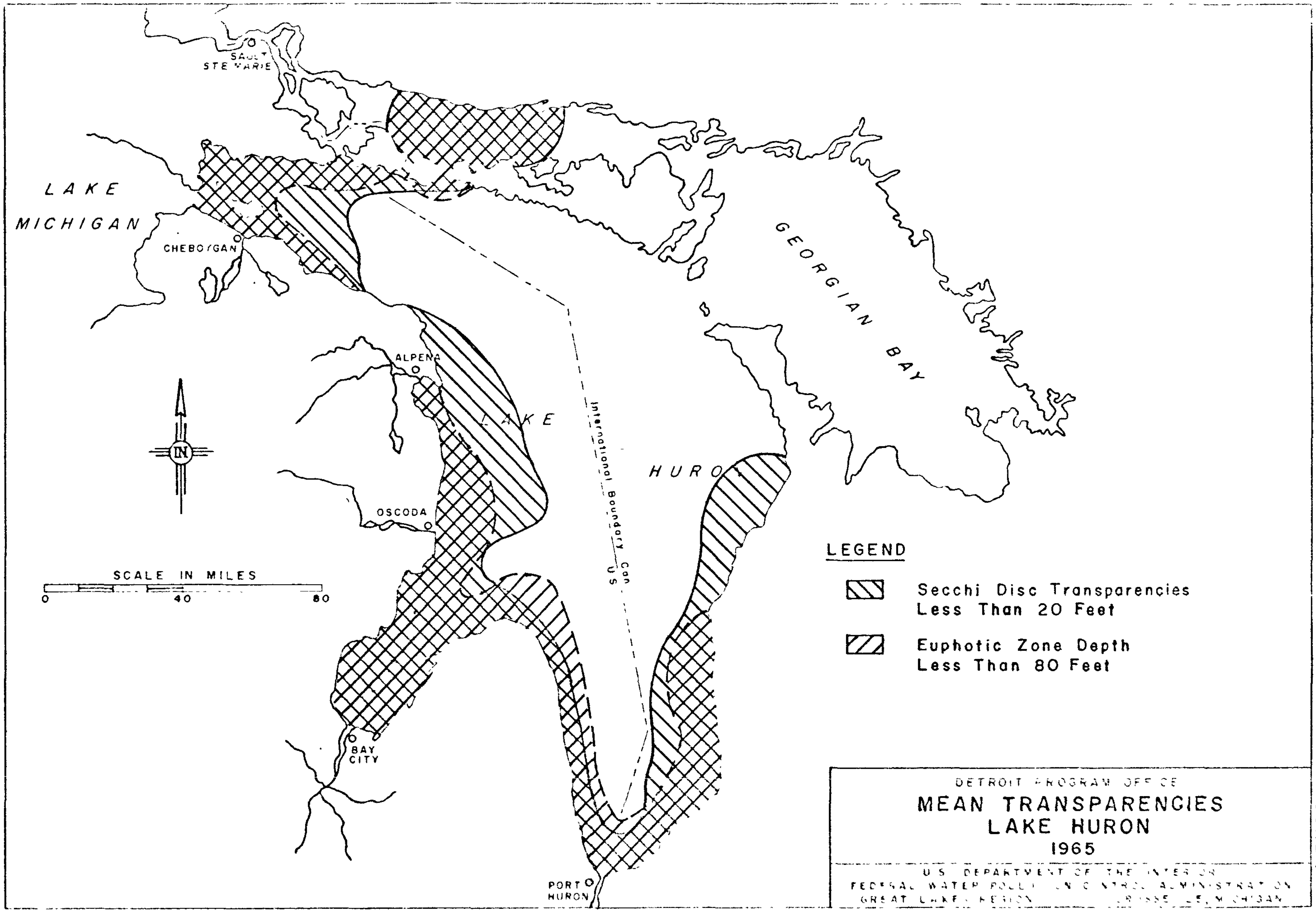

SAULT STE MARIE
LAKE MICHIGAN
CHEBOYGAN
ALPENA
OSCODA
BAY CITY
PORT HURON
LAKE HURON
GEORGIAN BAY
International Boundary
Can
US
SCALE IN MILES
0
40
80
LEGEND
Secchi Disc Transparencies Less Than 20 Feet
Euphotic Zone Depth Less Than 80 Feet
DETROIT PROGRAM OFFICE
MEAN TRANSPARENCIES
LAKE HURON
1965

FIGURE 15

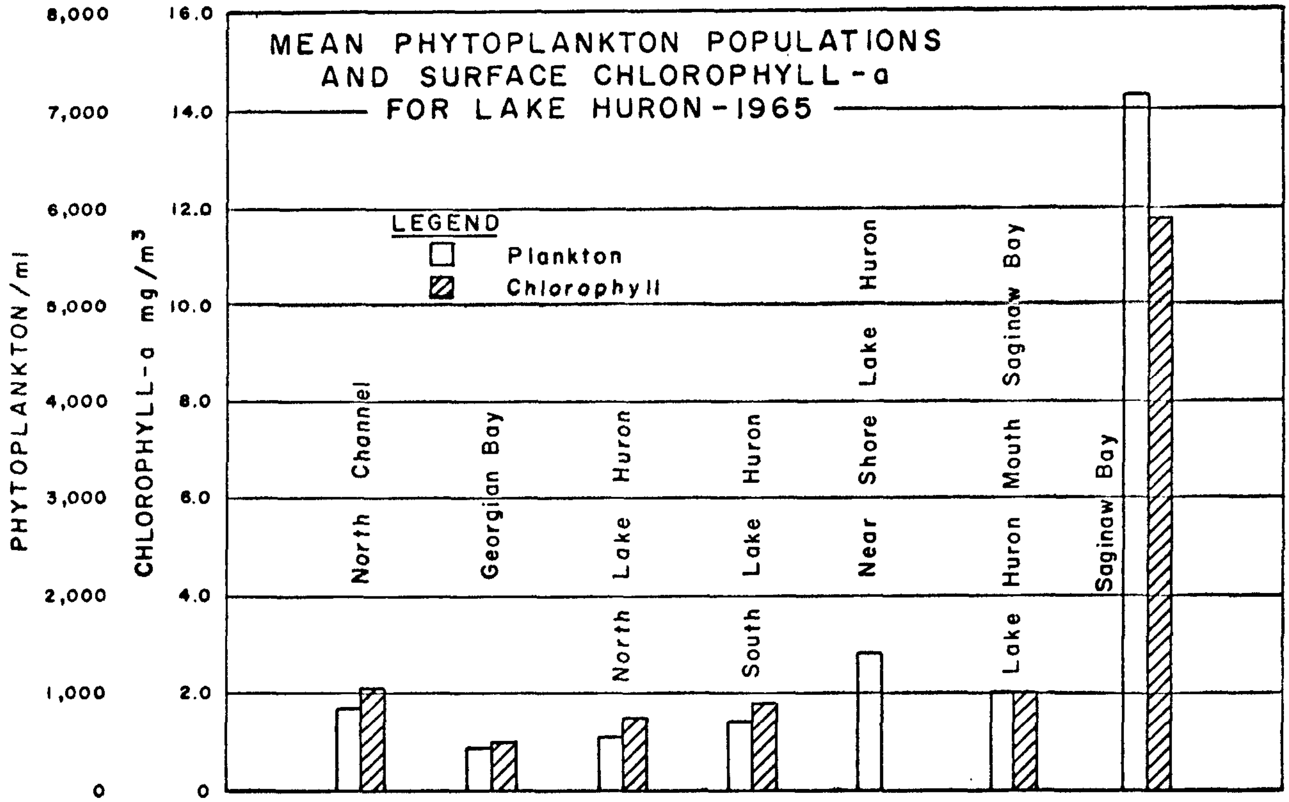


FIGURE 16

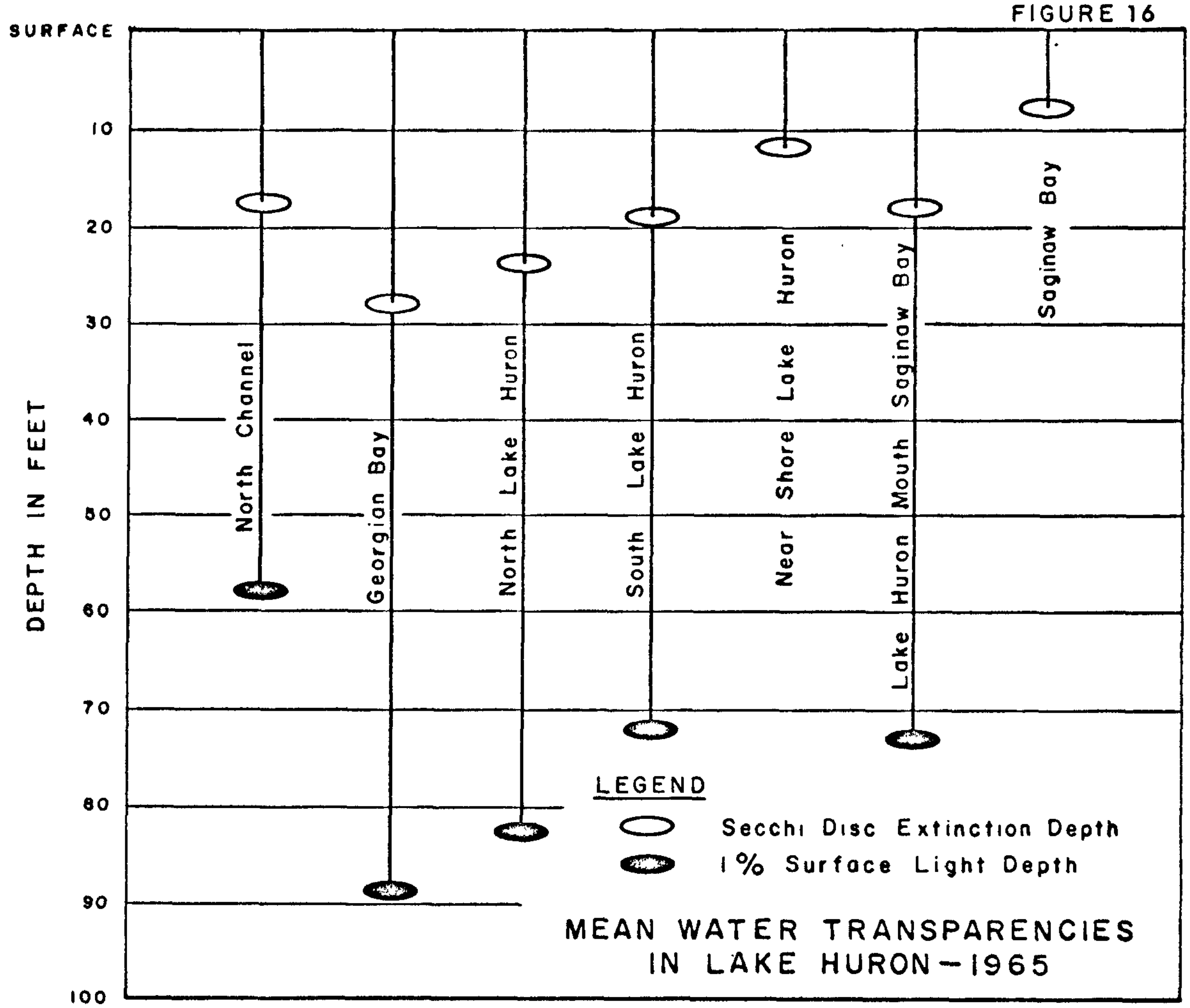


TABLE 53. IDENTIFIED BENTHIC MACROINVERTEBRATES
LAKE HURON AND SAGINAW BAY

Amphipoda (scuds)
- *Gammarus*
- *Hyallela azteca*
- *Pontoporeia affinis*

Isopoda (aquatic sow bugs)
- *Asellus*
- *Lirceus*

Mysidacea (opposum shrimp)
- *Mysis relicta*

Prosobranchia (gill snails)
- *Amnicola*
- *Bythinia*
- *Pleurocera*
- *Valvata tricarinata*

Pulmonata (lung snails)
- *Ferrisia*
- *Helisoma*
- *Lymnaea*
- *Planorbula*
- *Stagnicola*

Hirudinea (leeches)
- *Helobdella stagnalis*
- Several unidentified

Oligochaeta (aquatic earthworms)
- Tubificidae (sludgeworms)
- Several unidentified

Nematoda (round worms)
- Several unidentified

Turbellaria (flatworms)
- *Dugesia*
- Several unidentified

Unionidae (pearl button clams)
- *Lampsilis*
- Several unidentified

Sphaeriidae (fingernail clams)
- *Pisidium*
- *Sphaerium*

Diptera (flies)
- Ceratopogonidae
- Tendipedidae (bloodworms)
- Tipulidae

Ephemeroptera (mayflies)
- *Ephemera*
- *Hexagenia*
- Baetidae
  - *Baetisca*
  - *Caenis*
  - *Ephemerella*
  - *Tricorythodes*
  - Several unidentified
- Heptageniidae
  - *Stenonema*
  - Several unidentified

Trichoptera (caddisflies)
- Leptoceridae
- Phyryganeidae
- Psychomyiidae
  - *Polycentropus*
  - Several unidentified

Coleoptera (beetles)
- Elmidae
- Several unidentified

Hemiptera (true bugs)
- Corixidae

Bryozoa (moss animals)

Hydrozoa (Hydra)

Hydracarnia (aquatic mites)

Porifera (sponges)

TABLE 54 AVERAGE DEPTH DISTRIBUTION
OF BENTHIC MACROINVERTEBRATES
LAKE HURON DEEPWATER - 1965
(average organisms/sq. ft.)

Depth (feet)	No. of Samples	Fingernail Clams	Scuds	Sludgeworms	Others	Total
0-49	6	44	71	33	16	164
50-99	9	20	79	40	7	146
100-149	9	10	34	19	1	64
150-199	12	8	54	17	1	80
200-249	6	6	33	18	0	57
250-299	5	X	31	13	0	45
300-400	4	1	49	13	0	63
> 400	7	X	5	2	0	7
Total	58	11	45	19	3	78
Composition		14%	58%	24%	4%	100%

X Means less than 1/sq. ft.

TABLE 55. AVERAGE BENTHIC MACROINVERTEBRATES
LAKE HURON BASIN - 1965

Area	No. of Samples	No/sq. ft.
Deepwater		
North Channel	8	120
Georgian Bay	5	14
Northern Lake Huron	33	62
Southern Lake Huron	9	38
Mouth of Saginaw Bay	8	176
Average Total	63	78
Nearshore	35	153
Saginaw Bay	59	420

TABLE 56. BIOLOGICAL DATA DEEPWATER BENTHIC MACROINVERTEBRATES
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	Opposum Shrimp	Round-worms	Other*	Total
North Channel										
H808	6-23	-	-	-	3	9	-	-	X(f)	12
	8-30	1	-	-	4	16	-	X	-	21
H809	6-23	-	X	-	8	12	-	-	-	20
	8-30	2	X	-	10	20	X	2	-	34
H810	6-23	96	2	3	141	173	X	1	-	416
	8-29	64	3	5	125	241	-	-	1(e)	439
H812	6-23	-	-	-	4	10	-	X	-	14
	8-29	X	-	-	-	5	-	X	1(g)	6
Georgian Bay										
H384	6-16	8	3	-	9	8	-	-	-	28
	8-23	-	-	X	2	-	-	-	X(i)	2
H386	6-17	-	1	-	4	12	X	-	-	17
	8-24	-	-	-	X	8	-	-	-	8
H388	6-17	-	-	-	2	12	-	-	-	14

*See page 291

TABLE 56. BIOLOGICAL DATA DEEPWATER BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	Opposum Shrimp	Round-worms	Other*	Total
Northern Lake Huron										
H814	6-21	2	-	-	10	6	1	-	-	19
	8-29	2	X	-	4	14	-	-	-	20
H530	6-21	4	12	-	-	4	-	-	2(i)	22
H532	6-21	42	3	-	9	66	-	-	-	120
	8-27	20	2	-	3	34	-	-	-	59
H534	6-22	-	X	-	2	43	-	-	-	45
	8-29	1	-	-	-	44	-	-	-	45
H536	8-29	78	X	-	15	90	-	-	-	183
H420	6-20	3	-	-	15	4	-	2	-	24
H422	6-24	6	3	-	-	65	-	-	-	74
	8-27	X	X	-	1	42	-	-	-	43
H424	6-24	1	-	-	-	11	-	-	-	12
	8-30	-	-	-	-	6	-	-	-	6
H426	6-22	17	X	-	3	20	-	-	-	40
H428	6-22	40	1	-	6	66	-	-	-	113
	8-27	73	4	-	22	252	-	X	-	351

*See page 291

TABLE 56. BIOLOGICAL DATA DEEPWATER BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	Opposum Shrimp	Round-worms	Other*	Total
Northern Lake Huron (cont'd)										
H370	6-20	51	9	5	18	103	-	-	1(j)1(k)	188
	8-26	1	2	5	27	46	-	2	1(i)	84
H374	6-19	10	-	-	-	10	-	-	-	20
	8-26	-	-	-	-	3	-	-	-	3
H376	8-26	-	-	-	-	4	-	-	-	4
H378	6-19	50	X	-	2	80	-	-	-	132
	8-26	-	-	-	-	30	-	-	-	30
H380	6-19	-	-	-	6	2	-	-	-	8
	8-23	-	-	-	2	3	-	-	-	5
H320	6-15	9	2	-	14	33	X	-	1(h)	59
	8-22	24	X	-	28	102	-	-	-	154
H322	6-15	29	-	-	5	38	-	X	X(c)	72
	8-22	16	-	-	4	60	-	-	-	80
H324	6-15	56	X	-	-	40	-	-	-	96
	8-22	-	-	-	1	4	-	-	-	5

*See page 291

TABLE 56. BIOLOGICAL DATA DEEPWATER BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	Opposum Shrimp	Round-worms	Other*	Total
Northern Lake Huron (cont'd)										
H326	6-15	1	-	-	X	3	-	-	-	4
	8-22	-	-	-	-	1	-	-	-	1
H328	6-15	16	1	-	9	84	-	X	-	110
	8-22	10	-	-	9	46	-	1	-	66
Mouth of Saginaw Bay										
H200	6-14	84	8	-	22	62	-	2	2(e)	180
	8-21	116	5	1	19	210	-	3	2(e)	356
H202	6-14	24	3	-	44	110	-	2	2(f)	185
	8-21	46	-	-	56	148	-	-	-	250
H204	6-14	46	2	-	20	48	-	5	-	121
	8-21	52	-	-	24	108	-	-	-	184
H206	6-14	24	17	-	1	2	-	X	-	44
	8-21	78	5	-	-	5	-	7	X (a)	95
Southern Lake Huron										
H130	6-11	21	2	-	6	32	X	-	-	61
	8-20	-	-	-	-	-	-	-	-	0

*See page 291

TABLE 56. BIOLOGICAL DATA DEEPWATER BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	Opposum Shrimp	Round-worms	Other*	Total
Southern Lake Huron (cont'd)										
H132	8-20	11	-	-	-	12	-	-	-	23
H133	6-11	4	-	-	X	3	-	-	X(d)	7
H134	6-10	36	2	-	9	32	-	-	-	79
	8-20	12	-	-	5	36	-	X	-	53
H102	8-19	21	25	-	-	5	-	X	2(a)	53
H106	6-10	2	1	-	-	2	-	-	-	5
	8-19	12	45	-	-	2	-	X	2(a)X(b)X(i) 2(d)X(f)	63

Key to Deepwater Benthic Macroinvertebrates

*a - Hirudinea
b - Hydracarina
c - Caenis sp.
d - Corixidae
e - Asellus sp.
f - Dugesia sp.
g - Spongillidae
h - Ceratopognidae

i - Pulmonata
j - Bryozoa
k - Ephemera
X = less than 1/sq. ft.

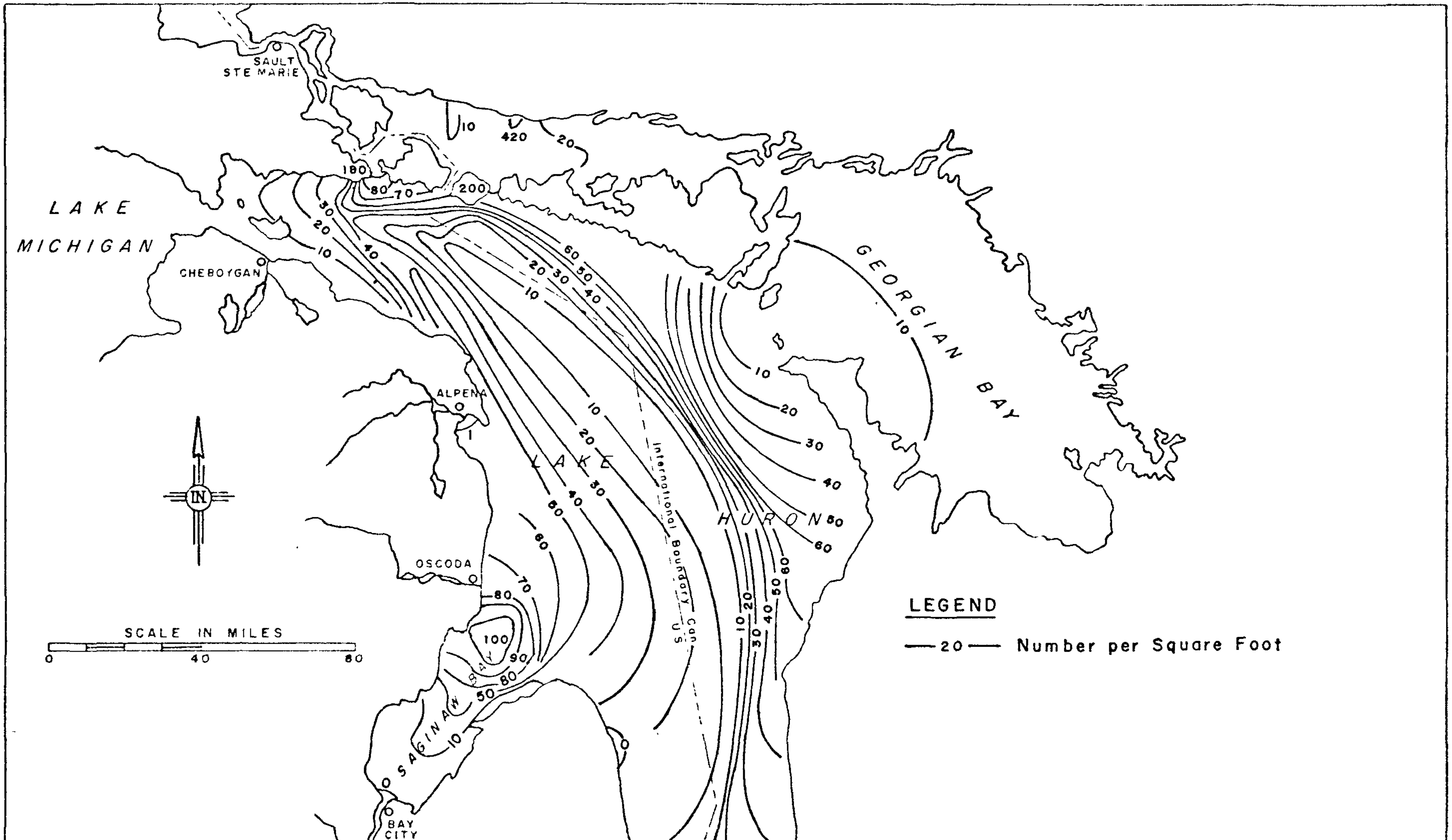
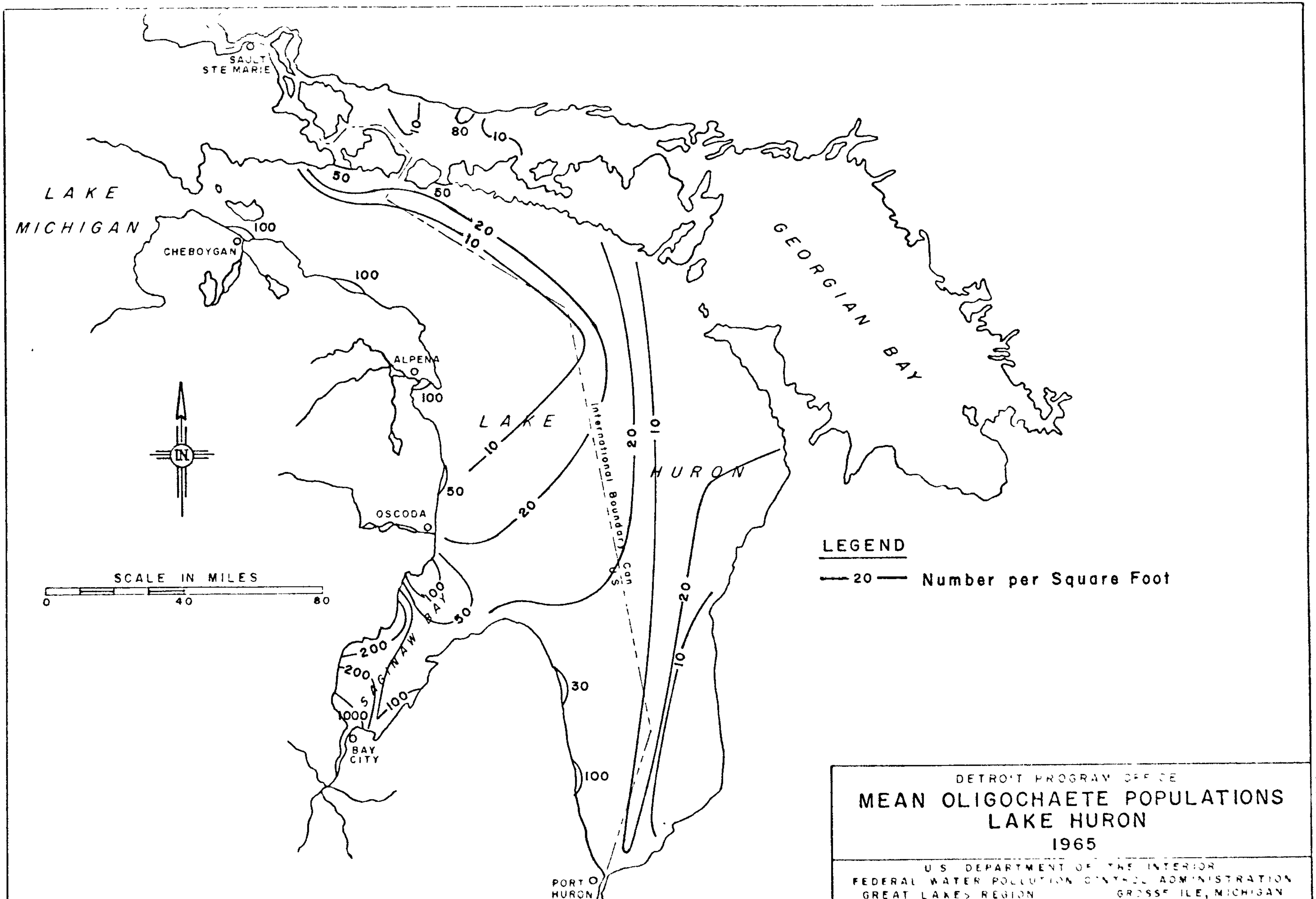


FIGURE 17

DETROIT PROGRAM OFFICE

MEAN AMPHIPOD POPULATIONS
LAKE HURON
1965

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN



DETROIT PROGRAM OFFICE

MEAN OLIGOCHAETE POPULATIONS
LAKE HURON
1965

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

FIGURE 18

TABLE 57 BIOLOGICAL DATA NEARSHORE BENTHIC MACROINVERTEBRATES
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	May-flies	Caddis-flies	Other*	Total
Straits of Mackinac										
H500	9-14	5	-	-	6	3	-	-	-	14
Cheboygan										
H523	4-20	22	48	15	9	-	-	2	20(a)X(i)X(k)3(l)	101
	9-15	24	10	2	X	48	5	4	1(a)X(b)6(i)5(l)	105
H524	4-20	273	102	8	2	5	2	1	6(i)X(k)X(l)	399
	7-11	9	7	3	X	-	-	-	X(a)	19
	9-15	189	59	-	X	7	-	-	1(a)X(b)X(d)1(e)	257
H525	7-11	22	32	-	6	29	2	3	2(i)	101
Rogers City										
H401	4-20	24	2	-	-	1	-	-	X(a)	27
	7-11	16	8	-	-	2	-	-	-	26
H402	4-20	181	164	-	-	41	5	3	2(a)5(b)2(l)2(f)5(l)	410
	7-11	5	6	-	-	14	-	-	-	25
H403	7-11	379	96	4	258	-	-	-	11(d)4(l)	752
H404	4-20	18	4	-	5	X	-	-	X(a)	27
	7-11	248	26	2	32	4	-	-	2(a)10(d)	324

*See Page 296

TABLE 57 BIOLOGICAL DATA NEARSHORE BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	May-flies	Caddis-flies	Other*	Total
Thunder Bay										
H361	4-21	202	65	X	-	4	40	X	X(a)X(b)2(i)	277
	7-11	222	8	-	-	-	-	-	-	230
	9-16	73	3	-	3	-	-	-	4(d)X(i)	83
H362	4-21	18	65	-	-	1	-	-	2(a)X(b)2(d)	88
	9-16	10	33	-	-	-	-	-	13(d)5(h)	61
H366	4-21	17	32	11	22	10	-	1	X(a)2(d)X(g)1(i)	96
	7-11	318	22	X	19	1	2	X	41(d)	403
	9-16	189	-	-	30	-	-	-	47(d)	266
Harrisville										
H351	7-13	4	16	-	-	-	X	1	X(d)	21
H352	7-13	96	36	X	7	3	-	-	37(d)	179
Oscoda										
H301	4-21	11	4	-	-	-	-	-	X(j)	15
H303	4-21	3	3	-	-	-	-	-	X(d)	6
Harbor Beach										
ST-1	9-19	45	3	-	-	-	-	-	-	48
ST-2	9-19	23	3	-	-	-	-	-	-	26

*See page 296

TABLE 57 BIOLOGICAL DATA NEARSHORE BENTHIC MACROINVERTEBRATES (cont'd)
LAKE HURON BASIN - 1965
(organisms/sq. ft.)

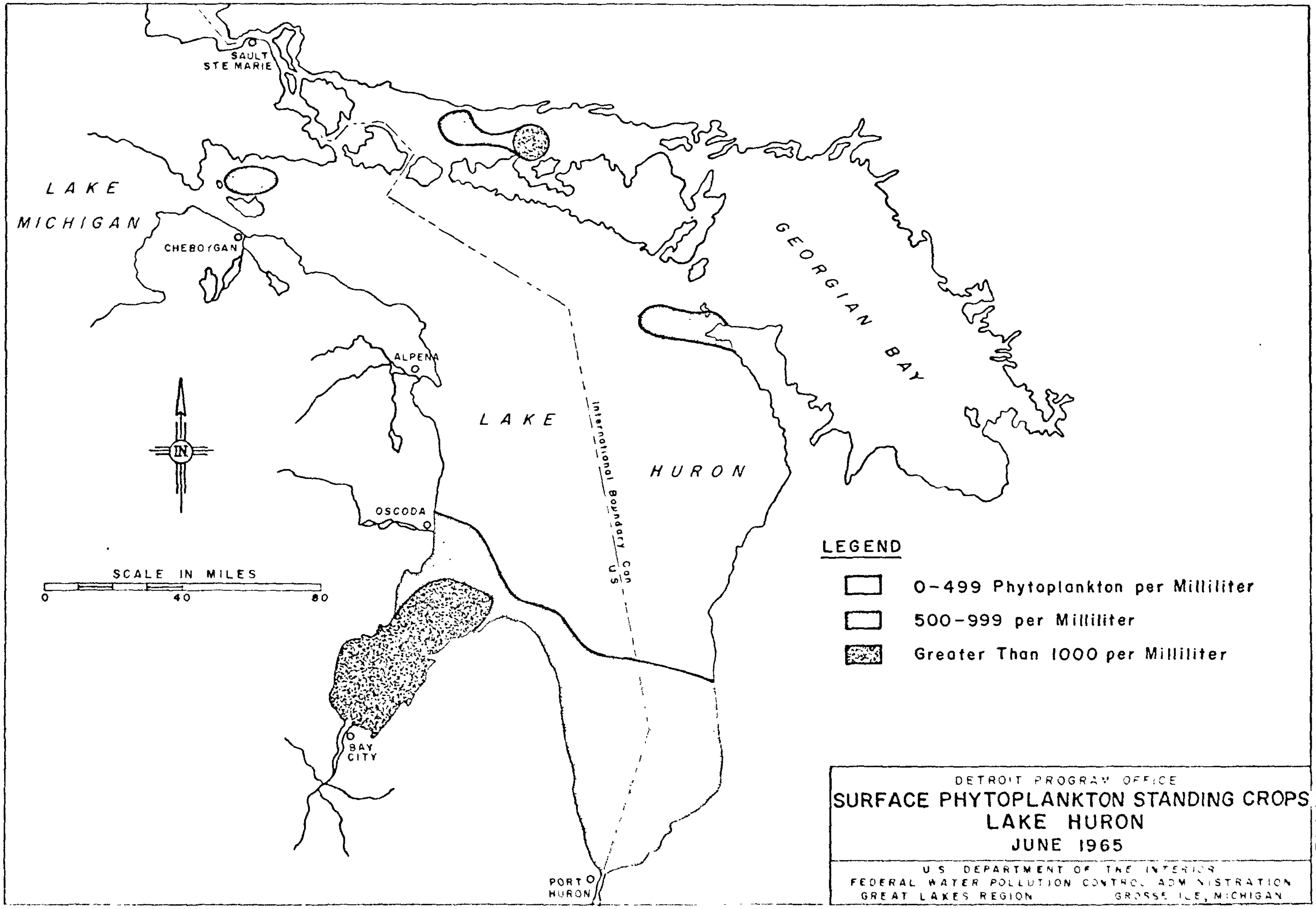
Station	Date	Sludge-worms	Blood-worms	Gilled Snails	Fingernail Clams	Scuds	May-flies	Caddis-flies	Other*	Total
Harbor Beach (cont'd)										
H125	4-27	5	4	-	-	-	-	-	-	9
H127	7-14	68	20	-	-	-	-	-	-	88
Port Sanilac										
H112	9-19	6	-	-	-	-	-	-	-	6
H113	7-14	14	21	-	-	-	-	-	X(d)8(e)	43
	9-18	68	14	-	-	-	-	-	4(c)X(d)2(e)	88
H115	4-27	60	35	-	-	X	-	-	-	95
	9-18	620	31	X	X	1	-	-	1(d)	653

Key to Nearshore Benthic Macrovinvertebrates

*a - Ceratopogonidae
b - Hirudinea
c - Turbellaria
d - Nematoda
e - Hydracarina
f - Corixidae
g - Elmidae

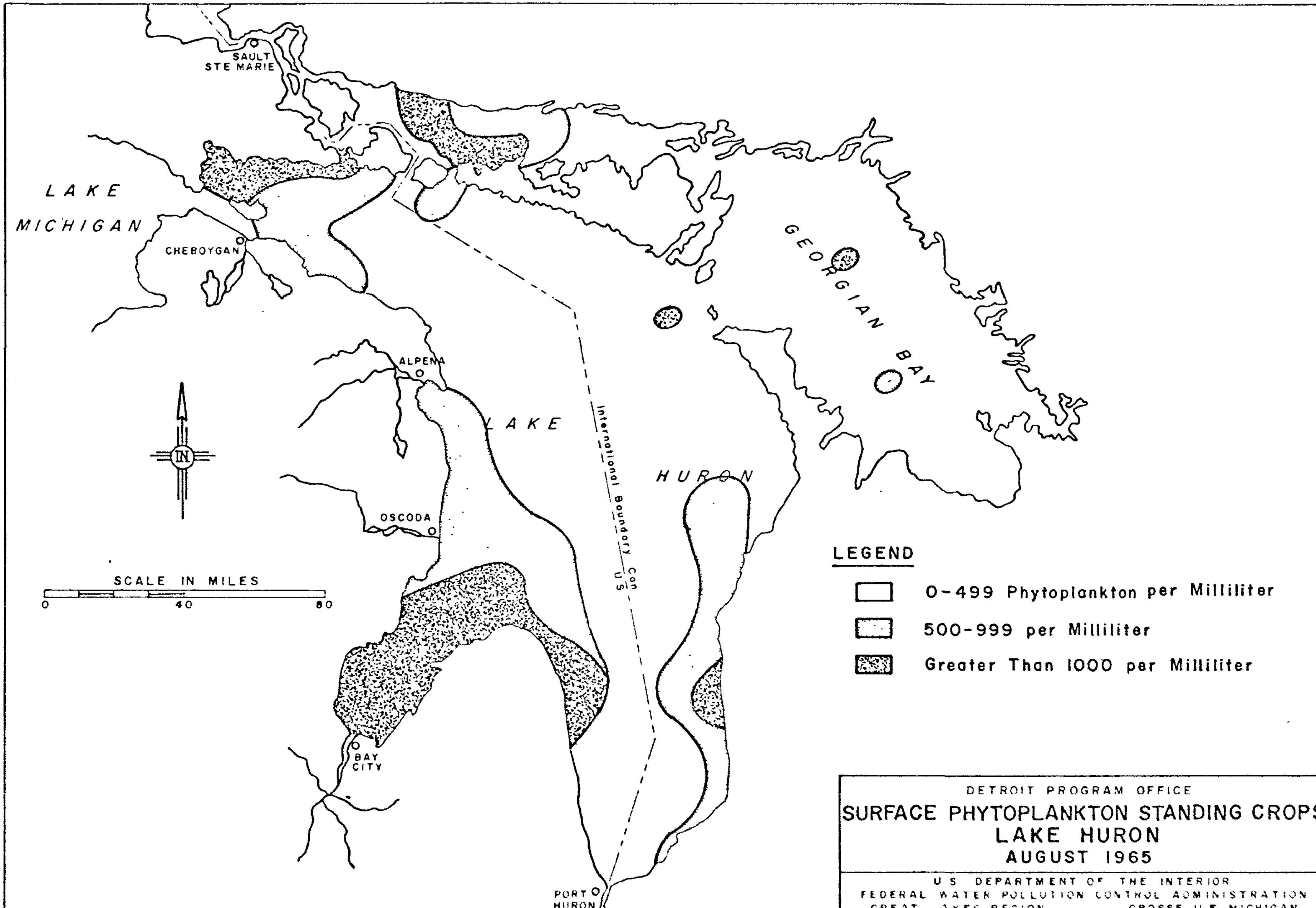
h - Coleoptera
i - Isopoda
j - Cladocera
k - Unionidae
X = less than 1/sq. ft.

FIGURE 19



DETROIT PROGRAM OFFICE
SURFACE PHYTOPLANKTON STANDING CROPS
LAKE HURON
JUNE 1965

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN



DETROIT PROGRAM OFFICE

SURFACE PHYTOPLANKTON STANDING CROPS
LAKE HURON
AUGUST 1965

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

FIGURE 20

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
North Channel										
H808	June	780	610	420	60	-	40	-	1,910	a, g, m
	Aug.	340	40	-	-	520	-	40	940	u, a, p
H809	June	130	130	100	20	-	-	20	400	a, j, v, h
	Aug.	100	-	40	60	-	270	20	490	u
H810	June	250	150	60	-	-	20	100	580	a, c, v
	Aug.	60	60	40	-	-	520	40	720	u
H812	June	80	230	60	-	20	-	20	410	a, q, g, d
	Aug.	360	20	20	-	-	970	-	1,370	a, b
Georgian Bay										
H382	June	60	170	-	-	-	40	40	310	i, c, v
	Aug.	180	-	10	-	-	10	-	200	a
H384	June	130	210	80	-	20	20	210	670	v, g, i
	Aug.	30	10	-	-	-	70	-	110	a, u, j
H386	June	170	20	-	-	-	20	-	210	a, c, i, s
	Aug.	130	20	-	-	-	1,010	-	1,160	u, a

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Georgian Bay (cont'd)										
H388	June	170	60	20	-	-	-	-	250	a, j
	Aug.	100	30	20	-	-	480	-	630	a, u
Northern Lake Huron										
H814	June	290	230	-	-	-	-	40	560	c, i, a
	Aug.	460	40	60	-	-	-	860	1,420	u, a
H530	June	130	270	-	-	20	20	-	440	i, c, h
	Aug.	520	60	-	-	-	400	-	980	a, u
H532	June	150	190	20	-	20	-	40	420	c, g, i, a
	Aug.	320	-	-	-	-	290	-	610	a, u
H534	June	130	100	40	-	20	40	-	330	c, g
	Aug.	420	40	20	-	-	130	-	610	a, u
H536	June	190	130	80	-	-	-	20	420	c, a, g, i
	Aug.	250	60	-	20	-	860	20	1,210	a, u
H420	June	40	130	-	-	-	20	-	190	g, a, c, h
	Aug.	320	-	-	-	-	150	-	470	a, u

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H422	June	100	190	20	-	-	20	40	370	c, e, j, b
	Aug.	250	-	-	-	-	60	-	310	a, u
H424	June	80	100	-	-	-	-	40	220	a, i, j, v
	Aug.	280	30	10	-	-	60	-	380	a, u
H426	June	150	190	40	-	-	40	60	480	c, i, j
	Aug.	460	-	20	-	-	230	-	710	a, u
H428	June	130	270	20	-	20	-	40	480	c, i, j
	Aug.	290	40	150	-	-	360	20	860	a, u, k
H432	June	130	100	100	-	20	-	100	450	u, a, n
	Aug.	100	-	60	20	-	100	40	320	a, u, k, v
H370	June	40	40	40	-	20	-	-	140	c, i, l, m
	Aug.	510	70	20	-	-	370	20	990	a, u
H372	Aug.	230	-	30	-	-	20	-	280	a
H374	June	100	150	-	-	-	20	20	290	c, i, h
	Aug.	80	-	10	-	-	20	-	110	a, u, o

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H376	June	250	80	-	20	-	20	-	370	c, g
	Aug.	440	-	-	-	40	-	-	480	a
H378	June	190	190	40	-	-	-	20	440	c, i
	Aug.	40	20	10	-	-	-	-	70	a, e, l
H380	June	340	360	-	-	-	20	40	760	c, i, o, g
	Aug.	640	20	110	-	-	700	20	1,490	a, u
H320	June	380	210	60	-	-	170	20	840	l, i, u
	Aug.	420	60	-	-	-	80	20	580	a, u
	Nov.	610	40	40	20	-	-	-	710	a
H321	Nov.	820	20	40	20	-	-	-	900	a
H322	June	100	250	20	-	-	80	20	470	i, c, u
	Aug.	820	-	40	-	-	20	-	880	a
	Nov.	480	20	-	20	-	20	-	540	a
H324	June	190	230	-	-	-	-	-	420	c, h, g, i
	Aug.	200	-	-	-	-	20	-	220	a, b

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H326	June	130	150	20	-	-	-	-	300	c, l, a, j
	Aug.	150	60	-	-	-	230	40	480	a, u, i
H328	June	80	170	20	-	-	20	-	290	i, a, d
	Aug.	340	20	20	-	-	400	20	800	u, a, d
H330	June	80	150	40	-	-	-	-	270	i, a
	Aug.	190	20	20	-	-	80	-	310	a, u
Mouth of Saginaw Bay										
H200	June	190	360	-	-	-	150	40	740	e, l, a
	Aug.	920	80	60	20	20	250	20	1,370	a, u
	Nov.	270	270	40	-	-	20	100	700	a
H202	June	210	190	20	-	-	250	40	710	u, a, e
	Aug.	1,010	60	130	-	150	440	20	1,810	a, u, o
	Nov.	610	20	-	20	-	-	-	650	a
H204	June	290	290	40	-	-	210	60	890	u, a, e, l
	Aug.	1,320	-	70	40	20	480	-	1,930	a, u
	Nov.	340	20	-	20	-	-	-	380	a

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
H206	June	230	290	-	-	20	150	40	730	a, e, l, n
	Aug.	940	40	60	40	130	130	-	1,340	a
	Nov.	760	150	60	-	170	-	20	1,160	a, q
Southern Lake Huron										
H250	Nov.	740	270	100	20	550	-	40	1,720	a, q
H252	Nov.	500	40	60	-	-	-	-	600	a
H254	Nov.	670	40	20	20	-	20	-	770	a
H130	June	320	290	20	-	20	80	20	750	i, a, u
	Aug.	650	40	60	-	-	270	-	1,020	a, u
	Nov.	360	20	40	-	-	-	-	420	a, o
H132	June	360	230	-	-	-	40	20	650	c, i
	Aug.	250	-	-	-	-	150	-	400	a, u
	Nov.	380	20	-	-	-	-	20	420	a
H133	June	250	230	20	-	-	170	-	670	c, u, i
H134	June	480	150	-	-	-	60	60	750	c
	Aug.	310	90	110	-	-	350	70	930	a, u, o
	Nov.	250	60	20	-	-	-	-	330	a, e

*See page 317

TABLE 58 BIOLOGICAL DATA SURFACE PHYTOPLANKTON (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Southern Lake Huron (cont'd)										
H136	June	60	340	-	-	-	100	-	500	i, u
	Aug.	400	170	-	-	-	650	20	1,240	a, u
	Nov.	460	170	40	-	-	-	-	670	a, q
H102	June	340	210	40	-	-	230	80	900	a, u, i
	Aug.	170	20	-	-	-	170	-	360	a, u
	Nov.	670	190	150	-	-	-	20	1,030	a, i
H106	June	290	130	40	-	-	60	-	520	c, i, a, u
	Aug.	210	20	20	-	-	230	-	480	a, u
	Nov.	380	100	40	40	-	-	20	580	a, f

*See page 317

TABLE 59 BIOLOGICAL DATA PHYTOPLANKTON AT THE TOP OF THE THERMOCLINE
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Georgian Bay										
H382	Aug.	180	-	10	-	-	30	-	220	a
H384	Aug.	70	10	10	-	-	120	-	210	u, a
H386	Aug.	20	-	10	-	30	360	-	420	u
H388	Aug.	-	-	20	-	-	710	-	730	u
Northern Lake Huron										
H814	Aug.	550	40	40	20	-	1,300	20	1,970	u, a
H530	Aug.	460	20	60	-	-	250	-	790	a, u
H532	June	130	170	20	-	-	40	-	360	a, h
	Aug.	520	-	-	20	-	130	-	670	a, u
H534	Aug	460	80	-	-	-	130	-	670	a, u
H422	Aug.	300	20	40	-	-	120	-	480	a, u
H424	June	60	60	20	-	-	40	-	180	a, h
	Aug.	340	-	-	-	-	170	40	550	a, u

*See page 317

TABLE 59 BIOLOGICAL DATA PHYTOPLANKTON AT THE TOP OF THE THERMOCLINE (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Filamentous	Green Flagellates	Brown Flagellates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H426	Aug.	460	40	-	40	-	340	-	880	a, u
H428	Aug.	150	20	80	-	-	270	20	540	u, a
H372	Aug.	290	-	-	-	-	40	-	330	a
H374	Aug.	420	-	-	-	-	60	-	480	a, u
H376	Aug.	320	20	20	-	-	40	-	400	a, u
H378	Aug.	150	-	10	-	-	20	-	180	a
H380	Aug.	350	20	180	-	-	860	-	1,410	u, a
H320	Aug.	360	20	20	-	-	130	-	530	a, t
H322	Aug.	840	60	-	-	-	60	-	960	a
H324	Aug.	180	-	20	-	-	20	20	240	a
H326	Aug.	110	10	-	-	-	100	-	220	a, u

*See page 317

TABLE 59 BIOLOGICAL DATA PHYTOPLANKTON AT THE TOP OF THE THERMOCLINE (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H328	Aug.	270	-	40	-	-	360	-	220	a, u
H330	Aug.	290	80	20	-	-	170	-	560	a, u
Mouth of Saginaw Bay										
H204	June	230	100	20	-	-	170	-	520	c, t, i
	Aug.	940	-	20	-	-	230	-	1,190	a, t
Southern Lake Huron										
H130	Aug.	760	20	60	-	-	400	20	1,260	a, t
H132	Aug.	270	-	40	20	-	190	-	520	a, t
H134	Aug.	590	-	60	-	-	380	-	1,030	a, t

*See page 317

TABLE 60 BIOLOGICAL DATA PHYTOPLANKTON AT EUPHOTIC ZONE
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
North Channel										
H808	June	190	340	20	-	20	-	80	650	a, j, g, c
	Aug.	250	80	-	-	-	190	60	580	a, u
H809	Aug.	210	20	20	-	-	190	-	440	u, a
H812	Aug.	270	60	-	-	-	440	20	790	u, a
Georgian Bay										
H386	Aug.	250	-	20	-	-	1,150	40	1,460	u
H388	Aug.	230	20	40	-	-	400	20	710	u, a
Northern Lake Huron										
H814	Aug.	480	60	-	-	-	590	-	1,130	u, a
H532	Aug.	180	30	10	-	-	60	-	280	u, a
H534	Aug.	340	80	-	-	-	60	-	460	a, u
H536	Aug.	80	150	20	-	-	1,600	20	1,870	a, u

*See page 317

TABLE 60 BIOLOGICAL DATA PHYTOPLANKTON AT EUPHOTIC ZONE (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H420	Aug.	250	80	-	-	-	230	-	560	a, u
H422	Aug.	570	-	-	-	-	60	-	630	a, u
H424	Aug.	360	40	-	-	-	20	40	460	a
H426	Aug.	250	100	-	-	-	210	40	600	a, u, i
H428	Aug.	210	20	40	-	-	170	20	460	u, a
H370	Aug.	270	40	-	-	-	60	20	390	a, u
H372	Aug.	190	60	-	-	10	30	10	300	a, u
H374	Aug.	190	100	-	-	-	20	60	370	a, i, v
H376	Aug.	210	100	20	-	-	20	40	390	a, i
H378	Aug.	180	-	-	-	-	20	-	200	a
H380	Aug.	550	-	110	-	-	420	150	1,230	a, u, v

*See page 317

TABLE 60 BIOLOGICAL DATA PHYTOPLANKTON AT EUPHOTIC ZONE (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H320	June	630	250	20	-	-	250	60	1,210	c, i, a
H321	Nov.	500	20	20	-	-	-	20	560	a
H322	June	360	130	20	-	-	60	-	570	c, i
	Aug.	610	20	40	-	-	20	-	690	a
H324	Aug.	400	60	40	-	-	-	60	560	a, u,
H326	Aug.	230	100	20	-	-	80	130	560	a, u, i
Mouth of Saginaw Bay										
H204	June	520	250	-	-	-	130	60	960	c, i, t
Southern Lake Huron										
H252	Nov.	460	60	20	-	-	-	-	540	a
H132	June	550	150	20	-	-	80	-	800	c, i, t
H133	June	400	320	-	-	-	190	-	910	c, i, t
H134	June	220	100	-	-	-	80	40	440	c, i, t

*See page 317

TABLE 61 BIOLOGICAL DATA PHYTOPLANKTON NEAR THE BOTTOM
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
North Channel										
H808	June	150	250	20	20	-	-	20	460	a, i, c
	Aug.	40	80	20	-	-	210	-	350	u
H809	Aug.	210	40	-	-	-	740	-	990	u, j
H810	Aug.	100	60	20	-	-	440	20	640	u, a
H812	Aug.	20	100	-	-	-	740	-	860	u, j
Georgian Bay										
H382	Aug.	150	20	-	-	10	-	-	180	a
H386	Aug.	290	60	-	20	970	-	40	1,340	r, a
H388	Aug.	130	20	-	-	-	570	-	720	u, a
Northern Lake Huron										
H814	Aug	150	100	40	-	-	1,430	-	1,720	u
H532	June	250	40	60	-	40	40	20	450	c, a
	Aug.	240	80	-	-	-	110	10	440	a, u

*See page 317

TABLE 61 BIOLOGICAL DATA PHYTOPLANKTON NEAR THE BOTTOM (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Filamentous	Green Flagellates	Brown Flagellates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H534	Aug.	210	190	80	80	-	250	-	810	u, a
H536	Aug.	150	100	-	-	-	480	-	730	u, a
H420	Aug.	130	60	-	-	-	230	-	420	u, a, i
H422	Aug.	70	70	-	-	-	90	-	230	u, a, j
H424	June	380	190	40	-	-	-	-	610	c, i
	Aug.	70	-	10	-	-	70	-	150	u, a
H426	Aug.	150	80	-	-	-	100	-	330	a, u
H428	Aug.	230	20	20	-	-	250	20	540	u, a
H432	Aug.	100	100	20	-	-	150	-	370	u
H372	Aug.	190	60	-	-	10	30	10	300	a, u
H374	Aug.	190	60	-	-	-	20	10	280	a, u
H376	June	230	230	-	-	-	20	20	500	c, i
	Aug.	140	60	-	-	-	40	-	240	a, u

*See page 317

TABLE 61 BIOLOGICAL DATA PHYTOPLANKTON NEAR THE BOTTOM (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Filamentous	Green Flagellates	Brown Flagellates	Total	Predominant Genera* (10% or more)
Northern Lake Huron (cont'd)										
H378	Aug.	40	40	10	-	-	30	-	120	r, c, i, a
H380	Aug.	40	130	-	-	-	340	20	530	u, h
H320	June	320	190	-	-	-	150	-	660	c, i, u
	Aug.	120	120	-	-	-	-	-	240	a, j
H321	Nov.	440	20	40	20	-	60	-	580	a
H322	June	290	170	-	-	-	20	-	480	c, i
	Aug.	340	60	20	-	-	20	20	460	a
H324	June	230	210	40	-	-	-	40	520	c, i
	Aug.	90	100	-	-	-	90	10	290	i, c, a, u
H326	Aug.	40	80	-	-	-	70	-	190	j, t
H328	Aug.	320	150	20	-	-	130	60	680	a, u
H330	Aug.	840	500	-	-	-	40	100	1,480	a, v

*See page 317

TABLE 61 BIOLOGICAL DATA PHYTOPLANKTON NEAR THE BOTTOM (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Filamentous	Green Flagellates	Brown Flagellates	Total	Predominant Genera* (10% or more)
Mouth of Saginaw Bay										
H200	June	420	460	-	-	40	150	60	1,130	c, i, a
	Aug.	1,320	40	80	40	130	150	40	1,800	a, b, u, q
H202	Aug.	1, 850	80	-	-	-	460	40	2,430	a, u
	Nov.	400	60	20	-	-	-	-	480	a, j
H204	Aug.	670	150	-	-	-	360	-	1,180	a, u
H206	June	670	500	170	-	20	230	-	1,590	a, c, i, u
	Aug.	1,160	-	20	-	-	270	-	1,450	a, u
Southern Lake Huron										
H252	Nov.	590	-	20	-	-	-	-	610	a, j
H130	June	570	230	-	-	-	60	20	880	c, i
H132	June	500	60	20	-	-	80	-	660	c, u
	Aug.	520	-	20	-	-	150	20	710	a, u
	Nov.	100	150	100	20	-	-	40	410	a, i
H134	June	380	460	-	-	-	150	-	990	i, c, a, u
	Aug.	150	130	-	-	-	150	20	450	a, j, u

*See page 317

TABLE 61 BIOLOGICAL DATA PHYTOPLANKTON NEAR THE BOTTOM (Cont'd)
LAKE HURON DEEPWATER - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Southern Lake Huron (cont'd)										
H136	June	130	250	-	-	-	170	40	590	i, c, u
	Aug.	670	380	170	-	670	-	-	1,890	r, a
H102	June	400	290	-	-	-	80	-	770	c, i, a
H106	June	170	360	40	-	-	80	-	650	i, c, u
	Aug.	290	20	20	-	-	190	40	560	a, u
	Nov.	270	190	60	20	-	20	-	560	a, g

*See page 317

EXPLANATION LIST OF DEEPWATER PHYTOPLANKTON GENERA LAKE HURON BASIN - 1965

Centric Diatoms

a. Cyclotella-Stephanodiscus
b. Melosira
c. Rhizoselenia

Pennate Diatoms

d. Amphora
e. Asterionella
f. Fragilaria
g. Navicula
h. Nitzschia
i. Synedra
j. Tabellaria

Green Coccoids

k. Micractinium
l. Oocystis
m. Scenedesmus
n. Tetraedon
o. Unidentified

Blue-Green Coccoids

p. Coelosphaerium

Blue-Green Filamentous

q. Oscillatoria
r. Unidentified

Green Flagellates

s. Euglena
t. Trachelomonas
u. Unidentified

Brown Flagellates

v. Dinobryon

TABLE 62. AVERAGE PHYTOPLANKTON POPULATIONS
LAKE HURON BASIN - 1965

Area	Surface No. of Samples	No/ml	Thermocline No. of Samples	No/ml	1% Zone No. of Samples	No/ml	Bottom No. of Samples	No/ml
Deepwater								
North Channel	8	850	-	-	4	615	5	660
Georgian Bay	8	440	4	395	2	1,085	3	747
Northern Lake Huron	48	535	21	622	21	642	28	509
Southern Lake Huron	22	710	3	937	4	910	13	748
Mouth of Saginaw Bay	12	1,030	2	855	-	-	7	1,437
Total	98	650	30	640	31	680	56	710
Nearshore	26	1,480	-	-	-	-	-	-
Saginaw Bay	90	7,090	-	-	-	-	-	-

TABLE 63 BIOLOGICAL DATA NEARSHORE PHYTOPLANKTON
LAKE HURON BASIN - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Cheboygan										
H524	4-20	140	110	-	-	-	80	10	340	a, j
H525	7-7	130	150	40	-	-	20	40	380	a, g, e
Rogers City										
H402	4-20	250	290	-	-	-	5,120	80	5,740	j
Thunder Bay										
H361	4-20	190	190	20	-	40	500	-	940	j, a
	7-13	210	1,110	130	40	-	-	190	1,680	e, g, a
H362	7-13	150	380	150	-	-	40	60	780	a, g
H366	7-13	360	1,130	170	20	-	20	60	1,760	e, a, g
Harrisville										
H350	7-13	360	3,460	270	20	-	-	440	4,550	e, f, k
H352	7-13	-	60	40	-	-	-	20	120	-
H353	7-13	130	270	360	-	20	-	60	840	a

*See page 321

TABLE 63 BIOLOGICAL DATA NEARSHORE PHYTOPLANKTON (Cont'd)
LAKE HURON BASIN - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera* (10% or more)
Oscoda										
H301	7-13	1,260	1,340	800	20	-	40	40	3,500	a, j
H302	7-13	250	500	130	40	60	80	20	1,080	a, f
H303	4-21	340	500	40	-	-	10,900	-	11,780	j
	7-13	40	340	40	20	20	-	40	500	g, d
H304	7-13	80	340	100	-	20	20	40	600	g, d, i
Harbor Beach										
H121	6-29	130	270	80	20	-	-	20	520	a, f
H122	6-29	80	290	190	20	-	-	-	580	a, c
H124	6-29	40	100	20	40	-	40	20	260	h, j
H125	4-27	30	170	-	-	-	-	-	200	c, f
H126	4-27	80	420	140	-	30	-	-	400	d, g
H127	4-27	460	460	-	-	-	630	-	1,550	j, b, g

*See page 321

TABLE 63 BIOLOGICAL DATA NEARSHORE PHYTOPLANKTON (Cont'd)
LAKE HURON BASIN - 1965
(No's./ml)

Station	Survey	Centric Diatoms	Pennate Diatoms	Green Coccoids	Blue-Green Coccoids	Blue-Green Fila-mentous	Green Flagel-lates	Brown Flagel-lates	Total	Predominant Genera (10% or more)
Port Sanilac										
H111	6-29	20	20	-	-	-	-	40	80	-
H112	6-29	60	60	-	-	-	-	-	120	-
H113	4-29	20	60	-	-	-	-	-	80	-
H114	4-28	60	60	20	-	-	-	20	160	a, g
H115	4-28	-	40	-	-	-	-	-	40	d, h

EXPLANATION FOR NEARSHORE PHYTOPLANKTON GENERA
LAKE HURON BASIN - 1965

Centric Diatoms

a. Cyclotella-Stephanodiscus
b. Rhizoselenia

Pennate Diatoms

c. Amphora
d. Fragilaria
e. Navicula

Pennate Diatoms (Cont'd)

f. Nitzschia
g. Synedra
h. Tabellaria

Green Coccoids

i. Scenedesmus

Green Flagellates

j. Unidentified

Brown Flagellates

k. Dinobryon

TABLE 64 BIOLOGICAL DATA - JUNE DEEPWATER CHLOROPHYLL
LAKE HURON BASIN - 1965
(a, b - mg/M^3, c - MSPU/M^{3*})

Station	Surface a	Surface b	Surface c	Near Bottom a	Near Bottom b	Near Bottom c
North Channel						
H808	1.9	-	2.8	1.1	-	2.4
H809	2.6	-	2.5	3.3	-	7.6
H810	2.5	-	2.1	2.2	-	0.1
H812	2.1	0.3	5.4	1.7	-	2.5
Georgian Bay						
H382	1.1	-	3.1	1.4	-	3.9
H384	1.0	-	2.2	1.3	-	0.3
H386	0.7	-	0.4	0.9	-	1.0
H388	1.4	-	1.7	1.5	-	-
Northern Lake Huron						
H814	1.3	-	2.7	2.0	-	4.4
H530	1.6	-	2.3	1.5	-	2.9
H532	1.6	-	2.5	2.2	-	3.9
H534	1.4	-	3.3	2.0	3.0	0.8
H536	-	-	-	2.7	-	3.0
H420	1.1	-	3.1	1.6	-	1.4
H422	2.0	-	2.3	1.5	-	1.1
H424	1.7	0.1	2.5	2.1	0.1	0.5
H426	1.6	-	0.1	2.2	0.2	2.0
H428	1.9	0.2	1.8	2.1	-	1.0
H432	1.8	-	-	3.0	0.1	1.8
H370	0.8	-	2.4	1.8	0.1	2.4
H372	1.4	-	1.5	2.4	-	2.5
H374	1.9	0.2	1.0	1.9	-	3.1
H376	1.7	-	2.4	1.8	0.1	1.1
H378	2.3	0.1	1.0	2.3	-	0.9
H380	2.6	-	0.5	3.7	-	3.2
H320	3.3	0.2	2.6	2.7	-	1.4
H322	2.3	0.2	1.2	2.7	0.2	1.5
H324	4.4	-	1.2	5.1	0.4	3.8
H326	2.4	0.1	1.3	2.4	0.3	1.9
H328	1.7	-	2.0	3.1	0.3	2.0
H330	2.4	0.1	0.7	3.5	-	2.0

*MSPU/M^3 - thousandths specific pigment units per cubic meter

TABLE 64 BIOLOGICAL DATA - JUNE DEEPWATER CHLOROPHYLL (Cont'd)
LAKE HURON BASIN - 1965
(a, b - mg/M^3, c - $MSPU/M^{3*}$)

Station	Surface a	Surface b	Surface c	Near Bottom a	Near Bottom b	Near Bottom c
Mouth of Saginaw Bay						
H200	2.2	0.2	-	-	-	-
H202	2.6	0.2	2.5	2.2	0.1	1.4
H204	3.5	-	1.7	3.1	-	1.6
H206	2.3	0.1	2.5	4.7	0.2	4.0
Southern Lake Huron						
H130	2.4	-	0.9	3.2	0.3	1.3
H132	3.5	-	2.0	3.3	-	3.5
H133	4.0	0.5	0.9	3.1	-	2.7
H134	2.3	0.4	1.4	3.7	0.3	1.3
H136	2.5	0.4	1.5	2.5	0.4	1.5
H102	1.8	0.4	3.9	1.8	-	7.4
H106	2.0	0.4	8.2	3.4	-	2.5

$^*MSPU/M^3$ - thousandths specific pigment units per cubic meter

TABLE 65 BIOLOGICAL DATA - AUGUST DEEPWATER CHLOROPHYLL
LAKE HURON BASIN - 1965
(a, b - mg/M^3, c - MSPU/M^{3*})

Station	Surface a	Surface b	Surface c	Near Bottom a	Near Bottom b	Near Bottom c
North Channel						
H808	2.1	-	2.1	1.1	0.5	-
H809	1.8	0.2	-	1.5	0.3	0.7
H810	1.2	0.2	0.1	1.2	0.4	0.4
H812	2.3	0.3	-	1.8	0.8	2.2
Georgian Bay						
H382	1.2	-	0.6	1.0	0.6	0.7
H384	0.7	0.3	-	0.8	0.1	1.3
H386	1.4	-	0.2	1.0	0.9	-
H388	0.8	0.4	0.9	1.2	0.9	-
Northern Lake Huron						
H814	1.2	0.4	-	2.2	-	-
H530	1.6	-	0.9	2.1	-	2.4
H532	1.5	-	3.9	2.2	-	1.5
H534	1.1	-	1.2	1.5	-	1.5
H536	1.3	0.5	0.2	1.8	0.1	3.2
H420	1.2	0.9	-	1.3	0.3	1.0
H422	0.8	0.1	2.9	1.4	0.2	3.4
H424	1.3	-	3.5	1.2	0.2	3.2
H426	1.0	-	2.4	1.3	0.4	4.5
H428	1.8	-	2.6	1.3	0.4	2.8
H432	2.5	-	1.8	1.5	-	4.2
H370	1.4	-	1.6	1.6	0.2	3.0
H372	1.1	0.3	1.6	1.8	-	2.1
H374	0.6	-	1.8	0.9	0.2	2.0
H376	0.7	0.2	0.5	1.0	0.2	4.3
H378	1.0	0.1	0.3	1.1	0.4	0.6
H380	1.2	-	3.6	1.2	-	4.2
H320	1.2	0.2	0.5	1.2	0.2	-
H322	1.0	-	1.2	1.6	0.1	1.0
H324	0.9	0.4	0.8	1.5	-	3.0
H326	0.7	-	1.6	1.0	-	3.5
H328	0.9	0.2	0.9	1.8	0.1	1.5
H330	1.1	-	1.4	2.6	-	3.7

*MSPU/M^3 - thousandths specific pigment units per cubic meter

TABLE 65 BIOLOGICAL DATA - AUGUST DEEPWATER CHLOROPHYLL (Cont'd)
LAKE HURON BASIN - 1965
(a, b - mg/M^3, c - MSPU/M^{3*})

Station	Surface			Near Bottom		
	a	b	c	a	b	c
Mouth of Saginaw Bay						
H200	1.7	0.4	0.2	2.4	0.5	3.5
H202	1.7	0.4	0.8	2.3	0.2	-
H204	0.7	-	-	3.0	0.3	1.5
H206	1.3	-	1.1	1.1	0.2	0.8
Southern Lake Huron						
H130	1.2	0.4	0.4	1.6	-	0.7
H132	0.6	-	1.4	1.6	-	1.7
H134	-	-	-	1.6	0.2	3.8
H136	1.3	-	0.9	1.1	-	2.2
H102	0.9	-	-	1.8	-	7.4
H106	1.4	0.4	0.1	-	-	-

*MSPU/M^3 - thousandths specific pigment units per cubic meter

TABLE 66 AVERAGE CHLOROPHYLL CONCENTRATIONS
LAKE HURON BASIN
(a, b - mg/M^3, c - $MSPU/M^{3*}$)

June 1965

Area	No. of Samples	Surface a	Surface b	Surface c	Bottom a	Bottom b	Bottom c
Deepwater							
North Channel	4	2.3	.08	3.2	2.1	.00	3.2
Georgian Bay	4	1.0	.00	1.0	1.3	.00	1.3
Northern Lake Huron	23	1.9	.05	1.7	2.5	.20	2.1
Southern Lake Huron	7	2.6	.30	2.7	3.0	.10	2.9
Mouth of Saginaw Bay	4	2.6	.10	1.7	3.3	.10	2.3
Total	42	2.0	.10	2.0	2.5	.10	2.3
Saginaw Bay	11	11.7	.60	3.1	-	-	-

August 1965

Area	No. of Samples	Surface a	Surface b	Surface c	Bottom a	Bottom b	Bottom c
Deepwater							
North Channel	4	1.8	.20	.6	1.4	.50	.8
Georgian Bay	4	1.0	.20	.4	1.0	.60	.8
Northern Lake Huron	23	1.2	.10	1.5	1.5	.10	2.5
Southern Lake Huron	6	.9	.10	.5	1.3	.03	2.6
Mouth of Saginaw Bay	4	1.4	.20	.5	2.2	.30	1.4
Total	41	1.2	.20	1.1	1.5	.20	2.0

*$MSPU/M^3$ - special chlorophyll c unit; thousandths of specific pigment units per cubic meter

WATER QUALITY PROBLEMS

After the physical, chemical, bacteriological, and biological surveys of Lake Huron were completed, the data were compiled and evaluated as to the present quality and the present and future problems.

In the Lake Huron deepwater areas, it was summarized that the upper lake area had good, acceptable quality and the nearshore areas showed varying levels of degradation. Chemical and bacteriological data indicated the effects from the tributaries and nearshore stations. The pollution-sensitive forms were predominant in the deepwater area (beyond five miles). Closer to the shore, one-half to one mile, the proportion of pollution-tolerant forms increased. Transparency measurements as high as thirty feet were characteristic of the deeper areas, whereas the harbor areas were less transparent, some cases being less than six feet. The levels of several parameters were observed to be lower at the Straits of Mackinac than at Port Huron, such as total soluble phosphate, chloride, ammonia nitrogen, and nitrate nitrogen, with the Saginaw Bay area being the greatest contributor. Dissolved oxygen showed a gradual decrease, indicating some degradation from the nearshore areas and Saginaw Bay.

The oxygen level was near saturation of the water flowing from Lake Michigan and Lake Superior into Lake Huron. The level was also near saturation of the water flowing from Lake Huron at Port Huron, although slightly lower.

Lake Superior had excellent water quality and was acceptable for all uses. The water from Lake Michigan had good water quality with occasional parameters that exceeded the recommended limits. The BOD_5, total solids, ammonia nitrogen, chlorides, phenols, magnesium, sulfate, hardness and conductivity parameters were all in greater concentrations in the water flowing from Lake Michigan than Lake Superior, although the levels are not in the range that could be considered as water quality problems.

Because the nearshore areas and tributaries were the areas that caused the degradation, each area was analyzed separately.

At the Straits of Mackinac, the three main sources of waste were the municipal treatment plants at St. Ignace, Mackinaw City, and Mackinac Island. The data for these areas indicated nutrients in concentrations that could, with adequate heat and light, create algae growths. The iron level at St. Ignace was above the recommended safe level for aquatic life.

Degradation was noted at the mouth of the Cheboygan River due to the municipal and industrial wastes and caused low dissolved oyxgen, high nutrients for potential algal growths, excess phenols, and high total coliform counts. These potential problems were reduced in the lake to minimal concentrations. A majority of pollution-sensitive animals were also found.

Limited data at Rogers City showed increased coliform concentration down lake from the marina area, but this was diluted in passage. The waste treatment plant for the community was the major waste source.

Water quality in the Thunder Bay River was degraded by paper mill waste and often appeared murky. Pollution-tolerant organisms were abundant. The dissolved oxygen concentrations diminished from the bay; 11.1 mg/l to the mouth of the river at 7.4 mg/l. The nutrient values also increased from the outer range to the mouth of the river. In the right combination, these nutrients, along with adequate heat and light, can stimulate algal blooms. The concentration of total solids at the mouth was greater than the maximum suggested value of 200 mg/l for water. Phenol concentrations were the highest just below the treatment plant as was the total coliform count. Generally, the total and total fecal coliforms at the mouth of the river were acceptable at time for recreational purposes. Of all the nearshore areas, Thunder Bay showed the most severe levels of degradation.

There are no known sources of municipal or industrial waste effluent in the Harrisville area. Possible sources of pollution might be storm runoff or watercraft discharges to the harbor area. A potential source exists from a submerged pipeline a mile north of Harrisville which extends one and one half miles from shore. Fuel tankers anchor in the 30-35 foot deepwater, engage and raise flexible end of the pipeline and pump cargo to a fuel farm located ashore. The immediate harbor area contained concentrations that could develop into problem areas, as the total and total soluble phosphates were at levels that - if combined with an adequate amount of nitrogen under the proper conditions - could produce algal growths.

The Au Sable River's main sources of waste were the domestic waste treatment plants at Wurtsmith Air Force Base and to a lesser degree those at Grayling and Roscommon. Urban runoff and inefficient individual treatment systems were minor sources. Pollution is evident in the elevated bacterial densities and minor dissolved oxygen depression in the lower river and at the mouth of the river. In addition to bacterial problems, elevated nutrient concentrations were evident. Although the Au Sable River in its lower reach and immediate harbor area were of a degraded nature, the effect was not carried into Lake Huron.

The Saginaw Bay area receives water from the Saginaw River system as well as the many small tributaries that line the bay. Nutrients are high from the Saginaw River as well as many of the tributaries, and algal growth is possible in many of these areas and would be aggravated by low flow. Solids are high from most of these areas but are settled out or diluted in the bay before reaching Lake Huron. These areas abound in pollution-tolerant bottom dwelling organisms. The high total coliforms present at the mouth of the Saginaw River and various tributaries, appeared to be diluted in the bay to levels that are acceptable for total body contact by the time the water reaches the outer bay area.

At Harbor Beach, the municipal treatment plant and the industrial treatment plant from Huron Milling Division-Hercules incorporated were the only major sources of wastewater. In 1967, treatment facility at the industry was rated as inadequate, but additional plans are underway for improved treatment. The variation observed was that higher results were obtained at the breakwater stations. In most cases, the phosphate levels were above desirable concentrations, ranging to 1.9 mg/l at the breakwater and .7 mg/l in the outer harbor area and could stimualte growths of algae. Bacterial quality was impaired in the breakwater area although the levels were recuded in the lake to levels of minimal concentrations.

The only possible sources of any waste material were from stormwater runoff and watercraft discharge in the marina area, as no sources of municipal or industrial waste were known in the Port Sanilac area. Values were the highest at the breakwater locations with solids, nutirents and total coliform showing what could develop into algal growth problems.

With all of the available undeveloped land in ideal recreational locations, development for this use is inevitable.

Planned development of the area is essential to make maximum utilization of the water resource possible without destroying the environment.