



# Water Resources Data Michigan Water Year 1991



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-91-1  
Prepared in cooperation with the State of Michigan  
and with other agencies

# CALENDAR FOR WATER YEAR 1991

1990

OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	2	3	4	5	6					1	2	3							1
7	8	9	10	11	12	13								2	3	4	5	6	7	8
14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15
21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22
28	29	30	31				25	26	27	28	29	30		23	24	25	26	27	28	29
														30	31					

1991

JANUARY							FEBRUARY							MARCH						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
		1	2	3	4	5						1	2						1	2
6	7	8	9	10	11	12								5	4	5	6	7	8	9
13	14	15	16	17	18	19	10	11	12	13	14	15	16	10	11	12	13	14	15	16
20	21	22	23	24	25	26	17	18	19	20	21	22	23	17	18	19	20	21	22	23
27	28	29	30	31			24	25	26	27	28			24	25	26	27	28	29	30
														31						
APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	2	3	4	5	6					1	2	3							1
7	8	9	10	11	12	13								2	3	4	5	6	7	8
14	15	16	17	18	19	20	5	6	7	8	9	10	11	9	10	11	12	13	14	15
21	22	23	24	25	26	27	12	13	14	15	16	17	18	16	17	18	19	20	21	22
28	29	30					19	20	21	22	23	24	25	23	24	25	26	27	28	29
							26	27	28	29	30	31		30						
JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	2	3	4	5	6					1	2	3	1	2	3	4	5	6	7
7	8	9	10	11	12	13								8	9	10	11	12	13	14
14	15	16	17	18	19	20	4	5	6	7	8	9	10	15	16	17	18	19	20	21
21	22	23	24	25	26	27	11	12	13	14	15	16	17	22	23	24	25	26	27	28
28	29	30	31				18	19	20	21	22	23	24	29	30					
							25	26	27	28	29	30	31							





# Water Resources Data Michigan Water Year 1991

by S.P. Blumer, W.W. Larson, R.J. Minnerick, C.R. Whited, and R.L. LeuVoy



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-91-1  
Prepared in cooperation with the State of Michigan  
and with other agencies

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

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Lansing, Michigan 48911

1992



## PREFACE

This volume of the annual hydrologic data report of Michigan is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each state, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and quality of water provide the hydrologic information needed by state, local, and federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the collection, processing, and tabulation of the data:

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## SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

Letters after station name designate type of data collected: (d) discharge, (c) chemical, (e) elevation, gage heights, or contents, (m) microbiological, (p) pesticide, (r) radio-chemical, (t) water temperature, (s) sediment

	Station number	Page
<b>ST. LAWRENCE RIVER BASIN</b>		
<b>STREAMS TRIBUTARY TO LAKE SUPERIOR</b>		
Washington Creek at Windigo (d,c,m,r,t,s)	04001000	26
Middle Branch Ontonagon River near Paulding (d)	04033000	31
Bond Falls Reservoir:		
Bond Falls Canal near Paulding (d)	04033500	32
Bond Falls Reservoir near Paulding (e)	04034000	33
Middle Branch Ontonagon River near Trout Creek (d)	04034500	34
Middle Branch Ontonagon River near Rockland (d)	04035500	35
Lake Gogebic near Bergland (e)	04035995	36
West Branch Ontonagon River near Bergland (d)	04036000	37
South Branch Ontonagon River:		
Cisco Lake near Watersmeet (e)	04037400	38
Cisco Branch Ontonagon River at Cisco Lake Outlet (d)	04037500	39
Ontonagon River near Rockland (d,c,m,s)	04040000	40
Portage River (Portage Lake):		
Sturgeon River near Sidnaw (d)	04040500	43
Sturgeon River near Alston (d)	04041500	44
Trap Rock River near Lake Linden (d)	04043050	45
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McClure Storage Basin Release near Marquette (d)	04043800	46
Sand River Wildlife Flooding at Sand River (e)	04044609	47
Tahquamenon River near Paradise (d,c,m,s)	04045500	48
<b>STREAMS TRIBUTARY TO ST. MARYS RIVER</b>		
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Manistique Lake near Curtis (e)	04047200	53
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Indian Lake near Manistique (e)	04057000	55
Sturgeon River near Nahma Junction (d)	04057510	56
Middle Branch Escanaba River at Humboldt (d)	04057800	57
Greenwood Reservoir near Greenwood (e)	04057811	59
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Schweitzer Reservoir near Palmer (e)	04058190	63
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Menominee River near Vulcan (d)	04065722	80
Menominee River below Pemene Creek near Pembine, WI (d)	04066003	81
St. Joseph River near Burlington (d)	04096400	82
Coldwater River:		
South Branch Hog Creek near Allen (d)	04096515	83
Nottawa Creek near Athens (d)	04096900	84
Portage River:		
Gourdneck Creek:		
Gourdneck Canal near Schoolcraft (d)	04097195	85
Prairie River near Nottawa (d)	04097540	86
St. Joseph River at Mottville (d)	04099000	87
Pigeon River near Scott, IN (d)	04099750	88
North Branch Elkhart River at Cosperville, IN (d)	04100222	89
Elkhart River at Goshen, IN (d)	04100500	90
St. Joseph River at Elkhart, IN (d)	04101000	91
St. Joseph River at Niles (d,c,m,s)	04101500	92
Dowagiac River at Sumnerville (d)	04101800	95
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Black River:		
South Branch Black River near Bangor (d)	04102700	97
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Battle Creek at Battle Creek (d)	04105000	99
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## SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME--Continued

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## SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME--Continued

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North Branch Belle River at Imlay City (d) . . . . .	04160570	196
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STREAMS TRIBUTARY TO LAKE ST. CLAIR		
Clinton River:		
Sashabaw Creek near Drayton Plains (d) . . . . .	04160800	198
Clinton River near Drayton Plains (d) . . . . .	04160900	199
Galloway Creek near Auburn Heights (d) . . . . .	04161100	200
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Paint Creek at Rochester (d) . . . . .	04161540	202
Stony Creek near Romeo (d) . . . . .	04161580	203
Stony Lake near Washington (e) . . . . .	04161790	204
Stony Creek near Washington (d) . . . . .	04161800	205
Red Run:		
Plum Brook at Utica (d) . . . . .	04163400	206
Clinton River near Fraser (d) . . . . .	04164000	207
North Branch Clinton River:		
East Pond Creek at Romeo (d) . . . . .	04164100	208
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East Branch Coon Creek at Armada (d) . . . . .	04164300	209
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## GROUND-WATER WELLS, BY COUNTY, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

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## DISCONTINUED SURFACE-WATER-DISCHARGE OR STAGE-ONLY STATIONS

The following continuous-record surface-water discharge or stage-only stations (gaging stations) in Michigan have been discontinued. Daily streamflow or stage records were collected and published for the period of record, expressed in water years, shown for each station. Those stations with an asterisk (\*) after the station number have had previous or subsequent operation as a crest-stage partial-record station. Information regarding these stations may be obtained from the District Office at the address given on the back side of the title page of this report.

[Letters after station name designate type of data collected: (d) discharge, (e) elevation (stage only). Letter (a) before drainage area means approximately.]

Station name	Station number	Drainage area (mi <sup>2</sup> )	Period of record
STREAMS TRIBUTARY TO LAKE SUPERIOR			
Montreal River at Ironwood, MI (d)	04028000	63.0	1918-22, 1924-26, 1949-54
Montreal River near Saxon, WI (d)	04030000	262	1938-70
Black River at Ramsay, MI (d)	04030500	a82	1924-25
Black River near Bessemer, MI (d)	04031000	200	1955-82
Presque Isle River at Marenisco, MI (d)	04031500	171	1945-82
Presque Isle River near Tula, MI (d)	04032000*	261	1945-73
Iron River near White Pine, MI (d)	04032500	98.1	1952-57
East Branch Ontonagon River near Mass, MI (d)	04035000	272	1942-79
Cisco Branch Ontonagon River near Watersmeet, MI (d)	04038000	62.2	1942-44
South Branch Ontonagon River at Ewen, MI (d)	04039500*	348	1942-71
Perch River near Sidnaw, MI (d)	04041000*	63.1	1913-15
Sturgeon River near Baraga, MI (d)	04042000	379	1927-31, 1943-47
Otter River near Elo, MI (d)	04042500*	162	1942-72
Sturgeon River near Arnheim, MI (d)	04043000	705	1942-74
Dead River near Negaunee, MI (d)	04043500	138	1902-03
Dead River at Forestville, MI (d)	04044000	158	1899-1902
Carp River near Negaunee, MI (d)	04044400	51.4	1961-87
Carp River near Marquette, MI (d)	04044500	a86	1902-04
Big Creek near Harvey, MI (d)	04044563	17.0	1979-81
Cedar Creek near Harvey, MI (d)	04044573	9.04	1979-81
Cherry Creek near Harvey, MI (d)	04044583	4.53	1965-70, 1979-81
Silver Creek at Harvey, MI (d)	04044595	8.58	1979-81
Tahquamenon River at Newberry, MI (d)	04045000	a200	1934-36
STREAMS TRIBUTARY TO LAKE MICHIGAN			
Black River near Garnet, MI (d)	04046000*	a28	1951-78
South Manistique Lake Outlet at Curtis, MI (d)	04046500	a44	1942-44
North Manistique Lake Outlet at Helmer, MI (d)	04047000	a15	1942-44
Manistique River near Germfask, MI (d)	04047500	a120	1942-50
Fox River at Seney, MI (d)	04048000	107	1942-44
East Branch Fox River near Germfask, MI (d)	04048500	104	1942-44
Holland Creek near Seney, MI (d)	04049000	a13	1938-42
Manistique River at Germfask, MI (d)	04049500*	341	1938-70
Goose Pen Outlet at Germfask, MI (d)	04050000	--	1939-41
Grays Creek near Germfask, MI (d)	04050500	a36	1938-40
Pine Creek near Germfask, MI (d)	04051000	a11	1938-40
Sand Creek near Germfask, MI (d)	04051500	a6	1938-40
Driggs River near Seney, MI (d)	04052000	a70	1938-42
Walsh Creek near Seney, MI (d)	04052500	a12	1938-42
Driggs River near Germfask, MI (d)	04053000	114	1938-41
Marsh Creek near Shingleton, MI (d)	04053500	a20	1938-42
Marsh Creek near Germfask, MI (d)	04054000	--	1938-41
Duck Creek near Blaney, MI (d)	04054500	a92	1938-54
Manistique River near Blaney, MI (d)	04055000*	704	1938-70
Creighton River near Shingleton, MI (d)	04055500	a35	1938-42

## DISCONTINUED SURFACE-WATER-DISCHARGE OR STAGE-ONLY STATIONS--Continued

Station name	Station number	Drainage area (mi <sup>2</sup> )	Period of record
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued			
West Branch Manistique River near Manistique, MI (d)	04056000	322	1938-56
Indian River near Manistique, MI (d)	04057000*	302	1938-71
Sturgeon River near St. Jacques, MI (d)	04057500	167	1950-52
Middle Branch Escanaba River near Greenwood, MI (d)	04057820*	73.3	1973-82
Black River near Republic, MI (d)	04057900*	34.4	1961-68
Middle Branch Escanaba River near Ishpeming, MI (d)	04058000	128	1954-75
Green Creek near Princeton, MI (d)	04058130	13.8	1977-82
Warner Creek near Palmer, MI (d)	04058300*	14.2	1961-68, 1972-78
Goose Lake Outlet near Sands Station, MI (d)	04058400*	37.5	1966-82
East Branch Escanaba River at Gwinn, MI (d)	04058500	124	1955-80
Tenmile Creek at Perronville, MI (d)	04059400*	38.4	1971-77
Iron River near Iron River, MI (d)	04060000	a65	1901-04
Iron River at Caspian, MI (d)	04060500	92.1	1948-80
Peshekee River near Michigamme, MI (d)	04062100	66.5	1961-68
Peshekee River near Champion, MI (d)	04062200*	133	1961-78
Michigamme River near Michigamme, MI (d)	04062230	194	1969-82
Michigamme River near Champion, MI (d)	04062270	231	1964-69
Michigamme River at Republic, MI (d)	04062300*	240	1961-75
Michigamme River near Witch Lake, MI (d)	04062400	316	1964-80
Menominee River near Iron Mountain, MI (d)	04065000	2,430	1898-99, 1903-14
West Branch Sturgeon River near Randville, MI (d)	04065300	56.1	1958-81
East Branch Sturgeon River below Skunk Creek near Felch, MI (d)	04065393	61.8	1974-84
East Branch Sturgeon River at Hardwood, MI (d)	04065397	90.8	1978-83
Sturgeon River near Foster City, MI (d)	04065500	237	1955-80
Pine Creek near Iron Mountain, MI (d)	04065600	16.8	1972-81
Menominee River below Koss, MI (d)	04067000	3,720	1907-09, 1913-81
Menominee River near McAllister, WI (d)	04067500*	3,930	1945-61, 1980-86, 1988-90
Galien River near New Troy, MI (d)	04095500	a47	1945-47
East Branch Galien River near New Troy, MI (d)	04096000	19.2	1945-47
Beebe Creek near Hillsdale, MI (d)	04096272*	42.4	1974-78
Sand Creek at Litchfield, MI (d)	04096312*	20.6	1974-77
Soap Creek near Litchfield, MI (d)	04096325	10.9	1975-77
St. Joseph River at Clarendon, MI (d)	04096340*	144	1974-77
Sauk (East Branch Coldwater) River at Coldwater, MI (d)	04096500	--	1938-62
Coldwater River near Hodunk, MI (d)	04096600	293	1963-89
St. Joseph River at Mendon, MI (d)	04097000	918	1903-05
Little Portage Creek near Fulton, MI (d)	04097060*	27.0	1965-67
Portage River near Vicksburg, MI (d)	04097170*	68.2	1946-51, 1965-80
Gourdneck Creek near Schoolcraft, MI (d)	04097200	7.29	1964-73
St. Joseph River at Three Rivers, MI (d)	04097500	1,350	1953-83
Fawn River near White Pigeon, MI (d)	04098500*	192	1903-04, 1958-75
St. Joseph River at Berrien Springs, MI (d)	04102000*	4,081	1901-07, 1909-32, 1951-56
Paw Paw River near Paw Paw, MI (d)	04102320	195	1980-82
Paw Paw River near Hartford, MI (d)	04102420	311	1980-82
South Branch Kalamazoo River near Albion, MI (d)	04102850	146	1972-76
Reed's Springs near Albion, MI (d)	04103000	--	1905-06
Kalamazoo River at Marshall, MI (d)	04103500	449	1949-82
Battle Creek at Charlotte, MI (d)	04104000	a67	1948-54
Battle Creek at Bellevue, MI (d)	04104500	178	1948-53
Gull Creek near Galesburg, MI (d)	04105800*	38.1	1965-73

## DISCONTINUED SURFACE-WATER-DISCHARGE OR STAGE-ONLY STATIONS--Continued

Station name	Station number	Drainage area (mi <sup>2</sup> )	Period of record
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued			
Portage Creek near Portage, MI (d)	04106190	18.6	1965-67
Portage Creek at Kalamazoo, MI (d)	04106500	46.8	1948-58, 1975-86
Gun River at dam near Shelbyville, MI (d)	04107000	a30	1946-47
Gun River near Martin, MI (d)	04107500	a35	1946-47
Kalamazoo River near Allegan, MI (d)	04108000	a1,470	1903-08
Portage River below Little Portage Lake near Munith, MI (d)	04109500	a55	1944-56
Orchard Creek at Munith, MI (d)	04110000	a49	1944-56
Portage River near Munith, MI (d)	04110500	118	1944-46
Grand River near Eaton Rapids, MI (d)	04111000	661	1951-82
Red Cedar River near Williamston, MI (d)	04111379	163	1975-89
Mud Lake Drain at Lansing, MI (d)	04112904	4.28	1975-76
Carrier Creek near Lansing, MI (d)	04113097	12.1	1975-80
Sebewa Creek near Sunfield, MI (d)	04113500	24.1	1954-56
Fish Creek near Carson City, MI (d)	04115500	145	1936-38
Flat River at Smyrna, MI (d)	04116500	528	1951-86
Quaker Brook near Nashville, MI (d)	04117000*	7.60	1954-75
Grand River at Eastmanville, MI (d)	04119300	a5,230	1976-77
Crockery Creek at Slocums Grove, MI (d)	04120000	--	1903
Higgins Lake Outlet (head of Muskegon River) near Roscommon, MI (d)	04120500	49.2	1942-50
Muskegon River near Merritt, MI (d)	04121000*	355	1947-74
Big Sable River near Freesoil, MI (d)	04123000*	115	1942-74
Manistee River near Grayling, MI (d)	04123500*	123	1943-74
East Branch Pine River near Tustin, MI (d)	04124500*	60.0	1952-63
Pine River near Le Roy, MI (d)	04125000*	128	1952-63
Pine River near Hoxeyville, MI (d)	04125500	251	1952-82
Little Manistee River near Freesoil, MI (d)	04126200*	178	1957-75
Little Manistee River near Stronach, MI (d)	04126500	a196	1931
Boardman River near Mayfield, MI (d)	04127000	182	1952-89
Boardman River at Traverse City, MI (d)	04127500	--	1903-04
STREAMS TRIBUTARY TO LAKE HURON			
Indian River at Indian River, MI (d)	04128500	598	1942-82
Pigeon River at Afton, MI (d)	04129500	139	1942-81
Cheboygan River near Cheboygan, MI (d)	04130000	889	1943-82
Rainy River near Onaway, MI (d)	04131000	75.7	1942-52
Rainy River near Ocqueoc, MI (d)	04131500*	87.9	1953-79
Black River near Cheboygan, MI (d)	04132000*	558	1943-74
Thunder Bay River near Hillman, MI (d)	04132500*	232	1945-73
Upper South Branch Thunder Bay River near Lachine, MI (d)	04133000	171	1945-54
Thunder Bay River near Bolton, MI (d)	04133500	588	1945-80
North Branch Thunder Bay River near Bolton, MI (d)	04134000	184	1945-80
Lower South Branch Thunder Bay River near Hubbard Lake, MI (d)	04134500	146	1945-54
East Branch Au Sable River at Grayling, MI (d)	04135600	76.0	1958-84
Au Sable River near Red Oak, MI (d)	04136000	a1,000	1909-16, 1931
Au Sable River at Bamfield, MI (d)	04137000	a1,420	1902-14
East Branch Au Gres River at McIvor, MI (d)	04138000*	a84	1951-74
Au Gres River near National City, MI (d)	04138500	154	1951-81
Houghton Creek near Lupton, MI (d)	04139000*	29.7	1950-73
Rifle River at "The Ranch" near Lupton, MI (d)	04139500	56.8	1950-71
Prior Creek near Selkirk, MI (d)	04140000*	21.4	1950-73
Rifle River at Selkirk, MI (d)	04140500*	117	1950-82



## DISCONTINUED SURFACE-WATER-DISCHARGE OR STAGE-ONLY STATIONS--Continued

Station name	Station number	Drainage area (mi <sup>2</sup> )	Period of record
STREAMS TRIBUTARY TO LAKE HURON--Continued			
South Branch Shepards Creek near Selkirk, MI (d)	04141000*	1.15	1952-78
West Branch Rifle River near Selkirk, MI (d)	04141500*	a52	1952-63
Rifle River at Omer, MI (d)	04143000	364	1902-04
North Branch Kawkawlin River near Kawkawlin, MI (d)	04143500	101	1951-82
Shiawassee River at Byron, MI (d)	04144000	365	1948-83
Bad River near Brant, MI (d)	04145500*	a89	1949-59
Flint River at Columbiaville, MI (d)	04146500	470	1932-33, 1948-52
Butternut Creek near Genesee, MI (d)	04147990	34.7	1970-84
Flint River at Genesee, MI (d)	04148000	a593	1931-52
Gilkey Creek near Flint, MI (d)	04148160	6.43	1970-84
Swartz Creek near Holly, MI (d)	04148200*	12.1	1956-75
Swartz Creek at Flint, MI (d)	04148300*	115	1970-84
Thread Creek near Flint, MI (d)	04148440*	54.4	1970-84
Brent Run near Montrose, MI (d)	04148720	20.8	1970-84
Flint River near Alicia, MI (e)	04149500	--	1949-84
South Branch Cass River near Cass City, MI (d)	04150000	238	1949-80
Cass River at Vassar, MI (d)	04151000*	710	1910-28, 1949-70
Tobacco River at Beaverton, MI (d)	04152500	487	1948-82
Kinney Creek near Clare, MI (d)	04153000	a9	1935-36
Salt River near North Bradley, MI (d)	04153500	138	1934-71
Chippewa River near Midland, MI (d)	04154500*	597	1948-73
Tittabawassee River at Freeland, MI (d)	04156500	a2,530	1903-10, 1912-36
State Drain near Sebewaing, MI (d)	04157500	67.3	1940-54
Columbia Drain near Sebewaing, MI (d)	04158000	33.9	1940-54, 1988-90
Pigeon River near Owendale, MI (d)	04158500	53.2	1953-82
Pigeon River near Pigeon, MI (d)	04159000	93.3	1947-52
STREAMS TRIBUTARY TO ST. CLAIR RIVER			
Silver Creek near Jeddo, MI (d)	04159488	20.6	1978-82
Mill Creek near Abbottsford, MI (d)	04160000*	185	1947-64
Black River near Port Huron, MI (d)	04160050	684	1931, 1933-44
STREAMS TRIBUTARY TO LAKE ST. CLAIR			
Clinton River at Auburn Heights, MI (d)	04161000*	123	1935-40, 1957-82
Clinton River at Sterling Heights, MI (d)	04161820	309	1979-83
Red Run near Warren, MI (d)	04162010	--	1980-88
Bear Creek at Warren, MI (d)	04162500	17.3	1954-57
Big Beaver Creek near Warren, MI (d)	04162900	--	1959-88
Big Beaver Creek at Warren, MI (d)	04163000	25.2	1954-58
Plum Brook near Utica, MI (d)	04163500	22.9	1954-66
Red Run near Cady, MI (e)	04163900	--	1980-82
North Branch Clinton River at Almont, MI (d)	04164010*	9.56	1963-68
North Branch Clinton River near Romeo, MI (d)	04164050*	49.7	1965-69
North Branch Clinton River near Meade, MI (d)	04164150*	89.6	1968-72
Coon Creek near Armada, MI (d)	04164200*	10.0	1966-70
Tupper Brook at Ray Center, MI (d)	04164250*	8.62	1960-64
Highbank Creek near Armada, MI (d)	04164350*	14.9	1965-70
East Branch Coon Creek near New Haven, MI (d)	04164360*	36.1	1968-72

## DISCONTINUED SURFACE-WATER-DISCHARGE OR STAGE-ONLY STATIONS--Continued

Station name	Station number	Drainage area (mi <sup>2</sup> )	Period of record
STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued			
Deer Creek near Meade, MI (d)	04164400*	12.7	1960-65
McBride Drain near Macomb, MI (d)	04164450*	5.79	1960-64
Middle Branch Clinton River near Macomb, MI (d)	04164600*	22.2	1965-69
Middle Branch Clinton River at Macomb, MI (d)	04164800*	41.0	1963-68, 1970-82
Middle Branch Clinton River near Mount Clemens, MI (d)	04165000	a51	1947-49
Gloede Ditch near Waldenburg, MI (d)	04165200*	16.0	1959-64
Clinton River By-Pass below weir at Mount Clemens, MI (e)	04165556	--	1980-83
Clinton River By-Pass at mouth at Mount Clemens, MI (e)	04165557	--	1980-83
STREAMS TRIBUTARY TO DETROIT RIVER			
Lower River Rouge at Dearborn, MI (d)	04168500	91.9	1931-33
STREAMS TRIBUTARY TO LAKE ERIE			
Hayes Creek at Commerce, MI (d)	04169000	a8	1946-51
Huron River at Commerce, MI (d)	04169500*	57.3	1946-75
Davis Creek near Whitmore Lake, MI (d)	04171000	65.8	1953-54
Ore Creek near Brighton, MI (d)	04171500	a31	1951-68
Portage River near Pinckney, MI (d)	04172500*	79.1	1945-71
Huron River near Dexter, MI (d)	04173000*	522	1904, 1946-72, 1976-77
Mill Creek near Dexter, MI (d)	04173500	128	1952-83
Huron River at Dexter, MI (e)	04174000	--	1904-16
Stony Creek at Oakville, MI (d)	04175340	68.0	1970-81
Huron River at Flat Rock, MI (d)	04175500	851	1904-11
Huron River at Flat Rock, MI (e)	04175500	851	1912-22
River Raisin near Tecumseh, MI (d)	04175700	267	1956-80
Saline River near Saline, MI (d)	04176400*	94.6	1966-77

## DISCONTINUED SURFACE-WATER-QUALITY STATIONS

The following stations were discontinued as continuous-record surface-water-quality stations prior to the 1991 water year. Daily records of temperature, specific conductance, or sediment were collected and published for the record shown for each station.

[Type of record: Temp. (temperature), S.C. (specific conductance), Sed. (sediment). Letter (a) before drainage area means approximately.]

Station name	Station number	Drainage area (mi <sup>2</sup> )	Type of record	Period of record
Black River near Bessemer, MI	04031000	200	Temp.	1955-71
Sturgeon River near Chassell, MI	04043004	723	Temp., S.C.	1978-81
Trap Rock River near Lake Linden, MI	04043050	28.0	Temp.	1972-83
Salmon Trout River near Big Bay, MI	04043250	37.8	Temp.	1971-73
Black River near Garnet, MI	04046000	a28	Temp.	1952-75 1977-78
Manistique River above Manistique, MI	04057004	a1,445	Temp., S.C.	1976-81
Manistique River at Manistique, MI	04057005	a1,450	Temp., S.C.	1975
Middle Branch Escanaba River at Humboldt, MI	04057800	46.0	Temp.	1973-78
Greenwood Afterbay near Greenwood, MI	04057812	67.4	Temp.	1973-86
Greenwood Diverson near Greenwood, MI	04057813	--	Temp.	1973-82
Greenwood Release near Greenwood, MI	04057814	67.4	Temp.	1973-82
Middle Branch Escanaba River near Greenwood, MI	04057820	73.3	Temp.	1973-78
Black River near Republic, MI	04057900	34.4	Sed.	1962-63, 1965, 1962-68
Middle Branch Escanaba River near Ishpeming, MI	04058000	128	Temp.	1962-75, 1977-82
Green Creek near Palmer, MI	04058120	8.42	Temp., Sed.	1965, 1979-80
Green Creek near Princeton, MI	04058130	13.8	Temp.	1977-81
Schweitzer Creek near Palmer, MI	04058200	23.6	Temp.	1962-71
Goose Lake Outlet near Sands Station, MI	04058400	37.5	Temp.	1977-81
East Branch Escanaba River at Gwinn, MI	04058500	124	Temp.	1955-64
Paint River near Alpha, MI	04062000	631	Sed.	1962-63
			Temp.	1953-54, 1956-57
Peshekee River near Champion, MI	04062200	133	Temp.	1962, 1964-78
Michigamme River near Witch Lake, MI	04062400	316	Temp., Sed.	1965-69
East Branch Sturgeon River at Hardwood, MI	04065397	90.8	Temp.	1978-83
Sturgeon River near Foster City, MI	04065500	237	Temp.	1957-80
Pine Creek near Iron Mountain, MI	04065600	16.8	Temp.	1972-81
Menominee River near McAllister, WI	04067500	3,930	Temp., S.C.	1980,
Beebe Creek near Hillsdale, MI	04096272	42.4	Sed.	1975,
Sand Creek at Litchfield, MI	04096312	20.6	Temp., Sed.	1976-77
Soap Creek near Litchfield, MI	04096325	10.9	Temp., Sed.	1975-76, 1977
St. Joseph River at Clarendon, MI	04096340	144	Sed.	1975-76, 1977
Paw Paw River near Paw Paw, MI	04102320	195	Temp., Sed.	1981-82
Paw Paw River near Hartford, MI	04102420	311	Sed.	1981-82
Black River near Bangor, MI	04102700	83.6	Temp., Sed.	1981-82
Kalamazoo River at Comstock, MI	04106000	a1,010	Temp.	1969-75
Portage Creek near Kalamazoo, MI	04106300	22.4	Temp., S.C.	1968-71

## DISCONTINUED SURFACE-WATER-QUALITY STATIONS--Continued

Station name	Station number	Drainage area (mi <sup>2</sup> )	Type of record	Period of record
West Fork Portage Creek at Kalamazoo, MI	04106400	18.7	Temp., S.C.	1971,
Portage Creek at Kalamazoo, MI	04106500	46.8	Temp.	1972-73
Kalamazoo River near Cooper Center, MI	04106770	1,248	S.C.	1968,
			Temp., S.C.	1972-75,
			Temp.	1976-86
			Temp.	1968,
				1970
			Temp., S.C.	1969,
Kalamazoo River at Saugatuck, MI	04108690	a2,020	S.C.	1971-75
Grand River near Eaton Rapids, MI	04111000	661	Temp., S.C.	1974,
			Temp.	1975-81
				1964-74,
				1976-77
Grand River at Lansing, MI	04113000	a1,230	Temp.	1964,
				1967-68,
				1970-73
Grand River at Portland, MI	04114000	1,385	Temp.	1964-68
Muskegon River at Evart, MI	04121500	a1,450	Temp.	1957-83
Little Muskegon River near Morley, MI	04121900	138	Temp.	1967-83
Muskegon River near Bridgeton, MI	04122030	a2,420	Temp., S.C.	1975-81
Pere Marquette River near Scottville, MI	04122500	681	Temp.	1968-83
Manistee River near Grayling, MI	04123500	123	Temp.	1957-77
East Branch Pine River near Tustin, MI	04124500	60	Temp.	1952-63
Pine River near LeRoy, MI	04125000	128	Temp.	1953-63
Pine River near Luther, MI	04125200		Sed.	1967-70
Silver Creek near Luther, MI	04125210		Sed.	1969-70
Poplar Creek near Hoxeyville, MI	04125350		Sed.	1969-70
Pine River near Dublin, MI	04125450		Sed.	1968-70
Pine River near Hoxeyville, MI	04125500	251	Temp.	1952-63
Pine River near Wellston, MI	04125510		Sed.	1967-70
Little Manistee River near Freesoil, MI	04126200	178	Temp.	1957-77
Boardman River near Mayfield, MI	04127000	182	Temp.	1962-77
Jordan River near East Jordan, MI	04127800	67.9	Temp.	1967-83
Sturgeon River near Wolverine, MI	04128000	198	Temp.	1959-83
Pigeon River near Vanderbilt, MI	04129000	62.6	Temp.	1951-66
Cheboygan River at Cheboygan, MI	04132052	a1,500	Temp., S.C.	1975-81
Thunder Bay River at Alpena, MI	04135020	a1,240	Temp., S.C.	1979
Au Sable River at Grayling, MI	04135500	110	Temp.	1953-80
South Branch Au Sable River near Luzerne, MI	04135700	401	Temp.	1967-83
Au Sable River at Mio, MI	04136500	a1,100	Temp.	1952-66
East Branch Au Gres River at McIvor, MI	04138000	a84	Temp.	1952-66
Au Gres River near National City, MI	04138500	154	Temp.	1952-59
Houghton Creek near Lupton, MI	04139000	29.7	Temp.	1950-68
Rifle River near Lupton, MI	04139500	56.8	Temp.	1950-71
Prior Creek near Selkirk, MI	04140000	21.4	Temp.	1951-68
Rifle River at Selkirk, MI	04140500	117	Temp.	1951-76
West Branch Rifle River near Selkirk, MI	04141500	a52	Temp.	1952-61
Shiawassee River at Byron, MI	04144000	365	Temp.	1962-81
Shiawassee River at Owosso, MI	04144500	538	Sed.	1966-72
Cass River at Frankenmuth, MI	04151500	841	Sed.	1966-72
Black River at Fargo, MI	04159500	480	Sed.	1966,
			Temp.	1979-82
Clinton River near Drayton Plains, MI	04160900	79.2	Temp.	1962-74
Clinton River near Fraser, MI	04164000	444	Sed.	1966
Detroit River at Detroit, MI	04165700	a228,800	Temp., S.C.	1974-81



## WATER RESOURCES DATA - MICHIGAN, 1991

### INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Michigan each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Michigan."

This report includes records on both surface and ground water in the State. Specifically, it contains: (1) Discharge records for 146 streamflow-gaging stations, 48 crest-stage partial-record stations, 8 low-flow partial-record stations, and 98 miscellaneous sites; (2) stage only records for 1 gaging station and 13 lake-gaging stations; (3) stage and content records for 5 lakes and reservoirs; (4) water-quality records for 23 streamflow-gaging stations and 13 miscellaneous sites; (5) water-level records for 51 ground-water wells; and (6) water-temperature records for 4 ground-water wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

This series of annual reports for Michigan began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Michigan were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Part 4." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report MI-91-1." For archiving and general distribution, the reports for 1971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Chief at the address given on the back of the title page or by telephone (517) 377-1608.

### COOPERATION

The U.S. Geological Survey and agencies of the State of Michigan have had cooperative agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

Michigan Department of Natural Resources, Roland Harmes, Jr., Director, through Land and Water Management Division, Lawrence N. Witte, Chief, and Geological Survey Division, R. Thomas Segall, Chief.

Michigan Department of Transportation, P.M. Nowak, Director.

Assistance with funds or services was given by the U.S. Army Corps of Engineers in collecting records for 8 gaging stations published in this report. Assistance was also furnished by the National Weather Service, National Oceanic Atmospheric Administration, and U.S. Department of Commerce.

The following organizations aided in collecting records:

Macomb County Board of Supervisors; Oakland County Drain Commission; Genesee County Drain Commission; Kalamazoo County; Otsego County; Wayne County; Huron-Clinton Metropolitan Authority; Cities of Ann Arbor, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Mason, Norway, Portage, and Ypsilanti; American Aggregate Co.; Consumers Power Co.; Cleveland Cliffs Iron Co.; Mead Corporation; Indiana Michigan Power Co.; Michigan Sugar Co.; Swift-Eckrich, Inc.; Upper Peninsula Power Co.; Wisconsin-Electric Power Co.; and Wolverine Power Supply Cooperative, Inc.

Organizations that supplied data are acknowledged in the station descriptions.

## SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

In the Upper Peninsula, streamflow at Sturgeon River near Sidnaw began the year in the above-normal range. Streamflow decreased to the below-normal range through February. In March, streamflow increased to the above-normal range after 4 months in the below-normal range. From April through the remainder of the year streamflow was at near normal levels except those for July. The monthly mean flow of 239 ft<sup>3</sup>/s (cubic feet per second) for July exceeded the 75th percentile and overall was the 7th highest for the period of record. Annual streamflow for 1991 was near the yearly median.

In the Lower Peninsula, streamflow at Muskegon River at Evart and at Red Cedar River at East Lansing was generally in the normal and above-normal range for much of the year. Streamflow for the Muskegon River at Evart exceeded the 75th percentile for 9 of the 12 months and the mean discharge for October was the second highest for the period of record. Mean annual streamflow was the third highest for the period of record and exceeded the 75th percentile. Mean monthly discharges at the Red Cedar River at East Lansing exceeded the 75th percentile 5 of the first 6 months of the water year and the discharge for December was the second highest for the period of record. However near mean and lower than normal discharges caused the annual mean to be in the normal range.

The highest water levels for Lake Superior for 1991 were slightly less than normal levels. In Lakes Michigan-Huron the levels departed from normal by less than one half foot for the year. Levels for Lake St. Clair and Lake Erie were slightly above normal throughout the year. No 1991 levels approached the extremes for the period of record 1900-1990. Damage to lake-front property and shoreline was not serious in the 1991 WY (water year).

Water Quality

Surface-water-quality data were collected at 18 National Stream Quality Accounting Network stations in WY 1991. Concentrations of dissolved solids and suspended sediments, analyzed from samples collected bimonthly or quarterly at the stations, generally fall within the range of concentrations in all previous samples. Although data are collected on a regular frequency, it is desirable to sample rivers at either high or low stage to determine water-quality characteristics at both extremes. During a period of high flow, runoff from the land is the dominant contributor to a river's discharge and chemical character. During a period of low flow, ground water usually affects a river's water discharge and chemical character. Several low-flow and high-flow samples were collected during the year.

Ground Water

Glacial deposits cover most of the State. The outwash sand and gravel in these deposits form the most productive aquifers in the State. Lacustrine sand also is very productive. Poorly sorted, relatively impermeable mixtures of clay, silt, sand, and gravel, that form some till deposits tend to be poor aquifers; clay deposits generally yield little or no water. In most areas of the State, glacial deposits are less than 200 ft (feet) thick. In some areas in the northern part of the Lower Peninsula, however, the deposits are greater than 800 ft thick. Sandstone, limestone, and dolomite are the principal bedrock aquifers. Where near enough to land surface to be recharged by precipitation, they yield freshwater. Where deeply buried, however, these rocks commonly yield brackish or salty water.

Annual recharge to aquifers in Michigan ranges from 3 to 18 in. (inches) and is derived from precipitation, which averages 31 in. annually.

Ground-water levels were measured at 108 wells in WY 1991. Of these, 51 were selected to comprise a statewide network of ground-water wells (fig. 9) that is designed to provide statewide areal coverage and to define ground-water conditions in the important aquifers in the State. Six index wells with long-term averages were used for this summary.

Ground-water levels for WY 1991 generally followed seasonal patterns. In the Upper Peninsula and southeastern Lower Peninsula ground-water levels continued to remain below average throughout the year. Levels in the Marquette County well (western Upper Peninsula) did rise slightly above average for brief periods in late March and April. In the northern, southcentral and southwestern portions of the Lower Peninsula ground-water levels were above or near average during WY 1991. The measured water level of 3.45 ft below land-surface datum at the Calhoun County well (southwestern Lower Peninsula) was the highest for December in 45 years of record. The measured water level of 14.08 ft below land-surface datum made on Apr. 26 at the Clinton County well (southcentral Lower Peninsula) was the second highest level measured in 43 years of record. Other wells throughout the State where notable extremes occurred during WY 1991 are Arenac and Eaton Counties with new record highs and Oceana County with a new record low.

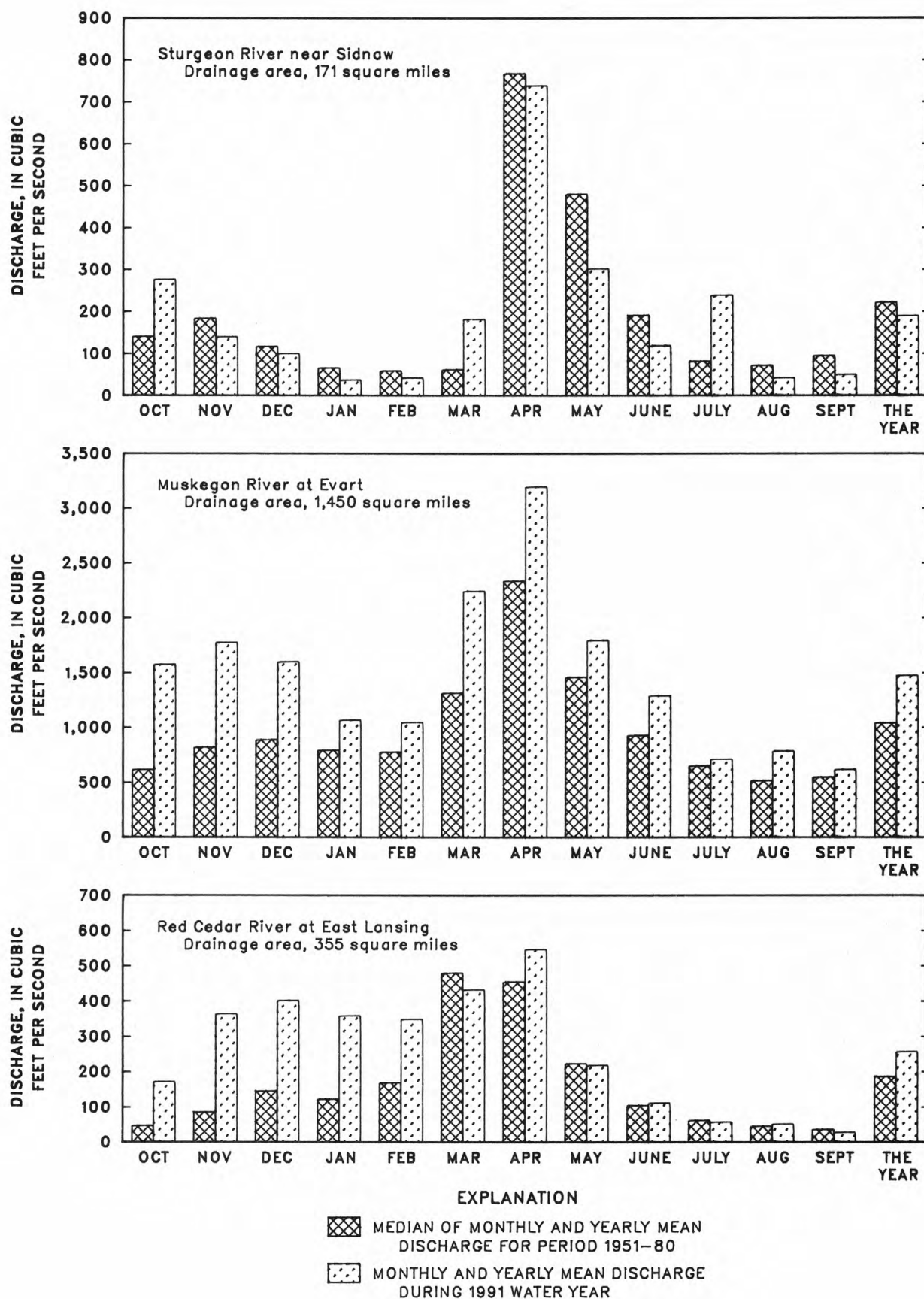


Figure 1.--Discharge during 1991 water year compared with median discharge for period 1951-80 for three representative stations.

The principal aquifers in Michigan are glacial outwash deposits and sandstone, limestone, and dolomite bedrock. The following table lists the aquifers and some of their characteristics.

Aquifer name and description	Well characteristics				Remarks
	Depth (feet)		Yield (gallons/minute)		
	Common range	May exceed	Common range	May exceed	
Glacial aquifers:					
Outwash: Mostly sand and gravel.	25-200	400	1-1,000	2,000	Water generally hard; iron concentrations common; deep wells may produce salty water in places.
Lacustrine sand: Mostly sand, some gravel.	25-100	200	80-500	500	Used for domestic supply in Saginaw Bay and Detroit areas; is salty in places at depth.
Till: Intermixed clay, silt, sand, gravel and boulders; abundant sand and gravel lenses in some areas.	25-200	400	5-200	200	Primary source of domestic supply in western Upper Peninsula.
Bedrock aquifers:					
Saginaw Formation: Sandstone, siltstone, some shale, limestone, and coal.	25-300	500	100-300	1,000	One of Michigan's most important bedrock aquifers; water generally hard; salty in places at depth.
Marshall Formation: Sandstone and siltstone.	25-200	400	100-500	1,500	Another of Michigan's import- ant bedrock aquifers; salty in places and at depth.
Silurian-Devonian rocks: Limestone and dolomite; some shale and sandstone.	25-150	200	10-300	500	Important aquifer in parts of eastern Upper Peninsula; water commonly hard.
Cambrian-Ordovician rocks: Sandstone, limestone, and dolomite.	25-150	200	10-100	500	Important aquifer in eastern Upper Peninsula; water com- monly very hard; salty in places and at depth.
Precambrian sandstone: Sandstone interbedded with siltstone.	25-400	500	5-50	100	Important aquifer in western Upper Peninsula; salty in places.

Natural chemical characteristics of ground water in Michigan are determined primarily by the geologic environment through which the water flows. Natural ground water generally is suitable for human consumption and most other uses. Water from glacial deposits, at places, contains elevated concentrations of iron [2.5 to 5.0 mg/L (milligrams per liter)]; water from carbonate rocks is likely to be very hard (400 to 900 mg/L as calcium carbonate); and water from the Saginaw Formation in the Saginaw Bay-Thumb area commonly is highly mineralized (2,000 to 80,000 mg/L of dissolved solids). Throughout the State, salty water underlies and is in contact with freshwater at depths ranging from about 100 ft in the eastern part of the Lower Peninsula to about 900 ft in the northern part. Average dissolved-solids concentration of water from bedrock (535 mg/L) is about twice as great as the average concentration from glacial deposits (241 mg/L) (Cummings, 1980).

#### REFERENCES CITED

- Cummings, T.R., 1980, Chemical and physical characteristics of natural ground waters in Michigan--A preliminary report: U.S. Geological Survey Open-File Report 80-953, 34 p.
- 1984, Estimates of dissolved and suspended yield of stream basins in Michigan: U.S. Geological Survey Water-Resources Investigations Report 83-4288, 57 p.



## SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a nation-wide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

Radiochemical Program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

## EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1991 water year that began October 1, 1990, and ended September 30, 1991. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for surface water, and ground-water level data. The locations of the stations and wells where the data were collected are shown in figures 4-10. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station Identification Numbers

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for all surface-water stations except some lakes and the "latitude-longitude" system is used for wells and lakes.

## Downstream Order System

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary with respect to the stream to which it is immediately tributary is indicated by an indentation in the "List of Stations" in the front of this report. Each indentation represents one rank. This downstream order and system of indentation shows which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete eight-digit number for each station, such as 04037500, which appears just to the left of the station name, includes the two-digit Part number "04" plus the six-digit downstream-order number "037500." The Part number designates the major river basin; for example, Part "04" is the St. Lawrence River basin.

## Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 2.)

## WATER RESOURCES DATA - MICHIGAN, 1991

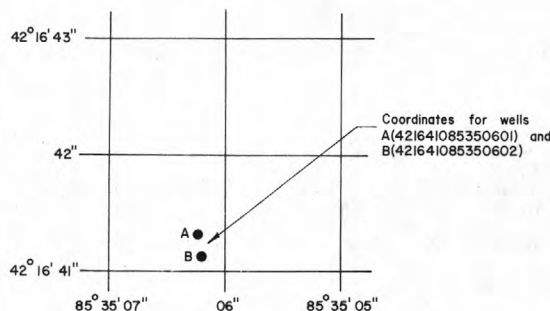


Figure 2. System for numbering wells (latitude and longitude).

## Local Well Numbering System

The local well number indicates the location of wells within the rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section and the letters A through D designate successively smaller subdivisions of the section as shown in figure 3. Thus, a well designated as 32N 6E 16CCCB would be located to the nearest 2.5 acres and would be within the shaded area in section 16. In the event that two or more wells are located in the same 2.5 acre tract, a sequential number designation follows the letter designations--for example, 16CCCB1, 16CCCB2, 16CCCB3, etc.

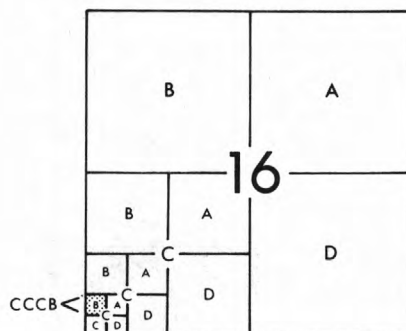


Figure 3. Local well numbering system in Michigan.

## Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for anytime, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-month contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "Crest-stage partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record water-discharge stations for which data are given in this report are shown in figures 4 and 5.

## Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adopted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or for various reasons fails to operate properly. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

#### Data Presentation

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

**LOCATION.**--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

**DRAINAGE AREA.**--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

**PERIOD OF RECORD.**--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

**REVISED RECORDS.**--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

**GAGE.**--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.



**REMARKS.**--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station, and possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

**COOPERATION.**--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

**AVERAGE DISCHARGE.**--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development.

**EXTREMES FOR PERIOD OF RECORD.**--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

**EXTREMES OUTSIDE PERIOD OF RECORD.**--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

**EXTREMES FOR CURRENT YEAR.**--Extremes given here are similar to those for the period of record, except the peak discharge listing may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

**REVISIONS.**--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the offices whose addresses are given on the back of the title page of this report to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line headed "CFSM"), or in inches (line headed "IN."), or in acre-feet (line headed "AC-FT"). Figures for cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations, and the second is a table of discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

#### Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated," or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

#### Accuracy of the Records

The accuracy of streamflow records depends primarily on: (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.



The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true values; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft<sup>3</sup>/s; to the nearest tenth between 1.0 and 10 ft<sup>3</sup>/s; to whole numbers between 10 and 1,000 ft<sup>3</sup>/s; and to 3 significant figures for more than 1,000 ft<sup>3</sup>/s. The number of significant figures used is based solely on the magnitude of the discharge value.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

#### Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables are on file in the Michigan District Office. Also, most of the daily mean discharges are in computer-readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Michigan District Office.

#### Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Traditionally, dissolved trace-element concentrations have been reported at the microgram per liter (µg/L) level. Recent evidence, mostly from large rivers, indicates that actual dissolved-phase concentrations for a number of trace elements are within the range of 10's to 100's of nanograms per liter (ng/L). Present data above the µg/L level should be viewed with caution. Such data may actually represent elevated environmental concentrations from natural or human causes; however, these data could reflect contamination introduced during sampling, processing, or analysis. To confidently produce dissolved trace-element data with insignificant contamination, the U.S. Geological Survey will begin using new trace-element protocols in the near future.

#### Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records", as used in this report, and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figures 6 and 7.

#### Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for miscellaneous sampling sites appear in a separate table following the table of discharge measurements at miscellaneous sites.

#### On-site Measurements and Sample Collection

In obtaining water-quality data, a major concern needs to be assuring that the data obtained represent the in situ quality of the water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen, need to be made on site when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for on site measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. All of these references are listed under "PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS", which appears at the end of the introductory text. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey Michigan District Office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. Many samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the Geological Survey Michigan District Office whose address is given on the back of the title page of this report.

#### Water Temperature

Water temperatures are measured at all the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures and/or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the Michigan District Office.

#### Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section.

At some stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

#### Laboratory Measurements

Sediment samples were analyzed in the Geological Survey laboratory in Harrisburg, Pennsylvania. All other samples were analyzed in the Geological Survey laboratories in Arvada, Colorado. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. In March 1989 the National Water-Quality Laboratory discovered a bias in the turbidimetric method for sulfate analysis, indicating that values below 75 mg/L have a median positive bias of 2 mg/L above the true value for the period between 1982 and 1989.

#### Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance and water temperature then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information is given only if a water-quality monitor or temperature recorder is or was in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

**REVISIONS.**--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water quality records for miscellaneous sampling sites are published in a separate table following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

#### Remark Codes

The following remark codes may appear with the water-quality data in this report:

<u>PRINTED OUTPUT</u>	<u>REMARK</u>
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organism count less than 0.5 percent (organism may be observed rather than counted)
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

#### Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Michigan are shown in figure 9.

#### Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (LSD). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (EOM).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

#### Data Presentation

Each well record consists of two parts, the station description and the data table of water levels observed during the water year. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

**LOCATION.**--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

**AQUIFER.**--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.



**WELL CHARACTERISTICS.**--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

**INSTRUMENTATION.**--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

**DATUM.**--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

**REMARKS.**--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

**PERIOD OF RECORD.**--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

**EXTREMES FOR PERIOD OF RECORD.**--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, only abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (EOM). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

#### ACCESS TO WATSTORE DATA

The National WATER Data STorage and RETrieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from the Michigan District Office.

General inquiries about WATSTORE may be directed to:

U.S. Geological Survey  
National Water Data Exchange  
421 USGS National Center  
Reston, Virginia 22092

#### DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting English units to International System (SI) Units on the inside of the back cover.

**Acre-foot (AC-FT, acre-ft)** is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

**Adenosine triphosphate (ATP)** is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP therefore provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

**Algae** are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

**Algal growth potential (AGP)** is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

**Aquifer** is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

**Artesian** means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

**Bacteria** are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.



Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C plus or minus 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C plus or minus 0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as Gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C plus or minus 1.0°C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by micro-organisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter ( $\text{g}/\text{m}^3$ ), and periphyton and benthic organisms in grams per square meter ( $\text{g}/\text{m}^2$ ).

Dry mass refers to the mass of residue present after drying in an oven at 105°C for zooplankton and periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed material.

Cells/volume refers to the number of cells of any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common green pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second ( $\text{ft}^3/\text{s}$ ) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Cubic foot per second-day [ $(\text{ft}^3/\text{s})/\text{d}$ ] is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, approximately 1.9835 acre-feet, about 646,000 gallons, or 2,445 cubic meters.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Dissolved refers to that material in a representative water sample which passes through a 0.45  $\mu$ m membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations and is expressed as the equivalent concentration of calcium carbonate ( $\text{CaCO}_3$ ).

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an eight-digit number.

Land-surface datum (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

Measuring point (MP) is an arbitrary permanent reference point from which the distance to the water surface in a well is measured to obtain the water level.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substances (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

Micrograms per gram ( $\mu\text{g/g}$ ) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

Micrograms per liter ( $\mu\text{g/L}$ ,  $\mu\text{g/L}$ ) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter ( $\text{mg/L}$ ,  $\text{mg/L}$ ) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in  $\text{mg/L}$  and is based on the mass of dry sediment per liter of water-sediment mixture.

National Geodetic Vertical Datum of 1929 (NGVD of 1929) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

Organism is any living entity.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter (m<sup>2</sup>), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter (mL) or liter (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter Code is a 5-digit number used in the U.S. Geological Survey computerized data system, WATSTORE, to uniquely identify a specific constituent. The codes used in WATSTORE are the same as those used in the U.S. Environmental Protection Agency data system, STORET. The Environmental Protection Agency assigns and approves all requests for new codes.

Partial-record station is a particular site where limited streamflow and/or water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Particle size is the diameter, in millimeters (mm), of a particle determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

Particle-size classification used in this report agrees with the recommendation made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

<u>Classification</u>	<u>Size (mm)</u>	<u>Method of analysis</u>
Clay.....	0.00024 - 0.004	Sedimentation
Silt.....	.004 - .062	Sedimentation
Sand.....	.062 - 2.0	Sedimentation or sieve
Gravel.....	2.0 - 64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native-water analysis.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass, or volume.

Periphyton is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms.

Pesticides are chemical compounds used to control undesirable organisms. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

Picocurie (PC, pCi) is one trillionth ( $1 \times 10^{-12}$ ) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields  $3.7 \times 10^{10}$  radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated (carbon method) by the plants.



Milligrams of carbon per area or volume per unit time [ $\text{mg C}/(\text{m}^2 \cdot \text{time})$ ] for periphyton and macrophytes and [ $\text{mg C}/(\text{m}^3 \cdot \text{time})$ ] for phytoplankton are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time [ $\text{mg O}_2/(\text{m}^2 \cdot \text{time})$ ] for periphyton and macrophytes and [ $\text{mg O}_2/(\text{m}^3 \cdot \text{time})$ ] for phytoplankton are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN., in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture ( $\text{mg/L}$ ).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry mass of sediment passes a section of a stream or is the quantity of sediment, as measured by dry mass or volume, that passes a section in a given time. It is calculated in units of tons per day as follows: concentration ( $\text{mg/L}$ )  $\times$  discharge ( $\text{ft}^3/\text{s}$ )  $\times$  0.0027.

Suspended-sediment load is a general term that refers to material in suspension. It is not synonymous with either discharge or concentration.

Total-sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry mass or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10-year low flow ( $7 Q_{10}$ ) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in microsiemens per centimeter at  $25^\circ\text{C}$ . Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.



Stage-discharge relation is the relation between gage height (stage) and volume of water, per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lives.

Natural substrate refers to any naturally occurring emerged or submersed solid surface, such as a rock or tree, upon which an organism lives.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest U.S.G.S. topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimeted. All areas shown are those for the stage when the planimeted map was made.

Surficial bed material is the part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is associated with the material retained on a 0.45-micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchical scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata, is the following:

Kingdom.....	Animal
Phylum.....	Arthropoda
Class.....	Insecta
Order.....	Ephemeroptera
Family.....	Ephemeridae
Genus.....	Hexagenia
Species.....	Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

Tons per day (T/DAY) is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined all of the constituent in the sample.)

Total discharge is the total quantity of any individual constituent, as measured by dry mass or volume, that passes through a stream cross-section per unit of time. This term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

Total, recoverable is the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1991, is called the "1991 water year."

WDR is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976).

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

WSP is used as an abbreviation for "Water-Supply Paper" in reference to previously published reports.

## PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

- 1-D1. *Water temperature--influential factors, field measurement, and data presentation*, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.
- 1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.
- 2-D1. *Application of surface geophysics to ground-water investigations*, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.
- 2-D2. *Application of seismic-refraction techniques to hydrologic studies*, by F. P. Haeni: USGS--TWRI Book 2, Chapter D2. 1988. 86 pages.
- 2-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. McCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.
- 2-E2. *Borehole geophysics applied to ground-water investigations*, by W. Scott Keys: USGS--TWRI Book 2, Chapter E2. 1990. 150 pages.
- 2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and Warren E. Teasdale: USGS--TWRI Book 2, Chapter F1. 1989. 97 pages.
- 3-A1. *General field and office procedures for indirect discharge measurements*, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.
- 3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.
- 3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.
- 3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H. F. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 pages.
- 3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.
- 3-A6. *General procedure for gaging streams*, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.
- 3-A7. *Stage measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A7. 1968. 28 pages.
- 3-A8. *Discharge measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.
- 3-A9. *Measurement of time of travel in streams by dye tracing*, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 pages.
- 3-A10. *Discharge ratings at gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

- 3-A11. *Measurement of discharge by moving-boat method*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.
- 3-A12. *Fluorometric procedures for dye tracing*, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS--TWRI Book 3, Chapter A12. 1986. 41 pages.
- 3-A13. *Computation of continuous records of streamflow*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.
- 3-A14. *Use of flumes in measuring discharge*, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.
- 3-A15. *Computation of water-surface profiles in open channels*, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.
- 3-A16. *Measurement of discharge using tracers*, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.
- 3-A17. *Acoustic velocity meter systems*, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.
- 3-A18. *Determination of stream reaeration coefficients by use of tracers*, by F. A. Kilpatrick, R. E. Rathburn, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.
- 3-A19. *Levels of streamflow gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A19. 1990. 27 pages.
- 3-B1. *Aquifer-test design, observation, and data analysis*, by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.
- 3-B2. *Introduction to ground-water hydraulics, a programmed text for self-instruction*, by G. D. Bennett: USGS--TWRI Book 3, Chapter B2. 1976. 172 pages.
- 3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.
- 3-B4. *Regression modeling of ground-water flow*, by Richard L. Cooley and Richard L. Naff: USGS--TWRI Book 3, Chapter B4. 1990. 232 pages.
- 3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction*, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.
- 3-B6. *The principle of superposition and its application in ground-water hydraulics*, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.
- 3-C1. *Fluvial sediment concepts*, by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.
- 3-C2. *Field methods for measurement of fluvial sediment*, by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.
- 3-C3. *Computation of fluvial-sediment discharge*, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.
- 4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.
- 4-A2. *Frequency curves*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.
- 4-B1. *Low-flow investigations*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.
- 4-B2. *Storage analyses for water supply*, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.
- 4-B3. *Regional analyses of streamflow characteristics*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.
- 4-D1. *Computation of rate and volume of stream depletion by wells*, by C. T. Jenkins: USGS--TWRI Book 4, Chapter D1. 1970. 17 pages.
- 5-A1. *Methods for determination of inorganic substances in water and fluvial sediments*, by M. J. Fishman and L. C. Friedman: USGS--TWRI Book 5, Chapter A1. 1989. 545 pages.



- 5-A2. *Determination of minor elements in water by emission spectroscopy*, by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.
- 5-A3. *Methods for the determination of organic substances in water and fluvial sediments*, edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.
- 5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*, by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 pages.
- 5-A5. *Methods for determination of radioactive substances in water and fluvial sediments*, by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.
- 5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments*, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.
- 5-C1. *Laboratory theory and methods for sediment analysis*, by H. P. Guy: USGS--TWRI Book 5, Chapter C1. 1969. 58 pages.
- 6-A1. *A modular three-dimensional finite-difference ground-water flow model*, by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 pages.
- 7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments*, by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.
- 7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water*, by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.
- 7-C3. *A model for simulation of flow in singular and interconnected channels*, by R. W. Schaffranek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.
- 8-A1. *Methods of measuring water levels in deep wells*, by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.
- 8-A2. *Installation and service manual for U.S. Geological Survey manometers*, by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.
- 8-B2. *Calibration and maintenance of vertical-axis type current meters*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.

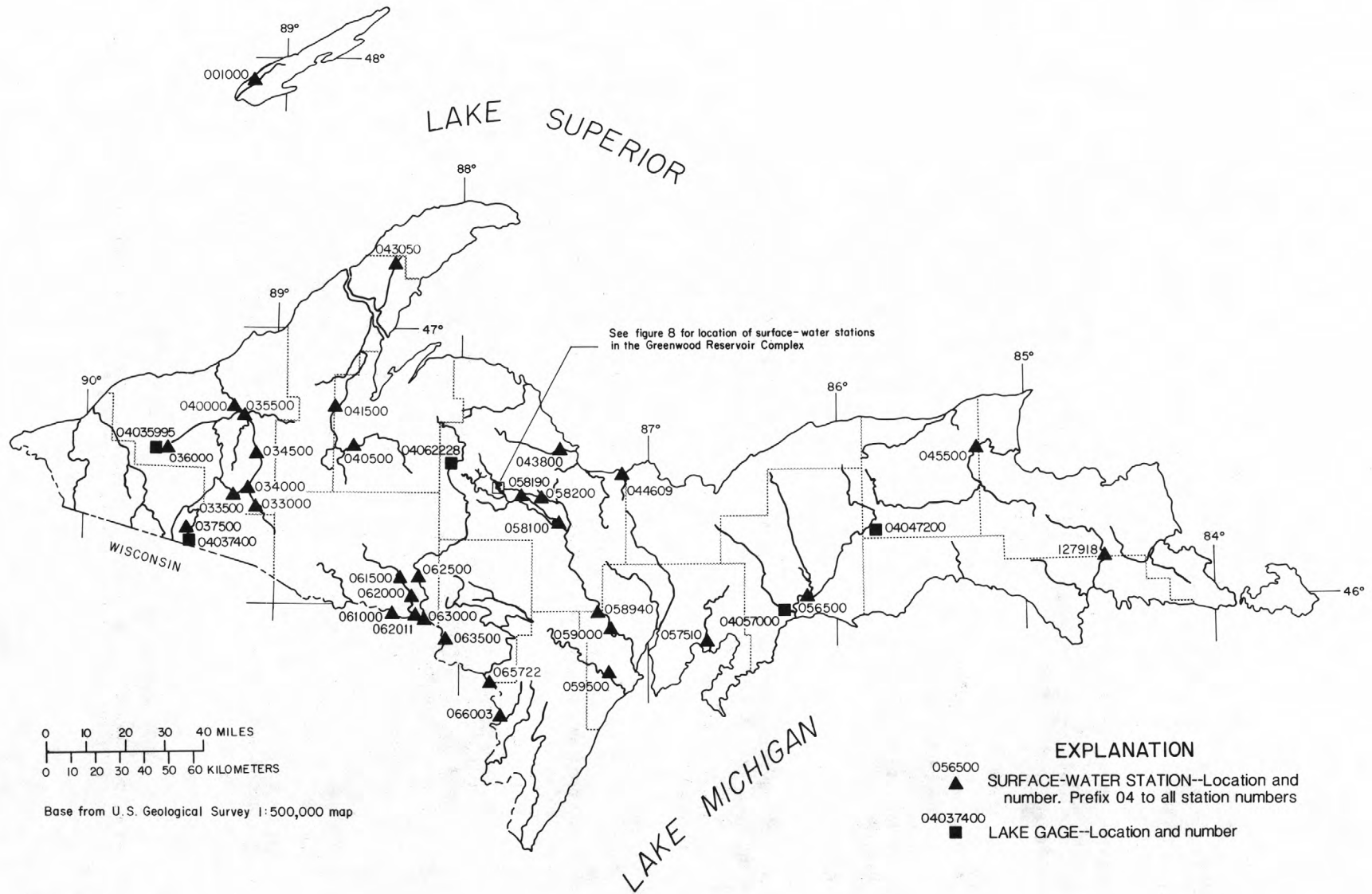
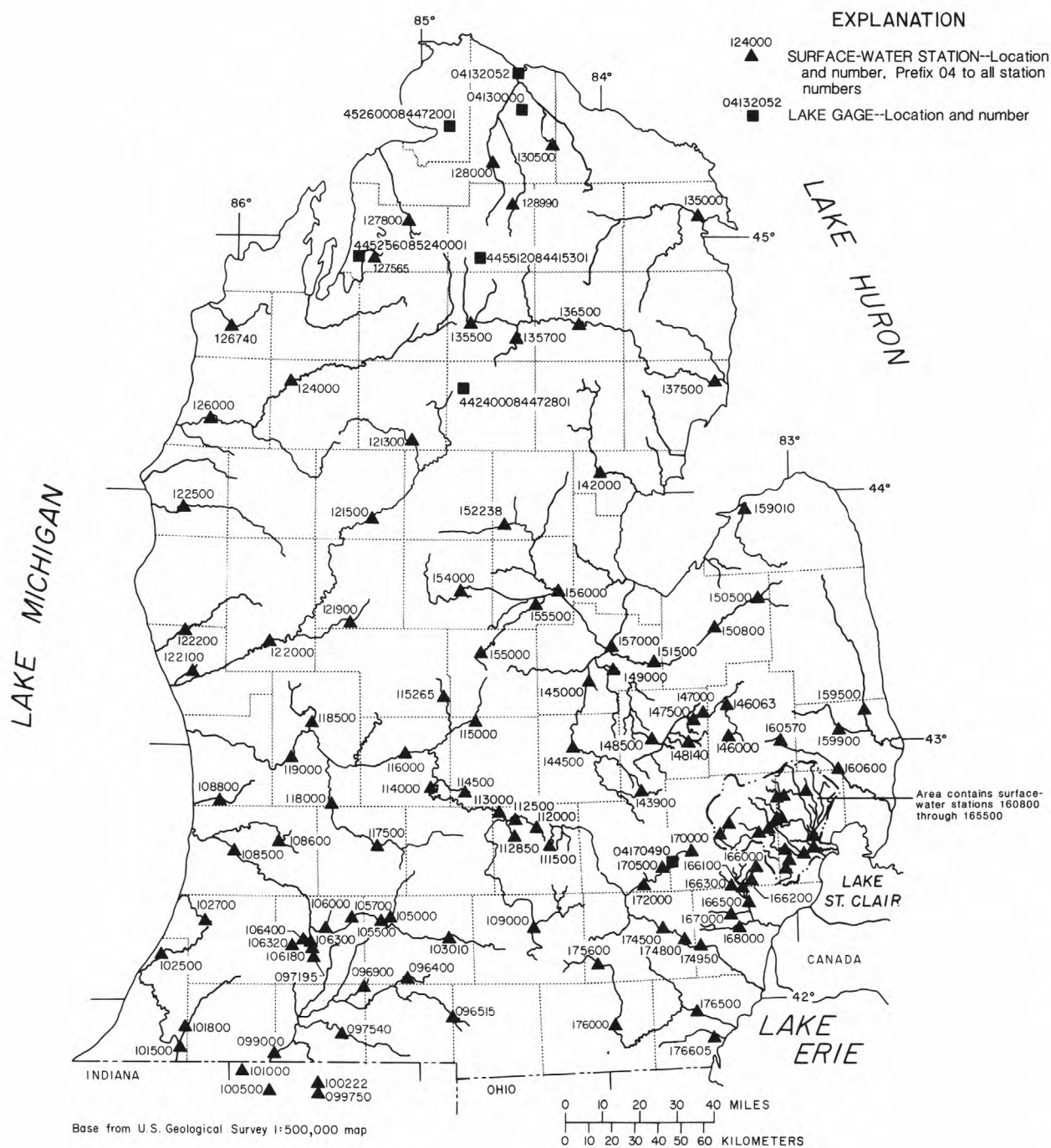


Figure 4.--Identification number and location of active surface-water gaging stations in the Upper Peninsula of Michigan.



**Figure 5.--Identification number and location of active surface-water gaging stations in the Lower Peninsula of Michigan.**

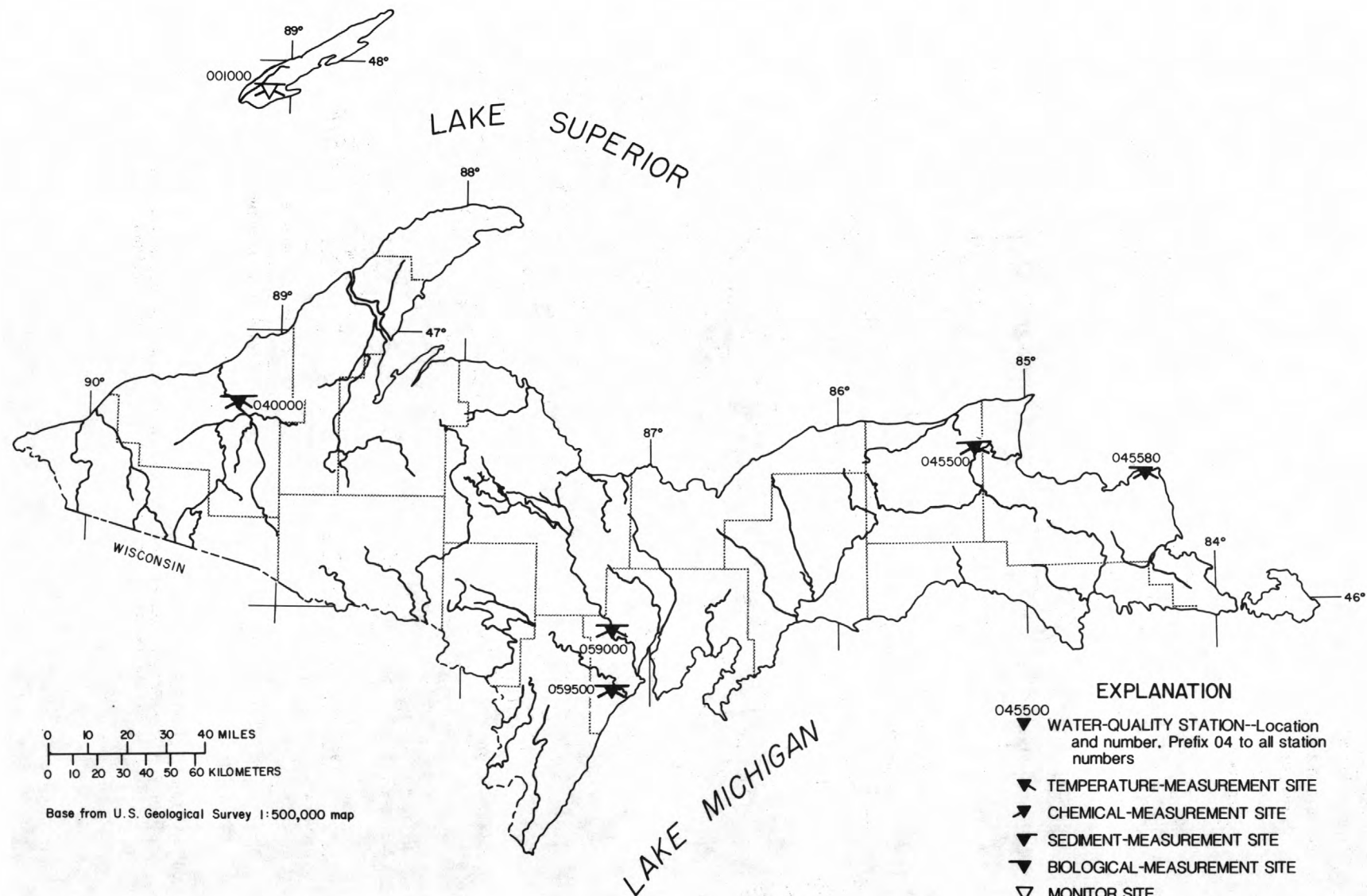


Figure 6.--Identification number and location of active surface-water-quality stations in the Upper Peninsula of Michigan.



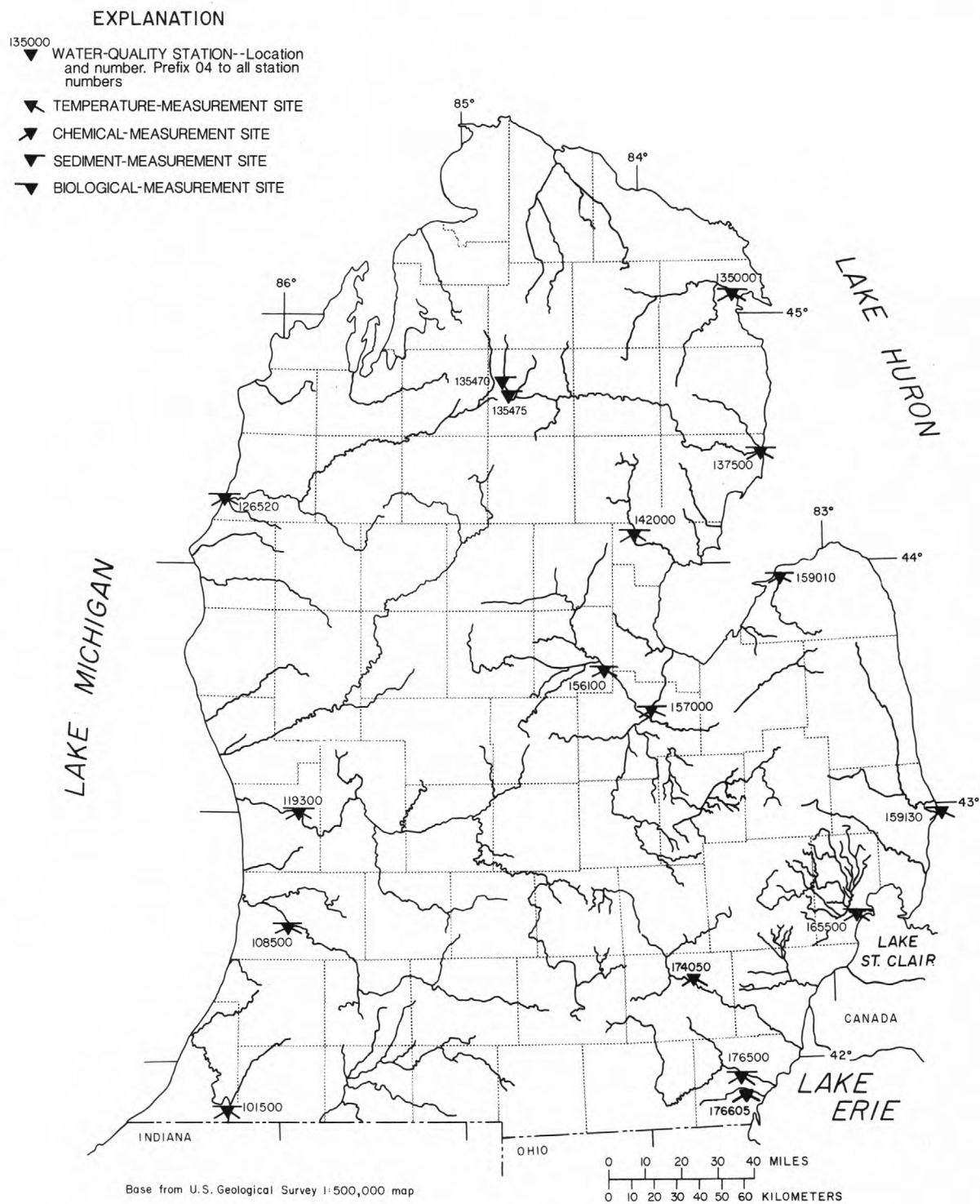


Figure 7.--Identification number and location of active surface-water-quality stations in the Lower Peninsula of Michigan.

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI  
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'23", long 89°08'42", in NW1/4 sec.28, T.64 N., R.38 W., Keweenaw County, Isle Royale National Park, Hydrologic Unit 04020300, on left bank 0.8 mi northeast of Windigo, and 35 mi southwest of Rock Harbor.

DRAINAGE AREA.--13.2 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder, crest-stage gage, and concrete control. Elevation of gage is 605 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 20-26, Jan. 17 to Feb. 2, Feb. 7, and Mar. 6 to Apr. 6. Water-discharge records good except for estimated daily discharges, which are poor.

AVERAGE DISCHARGE.--27 years, 16.5 ft<sup>3</sup>/s, 16.97 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 480 ft<sup>3</sup>/s, May 1, 1972, gage height, 6.82 ft, from rating curve extended above 160 ft<sup>3</sup>/s based on runoff characteristics of nearby stations; maximum gage height, 6.88 ft, Jan. 13, 1975, backwater from ice; minimum daily discharge, 0.44 ft<sup>3</sup>/s, Aug. 25, 1977; minimum gage height, 2.54 ft, July 28, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 110 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Apr. 8	2300	*211	*5.27	No other peak greater than base discharge.			
Minimum discharge, 0.64 ft <sup>3</sup> /s, Sept. 1, gage height, 2.56 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.9	7.3	11	2.8	1.8	1.6	24	41	13	38	1.8	.74
2	2.5	7.1	9.3	2.7	1.8	1.5	23	33	11	52	1.9	.73
3	8.1	6.5	8.1	2.6	1.8	1.6	28	28	9.0	44	1.9	.85
4	9.0	6.1	7.4	2.5	1.9	1.5	70	24	7.3	36	1.7	.85
5	7.5	5.6	6.7	2.4	2.1	1.5	100	21	6.2	27	1.5	1.1
6	5.9	5.4	5.8	2.4	2.1	1.5	140	51	5.4	21	1.4	1.3
7	5.3	5.0	5.6	2.3	2.2	1.5	171	77	4.7	17	1.3	1.1
8	4.5	4.6	5.6	2.2	2.2	1.5	172	56	4.2	34	1.2	1.2
9	4.1	4.8	5.6	2.2	2.3	1.5	118	40	3.8	21	1.2	6.4
10	3.6	5.3	5.5	2.2	2.2	1.5	78	32	3.7	18	1.2	4.8
11	3.4	4.6	5.5	2.2	2.2	1.5	62	28	3.5	14	1.1	3.0
12	4.4	4.1	7.5	2.2	2.2	1.5	51	29	2.8	11	1.1	2.6
13	5.3	3.7	9.0	2.2	2.2	1.5	46	25	2.5	10	.97	2.7
14	6.1	3.8	6.3	2.2	2.1	1.5	55	22	10	7.9	.88	7.6
15	10	4.1	6.2	2.2	2.0	1.5	94	19	8.7	6.7	.88	14
16	8.3	4.2	5.4	2.2	2.0	1.5	87	17	6.5	6.0	1.2	17
17	18	4.0	5.4	2.2	2.0	1.6	90	15	5.2	5.4	2.0	13
18	44	3.9	4.9	2.1	2.0	1.6	76	13	4.2	4.9	1.4	12
19	29	3.9	4.6	2.1	1.9	1.8	64	11	3.8	4.7	1.2	9.5
20	27	4.1	4.5	2.1	2.0	2.1	49	10	3.1	4.2	1.1	7.5
21	38	13	4.4	2.1	1.9	2.4	41	9.6	2.9	4.1	1.0	6.4
22	32	12	4.3	2.0	1.9	2.8	36	9.5	2.3	5.1	.88	5.6
23	26	10	4.2	2.0	1.9	5.6	33	9.2	2.0	5.2	.92	4.6
24	21	8.7	4.1	2.0	1.9	8.0	35	8.2	1.8	3.9	1.0	4.3
25	17	7.1	3.7	1.9	1.9	14	29	7.2	1.7	3.3	.98	6.1
26	14	6.9	3.4	1.9	1.8	50	29	36	11	2.9	.95	6.7
27	13	20	3.2	1.9	1.8	60	29	51	37	2.9	.95	5.5
28	11	17	3.2	1.9	1.8	52	28	35	30	2.5	.92	5.2
29	10	15	3.2	1.8	---	40	32	26	53	2.3	.86	4.8
30	9.1	13	3.1	1.8	---	30	43	21	42	2.1	.80	7.1
31	8.0	---	2.9	1.8	---	26	---	17	---	1.9	.73	---
TOTAL	408.0	220.8	169.6	67.1	55.9	322.1	1933	821.7	302.3	419.0	36.92	164.27
MEAN	13.2	7.36	5.47	2.16	2.00	10.4	64.4	26.5	10.1	13.5	1.19	5.48
MAX	44	20	11	2.8	2.3	60	172	77	53	52	2.0	17
MIN	2.5	3.7	2.9	1.8	1.8	1.5	23	7.2	1.7	1.9	.73	.73
CFSM	1.00	.56	.41	.16	.15	.79	4.88	2.01	.77	1.02	.09	.42
IN.	1.15	.62	.48	.19	.16	.91	5.45	2.32	.85	1.18	.10	.46

CAL YR 1990	TOTAL	3617.37	MEAN	9.91	MAX	83	MIN	.74	CFSM	.75	IN	10.19
WTR YR 1991	TOTAL	4920.69	MEAN	13.5	MAX	172	MIN	.73	CFSM	1.02	IN	13.87

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1965 to current year.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURE: October 1964 to current year.

INSTRUMENTATION.--Water-temperature recorder since Oct. 20, 1964. Digital recorder set for one-hour-interval punches.

REMARKS.--Quarterly samples were collected at or near gage. Water-quality table includes some radiochemical data collected in the 1990 water year.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURE (water years 1966-72, 1974-91): Maximum, 24.5°C, July 8, 1987; minimum, 0.0°C on many days during winter.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURE: Maximum, 23.5°C, Aug. 29; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED CENT- SATUR- ATION (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 25...	1345	17.0	88	7.60	4.0	1.4	12.5	97	58	K10
FEB 07...	1320	2.3	166	7.71	0.5	2.0	13.7	97	K2	K3
MAY 08...	1330	58	64	7.10	5.0	2.6	12.3	97	K31	K5
AUG 13...	1250	0.97	200	7.67	17.5	2.5	9.2	98	K580	240

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD HCO3 (MG/L AS CACO3) (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
OCT 25...	44	--	12	3.5	2.2	0.4	--	--	7.7	1.8
FEB 07...	78	10	21	6.1	4.0	0.4	83	68	4.6	5.4
MAY 08...	32	9	8.6	2.5	1.6	0.3	28	23	4.9	0.40
AUG 13...	97	9	27	7.1	5.5	0.6	107	88	2.8	7.1

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L AS SIO2) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 25...	<0.1	10	71	0.10	3.26	<0.01	<0.01	<0.10	<0.10	0.05
FEB 07...	<0.1	15	107	0.15	0.66	<0.01	<0.01	0.10	0.10	0.03
MAY 08...	<0.1	7.6	52	0.07	8.14	<0.01	<0.01	<0.05	<0.05	0.04
AUG 13...	0.1	14	133	0.18	0.35	<0.01	<0.01	0.06	0.05	0.02

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
OCT 25...	0.06	0.7	<0.01	<0.01	<0.01	<0.01	100	<1	28	<0.5
FEB 07...	0.03	0.5	0.02	<0.01	<0.01	<0.01	20	<1	14	<0.5
MAY 08...	0.04	0.6	<0.01	<0.01	<0.01	<0.01	70	<1	12	<0.5
AUG 13...	0.01	0.5	0.02	<0.01	<0.01	<0.01	<10	<1	18	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 25...	<1	<1	<3	3	250	<1	<4	9	<0.1	<10
FEB 07...	<1	<1	<3	2	470	<1	<4	26	<0.1	<10
MAY 08...	<1	<1	<3	<1	140	<1	<4	6	<0.1	<10
AUG 13...	<1	<1	<3	2	360	<1	<4	24	<0.1	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. & FINER THAN .062 MM (70331)	
OCT 25...	<1	<1	<1	22	<6	47	3	0.14	54	
FEB 07...	1	<1	<1	39	<6	14	8	0.05	87	
MAY 08...	1	<1	<1	17	<6	5	14	2.2	63	
AUG 13...	<1	<1	<1	59	<6	12	3	0.01	--	
DATE	TIME	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)	URANIUM NATURAL DIS- SOLVED (UG/L AS U) (22703)	
MAY 1990 22...	1315	<0.4	<0.4	1.4	0.8	1.2	0.6	0.06	0.03	
OCT 1990 25...	1345	<0.4	<0.4	1.1	<0.4	1.0	<0.4	0.04	0.02	
MAY 1991 08...	1330	<0.4	<0.4	0.8	<0.4	0.7	<0.4	0.02	0.02	



## STREAMS TRIBUTARY TO LAKE SUPERIOR

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04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
OCTOBER				NOVEMBER			DECEMBER			JANUARY		
1	10.0	9.0	9.5	6.0	3.0	4.5	.0	.0	.0	.0	.0	.0
2	9.5	6.5	8.5	7.0	6.0	6.5	.5	.0	.0	.5	.0	.0
3	10.5	9.5	10.0	6.5	5.0	6.0	.5	.0	.0	.5	.0	.5
4	10.0	9.0	9.5	5.0	3.0	4.0	.5	.0	.5	.5	.0	.0
5	9.0	8.0	8.5	3.0	2.5	3.0	.5	.0	.0	.0	.0	.0
6	8.5	7.5	8.0	2.5	1.5	2.0	.0	.0	.0	.5	.0	.0
7	7.5	6.5	7.0	1.5	.5	1.0	.0	.0	.0	.5	.0	.5
8	6.5	5.0	5.5	.5	.0	.5	.0	.0	.0	.0	.0	.0
9	5.0	3.5	4.5	1.5	.5	1.0	.0	.0	.0	.5	.0	.0
10	4.5	2.5	3.5	.5	.0	.5	.0	.0	.0	.5	.0	.0
11	5.5	3.5	4.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
12	7.0	5.0	6.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
13	6.5	4.5	5.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
14	7.0	6.0	6.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
15	6.5	5.5	6.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
16	6.5	5.0	6.0	1.0	.5	.5	.0	.0	.0	.0	.0	.0
17	6.5	3.5	6.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18	3.5	3.0	3.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
19	3.0	2.5	3.0	.5	.0	.5	.0	.0	.0	.0	.0	.0
20	4.0	3.0	3.5	1.0	.0	.5	.0	.0	.0	.0	.0	.0
21	5.0	4.0	4.5	3.0	1.0	2.0	.0	.0	.0	.0	.0	.0
22	4.5	4.0	4.5	3.0	1.5	2.0	.0	.0	.0	.0	.0	.0
23	4.5	3.5	4.5	1.5	.0	1.0	.0	.0	.0	.0	.0	.0
24	4.5	4.0	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
25	4.5	3.5	4.0	.0	.0	.0	.5	.0	.0	.0	.0	.0
26	4.5	3.0	4.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
27	5.0	4.5	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
28	4.5	3.0	3.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
29	3.5	2.0	3.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
30	3.0	2.0	2.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
31	3.0	1.5	2.5	---	---	---	.0	.0	.0	.0	.0	.0
MONTH	10.5	1.5	5.5	7.0	.0	1.0	.5	.0	.0	.5	.0	.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
FEBRUARY			MARCH			APRIL			MAY			
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	7.0	5.0	5.5
2	.0	.0	.0	.5	.0	.0	.0	.0	.0	5.5	4.5	5.0
3	.0	.0	.0	.5	.0	.0	.0	.0	.0	7.5	4.5	6.0
4	.0	.0	.0	.5	.0	.0	.0	.0	.0	6.0	5.0	5.5
5	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.0	4.5	5.0
6	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.5	4.0	5.0
7	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.5	3.5	4.5
8	.0	.0	.0	.0	.0	.0	.5	.0	.0	7.5	4.5	6.0
9	.0	.0	.0	.0	.0	.0	.5	.0	.0	8.5	6.0	7.5
10	.0	.0	.0	.0	.0	.0	1.5	.0	.5	12.0	7.0	9.5
11	.5	.0	.0	.0	.0	.0	1.5	.0	.5	14.0	10.5	12.0
12	.5	.0	.0	.0	.0	.0	1.5	.0	1.0	16.5	12.5	14.0
13	.0	.0	.0	.0	.0	.0	3.0	.5	2.0	16.0	13.5	15.0
14	.5	.0	.0	.0	.0	.0	2.0	.5	1.5	17.0	13.0	15.0
15	.5	.0	.5	.0	.0	.0	1.0	.5	1.0	17.5	13.5	15.5
16	.5	.0	.0	.0	.0	.0	1.5	1.0	1.0	16.0	14.0	15.5
17	.5	.0	.0	.0	.0	.0	3.5	.5	2.0	15.0	12.0	13.0
18	.5	.0	.0	.0	.0	.0	4.5	2.0	3.0	13.5	10.0	11.5
19	.0	.0	.0	.0	.0	.0	4.0	2.5	3.0	13.5	8.5	11.0
20	.0	.0	.0	.0	.0	.0	4.5	1.5	3.0	14.5	9.5	12.0
21	.0	.0	.0	.0	.0	.0	5.0	2.0	3.0	16.5	11.5	14.0
22	.5	.0	.0	.0	.0	.0	5.5	2.0	3.5	16.5	14.5	15.5
23	.5	.0	.0	.0	.0	.0	6.5	3.0	4.5	20.0	15.5	17.5
24	.5	.0	.0	.0	.0	.0	7.0	3.5	5.0	19.5	17.0	18.0
25	.5	.0	.5	.0	.0	.0	8.5	4.0	6.0	19.5	16.0	17.5
26	.5	.0	.0	.0	.0	.0	10.0	5.5	7.5	17.0	13.0	15.0
27	.5	.0	.0	.0	.0	.0	8.5	7.0	8.0	16.0	12.5	14.0
28	.5	.0	.0	.0	.0	.0	10.5	7.0	8.5	16.0	15.5	16.0
29	---	---	---	.0	.0	.0	9.5	8.0	8.5	16.5	14.5	15.5
30	---	---	---	.0	.0	.0	8.0	7.0	7.5	17.0	14.5	16.0
31	---	---	---	.0	.0	.0	---	---	---	18.0	15.5	17.0
MONTH	.5	.0	.0	.5	.0	.0	10.5	.0	2.5	20.0	3.5	12.0

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	JUNE			JULY			AUGUST			SEPTEMBER		
1	18.0	15.0	16.5	15.5	13.0	14.5	18.5	15.5	17.0	16.0	10.5	13.5
2	19.0	15.5	17.0	14.0	12.5	13.5	18.0	14.5	16.5	18.0	13.0	15.5
3	19.5	16.0	17.5	14.5	14.0	14.0	16.5	15.0	16.0	19.5	15.5	17.5
4	18.5	15.0	16.5	15.5	14.5	14.5	17.5	13.5	15.5	17.5	13.5	15.0
5	18.5	14.0	16.0	16.0	14.5	15.0	17.5	12.5	15.0	14.5	13.0	13.5
6	18.0	13.5	16.0	18.0	15.5	16.5	18.0	13.0	15.5	15.5	11.0	13.0
7	18.0	13.0	16.0	17.0	15.5	16.0	18.0	13.5	16.0	16.0	11.0	13.5
8	19.0	14.0	16.5	16.0	14.5	15.5	18.5	13.0	15.5	16.0	14.0	15.0
9	18.5	15.5	17.0	16.0	14.0	15.0	19.0	14.0	16.5	16.0	15.0	15.5
10	20.0	16.0	17.5	17.0	14.5	16.0	19.5	14.5	16.5	16.0	12.5	15.0
11	19.5	15.5	17.0	18.0	15.0	16.5	20.0	15.0	17.0	14.0	12.0	13.0
12	18.0	14.5	16.5	17.5	16.5	17.0	20.0	15.0	17.0	---	---	---
13	17.5	13.5	15.5	18.5	15.5	17.0	21.0	15.5	18.0	---	---	---
14	16.0	15.0	15.5	18.0	14.5	16.5	21.5	16.0	18.5	---	---	---
15	18.0	15.0	16.0	19.0	15.0	17.0	21.0	17.0	19.0	---	---	---
16	18.5	14.5	16.5	19.5	17.0	18.5	19.5	16.5	18.0	---	---	---
17	19.5	14.5	17.0	21.5	17.5	19.5	20.0	17.0	18.5	---	---	---
18	18.5	16.0	17.0	22.5	19.0	20.5	17.5	15.5	17.0	---	---	---
19	19.0	15.0	17.0	---	---	---	17.0	12.5	14.5	---	---	---
20	16.5	15.5	16.0	---	---	---	17.0	11.0	14.0	---	---	---
21	17.5	14.5	15.5	---	---	---	18.0	13.5	15.5	---	---	---
22	18.0	12.5	15.0	---	---	---	18.5	14.0	16.0	---	---	---
23	18.0	12.5	15.5	---	---	---	16.0	15.0	15.5	---	---	---
24	18.0	13.5	16.0	---	---	---	17.5	15.5	16.5	---	---	---
25	20.0	15.0	17.5	17.5	15.5	16.0	21.0	16.5	18.0	---	---	---
26	19.0	16.0	17.0	16.5	14.5	15.5	21.0	18.0	19.5	---	---	---
27	17.5	15.5	16.5	18.0	14.5	16.0	21.5	18.0	19.5	---	---	---
28	18.5	17.0	17.5	16.0	14.5	15.5	22.5	17.5	20.0	---	---	---
29	17.5	15.5	16.0	16.5	13.5	15.0	23.5	19.5	21.0	---	---	---
30	15.5	15.0	15.5	17.5	13.0	15.5	22.0	18.0	19.5	---	---	---
31	---	---	---	19.0	15.5	17.0	18.0	13.0	16.0	---	---	---
MONTH	20.0	12.5	16.5	22.5	12.5	16.0	23.5	11.0	17.0	19.5	10.5	14.5

## STREAMS TRIBUTARY TO LAKE SUPERIOR

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## 04033000 MIDDLE BRANCH ONTONAGON RIVER NEAR PAULDING, MI

LOCATION.--Lat 46°21'25", long 89°04'38", in SE1/4 NE1/4 sec.29, T.46 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, Ottawa National Forest, on right bank 25 ft downstream from bridge on Forest Service Road 172, 2.4 mi upstream from Bond Falls Reservoir, and 5.7 mi southeast of Paulding.

DRAINAGE AREA.--164 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,485.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 3 to Mar. 25. Records excellent except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 172 ft<sup>3</sup>/s, 14.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,050 ft<sup>3</sup>/s, Apr. 30, 1951, gage height, 10.0 ft, from floodmark; minimum, 27 ft<sup>3</sup>/s, Nov. 22, 1946, result of freezeup; minimum gage height, 2.96 ft, Nov. 26, 1942, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 680 ft<sup>3</sup>/s, Apr 9, 10, gage height, 6.67 ft; minimum, 55 ft<sup>3</sup>/s, Sept. 1, 2, 3, gage height, 3.42 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	151	169	90	82	84	247	430	344	182	101	59
2	87	151	148	87	83	84	228	380	286	176	93	57
3	92	147	130	85	85	84	238	318	239	168	89	91
4	109	143	120	82	90	85	299	286	205	159	88	135
5	109	139	150	82	94	86	386	278	178	201	84	129
6	98	134	150	82	96	87	453	316	161	174	78	101
7	95	128	140	82	98	87	459	361	147	147	77	93
8	95	122	130	82	98	87	503	338	140	140	77	94
9	92	120	120	82	96	87	647	298	136	130	74	100
10	90	118	115	82	85	88	655	267	127	119	71	121
11	94	114	110	82	88	88	577	245	120	112	68	120
12	102	106	105	82	86	88	491	227	113	117	66	107
13	108	128	100	83	85	88	420	213	107	122	71	101
14	112	127	100	83	84	88	386	196	109	117	70	101
15	120	108	120	83	83	88	409	180	143	108	68	117
16	115	110	110	83	83	89	407	196	142	100	65	119
17	168	107	108	84	83	90	371	218	128	110	79	109
18	363	103	105	84	83	92	333	196	116	113	87	111
19	353	103	102	83	83	97	301	175	108	103	79	108
20	297	106	110	83	83	105	272	161	105	97	72	105
21	327	127	103	82	84	130	248	151	111	100	68	98
22	333	159	99	82	84	180	231	145	117	97	68	94
23	301	150	97	82	84	175	218	149	108	92	70	94
24	257	137	96	81	84	170	217	148	101	84	73	86
25	225	127	96	81	84	163	207	136	98	81	77	88
26	202	138	96	80	84	200	197	210	94	80	74	105
27	185	141	96	81	84	315	190	365	90	78	71	101
28	182	169	95	82	84	370	207	450	118	89	68	96
29	171	168	95	82	---	349	261	525	199	130	65	90
30	159	173	94	82	---	312	390	464	218	135	64	86
31	152	---	92	82	---	289	---	393	---	117	61	---
TOTAL	5279	3954	3501	2563	2420	4425	10448	8415	4408	3778	2316	3016
MEAN	170	132	113	82.7	86.4	143	348	271	147	122	74.7	101
MAX	363	173	169	90	98	370	655	525	344	201	101	135
MIN	86	103	92	80	82	84	190	136	90	78	61	57
CFSM	1.04	.81	.69	.50	.53	.87	2.12	1.65	.90	.74	.46	.62
IN.	1.20	.90	.79	.58	.55	1.00	2.37	1.91	1.00	.86	.53	.68
CAL YR 1990	TOTAL	44971	MEAN	123	MAX	450	MIN	57	CFSM	.75	IN	10.20
WTR YR 1991	TOTAL	54523	MEAN	149	MAX	655	MIN	57	CFSM	.91	IN	12.37

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 04033500 BOND FALLS CANAL NEAR PAULDING, MI

LOCATION.--Lat 46°23'57", long 89°08'47", in SW1/4 NE1/4 sec.11, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 80 ft upstream from intake to pipeline No. 2, 0.8 mi downstream from Bond Falls Reservoir on Middle Branch Ontonagon River, and 1.6 mi east of Paulding.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,441.59 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at datum 3.00 ft higher.

REMARKS.--Estimated daily discharges: Jan. 4-7, 10, 11, 22-27, and Feb. 1. Records excellent except those below 5.0 ft<sup>3</sup>/s, which are poor. Canal diverts water from Bond Falls Reservoir (station 04034000) to South Branch Ontonagon River; water is used for power production at Victoria Dam near Rockland. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 140 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 368 ft<sup>3</sup>/s, May 5, 1960; no flow for several days in 1963-70, 1973-75, 1982, 1987, 1991.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	111	8.6	219	194	110	122	.00	59	12	148	300	4.3
2	111	8.7	217	193	114	120	.00	8.8	12	10	299	4.6
3	112	8.9	216	193	119	119	.00	38	98	9.4	295	5.5
4	112	8.9	215	193	100	119	.00	95	195	9.4	292	4.6
5	111	8.9	215	193	66	120	.00	96	194	8.9	289	4.8
6	111	8.9	217	193	56	120	.00	55	237	8.7	287	4.8
7	110	8.9	217	193	56	118	.00	9.7	295	8.7	211	4.8
8	110	8.9	216	194	56	118	.00	9.6	295	94	152	4.8
9	67	8.9	217	192	55	119	.00	10	294	266	102	5.2
10	76	8.9	236	193	55	118	.00	26	293	315	6.9	5.0
11	191	8.9	265	193	54	118	.00	62	292	315	6.2	4.8
12	190	9.0	263	192	54	117	.00	46	290	314	6.3	5.1
13	189	46	225	192	54	117	.00	46	289	316	6.6	5.3
14	190	118	191	191	72	116	.00	79	301	314	5.4	5.7
15	190	119	191	190	98	116	1.9	134	314	314	5.2	5.6
16	189	117	191	188	98	118	1.5	160	312	317	5.5	5.2
17	190	117	191	184	99	119	.90	159	313	315	5.2	5.4
18	114	117	190	184	99	119	.90	158	312	314	4.8	5.2
19	8.1	117	189	186	99	101	1.1	159	311	312	4.9	5.2
20	7.9	117	189	184	99	70	1.2	212	308	309	4.7	5.2
21	7.9	117	188	182	99	42	1.5	281	307	308	4.7	4.9
22	7.7	116	138	182	98	5.5	1.6	280	307	305	4.7	4.8
23	7.7	115	82	181	98	5.6	1.8	280	304	302	4.5	5.0
24	7.7	115	82	180	97	5.2	1.7	279	302	300	4.6	5.2
25	7.6	115	80	179	97	5.4	2.2	277	303	297	4.7	5.3
26	7.9	138	79	178	116	3.9	25	175	302	296	4.6	5.1
27	8.0	200	126	177	137	.59	62	12	302	295	4.8	5.2
28	7.9	221	198	177	130	.04	45	11	299	293	4.8	5.4
29	8.2	220	201	175	---	.00	27	12	298	298	4.7	5.4
30	8.2	220	198	145	---	.00	55	12	295	305	4.5	5.5
31	8.4	---	195	112	---	.00	---	12	---	303	4.1	---
TOTAL	2577.2	2551.4	5837	5683	2485	2372.23	230.30	3253.1	7986	7320.1	2339.4	152.9
MEAN	83.1	85.0	188	183	88.8	76.5	7.68	105	266	236	75.5	5.10
MAX	191	221	265	194	137	122	62	281	314	317	300	5.7
MIN	7.6	8.6	79	112	54	.00	.00	8.8	12	8.7	4.1	4.3
CAL YR 1990	TOTAL	36342.40	MEAN	99.6	MAX	311	MIN	1.5				
WTR YR 1991	TOTAL	42787.63	MEAN	117	MAX	317	MIN	.00				



## STREAMS TRIBUTARY TO LAKE SUPERIOR

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## 04034000 BOND FALLS RESERVOIR NEAR PAULDING, MI

LOCATION.--Lat 46°24'29", long 89°07'42", in SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Dam on Middle Branch Ontonagon River, 2.5 mi east of Paulding.

DRAINAGE AREA.--190 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1942 to current year. Prior to October 1950, monthend contents only published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Nonrecording gage read once daily. Datum of gage is 1,335.59 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by earthfill and concrete dam with one taintor gate; dam completed in 1937. Capacity of reservoir, 41,300 acre-ft between gage heights of 120 ft (maximum drawdown) and 141 ft (full pond). Dead storage unknown. Water diverted to South Branch Ontonagon River through Bond Falls Canal (station 04033500); water used for power production at Victoria Dam near Rockland.

COOPERATION.--Gage-height record provided by Upper Peninsula Power Co. and converted to acre-feet by U.S. Geological Survey.

EXTREMES FOR PERIOD OF RECORD (SINCE 1947).--Maximum contents observed, 42,980 acre-ft, July 3, 1953, gage height, 141.7 ft, of which 1,680 acre-ft was uncontrolled storage; no usable storage at times; minimum gage height observed, 116.0 ft, Mar. 21, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 37,750 acre-ft, May 31, gage height, 139.5 ft; minimum, 5,510 acre-ft, Mar. 18-20, gage height, 123.5 ft.

## MONTHEND GAGE HEIGHT AND CONTENTS AT 1030, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre- feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 . . . . .	130.6	18,740	--	--
Oct. 31 . . . . .	132.8	23,100	+4,360	+70.9
Nov. 30 . . . . .	133.1	23,700	+600	+10.1
Dec. 31 . . . . .	129.7	17,030	-6,670	-108.5
CAL YR 1990 . . . . .	--	--	-6,270	-8.7
Jan. 31 . . . . .	125.4	8,920	-8,110	-131.9
Feb. 28 . . . . .	124.7	7,660	-1,260	-22.7
Mar. 31 . . . . .	126.8	11,520	+3,860	+62.8
Apr. 30 . . . . .	136.2	30,240	+18,720	+314.6
May 31 . . . . .	139.5	37,750	+7,510	+122.1
June 30 . . . . .	134.1	25,710	-12,040	-202.3
July 31 . . . . .	129.8	17,220	-8,490	-138.1
Aug. 31 . . . . .	128.7	15,130	-2,090	-34.0
Sept. 30 . . . . .	130.9	19,310	+4,180	+70.2
WTR YR 1991 . . . . .	--	--	+570	+0.8

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04034500 MIDDLE BRANCH ONTONAGON RIVER NEAR TROUT CREEK, MI

LOCATION.--Lat 46°28'40", long 89°05'25", in SW1/4 sec.8, T.47 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.1 mi upstream from State Highway 28, 3.8 mi west of village of Trout Creek, and 7.5 mi downstream from Bond Falls Reservoir.

DRAINAGE AREA.--203 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,132.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 4, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 23-28, 30, 31, Jan. 2-5, 10, 22-31, and Feb. 1, 15, 17, 23-28. Records excellent except for estimated daily discharges, which are good. Flow regulated by Bond Falls Reservoir (station 04034000) 7.5 mi upstream. Diversion to South Branch Ontonagon River 8.5 mi upstream by Bond Falls Canal (station 04033500). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 64.7 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,750 ft<sup>3</sup>/s, Nov. 7, 1951, gage height, 5.05 ft; minimum, 14 ft<sup>3</sup>/s, sometime during period Jan. 23 to Feb. 13, 1947, gage height, 1.14 ft, from recorded range in stage, caused by ice jams upstream from station.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 416 ft<sup>3</sup>/s, June 1, 2, gage height, 3.06 ft; minimum daily, 41 ft<sup>3</sup>/s, Feb. 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	45	49	48	45	45	45	51	52	415	55	53	55
2	43	49	43	45	45	43	52	49	414	54	54	55
3	45	49	45	45	45	45	59	46	238	55	54	63
4	45	49	46	45	46	45	70	44	57	54	53	54
5	45	49	48	45	45	44	69	45	55	53	52	45
6	45	49	49	44	45	44	66	62	55	52	52	45
7	45	49	50	46	45	43	63	56	55	53	52	45
8	45	49	48	44	45	44	67	49	54	54	52	45
9	45	49	48	44	45	43	67	46	55	52	52	49
10	45	49	48	44	41	43	60	44	54	52	52	48
11	47	48	48	44	42	43	59	43	54	51	51	46
12	47	48	48	43	43	43	57	42	54	55	51	46
13	46	48	44	43	48	43	57	42	54	54	52	46
14	47	48	44	44	45	44	65	42	59	52	53	50
15	47	49	50	46	45	45	67	45	59	51	53	49
16	46	48	48	46	46	44	59	50	56	51	54	47
17	64	48	47	46	45	45	57	46	54	53	57	47
18	77	48	47	46	45	45	54	45	54	51	54	48
19	56	48	43	46	45	46	49	44	53	50	54	48
20	61	48	49	44	45	46	47	58	54	54	54	48
21	68	50	47	45	45	60	45	381	58	52	54	47
22	56	49	47	45	43	53	44	338	54	51	54	46
23	52	48	47	45	46	60	43	47	53	50	54	46
24	51	48	46	45	45	54	42	45	52	51	55	46
25	50	48	46	45	45	52	42	44	52	52	55	49
26	50	48	46	45	45	66	42	78	52	52	54	48
27	50	49	46	45	45	91	43	63	52	52	54	48
28	49	52	46	45	45	71	43	55	54	61	55	48
29	49	49	46	45	---	58	49	59	62	62	55	48
30	49	49	45	45	---	54	60	66	54	55	55	48
31	49	---	45	45	---	52	---	209	---	54	55	---
TOTAL	1559	1461	1448	1390	1255	1554	1648	2335	2546	1648	1659	1453
MEAN	50.3	48.7	46.7	44.8	44.8	50.1	54.9	75.3	84.9	53.2	53.5	48.4
MAX	77	52	50	46	48	91	70	381	415	62	57	63
MIN	43	48	43	43	41	43	42	42	52	50	51	45
CAL YR 1990	TOTAL	18025	MEAN	49.4	MAX	232	MIN	39				
WTR YR 1991	TOTAL	19956	MEAN	54.7	MAX	415	MIN	41				

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 04035500 MIDDLE BRANCH ONTONAGON RIVER NEAR ROCKLAND, MI

LOCATION.--Lat 46°41'57", long 89°09'36", in SE1/4 sec.27, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 10 ft upstream from bridge on U.S. Highway 45, 700 ft downstream from East Branch, and 2.8 mi southeast of Rockland.

DRAINAGE AREA.--671 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 661.1 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1959, nonrecording gage at site 400 ft upstream at same datum. Apr. 1, 1959, to Oct. 21, 1968, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 24 to Mar. 22. Records good except for estimated daily discharges, which are fair. Regulation by Bond Falls Reservoir (station 04034000) 30.0 mi upstream. Diversion to South Branch Ontonagon River by Bond Falls Canal (station 04033500) 31.0 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 522 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 27,000 ft<sup>3</sup>/s, Aug. 22, 1942, gage height, 21.2 ft, from floodmarks, from rating curve extended above 7,500 ft<sup>3</sup>/s, on basis of slope-area measurement of peak flow; minimum observed, 142 ft<sup>3</sup>/s, Dec. 3, 1963, discharge measurement; minimum daily, 145 ft<sup>3</sup>/s, Dec. 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,460 ft<sup>3</sup>/s, Mar. 27, gage height, 8.44 ft; minimum, 155 ft<sup>3</sup>/s, Nov. 26, gage height, 3.29 ft, result of freeze-up; minimum daily, 171 ft<sup>3</sup>/s, Sept. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	182	256	326	202	202	220	587	1030	836	525	253	171
2	185	249	257	200	204	220	632	669	730	446	221	171
3	191	240	203	198	210	220	1440	502	632	1080	208	222
4	195	239	227	198	220	220	2480	426	293	1280	209	276
5	198	233	238	196	236	220	2310	450	254	488	197	241
6	192	227	262	194	250	220	2170	2090	232	369	189	205
7	190	222	259	196	260	220	1700	2080	221	283	186	193
8	188	215	263	197	268	220	1610	1140	213	256	184	189
9	185	213	250	198	260	220	1750	741	204	242	180	203
10	181	214	245	198	254	220	1250	552	202	225	178	226
11	191	206	242	198	244	220	1180	450	197	208	176	217
12	205	201	242	198	234	220	1100	390	192	332	174	198
13	212	196	230	198	224	220	896	356	188	1250	172	191
14	212	244	229	199	222	221	1320	322	189	555	176	194
15	225	219	248	199	220	221	1950	296	213	338	178	290
16	224	213	267	199	220	221	1100	333	236	273	194	260
17	465	209	231	199	220	221	830	331	255	252	244	224
18	2030	203	228	199	220	222	667	295	230	239	239	226
19	1150	201	201	199	220	232	548	268	209	218	213	246
20	938	201	198	199	219	430	454	251	195	209	196	235
21	2050	219	234	199	219	1140	393	378	207	315	189	214
22	1170	240	231	199	219	2000	356	518	218	294	186	201
23	686	242	212	199	218	2090	335	352	202	241	183	190
24	503	233	212	199	218	2040	312	234	190	213	185	184
25	401	217	210	199	219	1280	296	226	184	200	188	197
26	339	192	208	199	220	2650	287	1970	181	193	190	246
27	311	270	208	200	220	4120	286	1960	181	188	188	241
28	350	381	206	200	220	2890	304	1110	204	216	183	215
29	326	373	204	200	---	1460	487	1580	408	540	180	202
30	293	312	204	200	---	888	1270	1440	353	436	176	202
31	269	---	202	200	---	787	---	782	---	311	172	---
TOTAL	14437	7080	7177	6158	6360	25973	30300	23522	8249	12215	5987	6470
MEAN	466	236	232	199	227	838	1010	759	275	394	193	216
MAX	2050	381	326	202	268	4120	2480	2090	836	1280	253	290
MIN	181	192	198	194	202	220	286	226	181	188	172	171
CAL YR 1990	TOTAL	140292	MEAN	384	MAX	7000	MIN	167				
WTR YR 1991	TOTAL	153928	MEAN	422	MAX	4120	MIN	171				

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 04035995 LAKE GOGEBIC NEAR BERGLAND, MI

LOCATION.--Lat 46°35'19", long 89°32'52", in SW1/4 NW1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, at upstream side of dam on lake outlet, 1.0 mi southeast of Bergland, and 4.3 mi east of Merriweather.

DRAINAGE AREA.--162 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1958 to September 1959 (no winter record), February 1969 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,292.70 ft above National Geodetic Vertical Datum of 1929. July 1958 to September 1959, nonrecording gage at mouth of Merriweather Creek at different datum. February 1969 to September 1988, at datum 1.00 ft higher.

REMARKS.--Lake Gogebic is used as a storage reservoir (capacity 35,200 acre-ft) by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete and steel dam with removable flash boards. Major inlets to Lake Gogebic are Slate River, Trout Brook, and Merriweather Creek. Streamflow records are currently collected at the outlet, West Branch Ontonagon River (station 04036000). Surface area of lake is 14,780 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 4.30 ft, present datum, Apr. 22, 1971; minimum daily, 0.68 ft, present datum, Apr. 5, 6, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.78 ft, May 29, result of wind action; minimum, 0.88 ft, Mar. 17.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.73	2.93	1.96	1.93	1.81	1.25	1.99	3.17	3.29	3.14	2.90	2.62
2	2.72	2.90	1.96	1.93	1.79	1.23	2.02	3.12	3.23	3.17	2.85	2.62
3	2.77	2.84	1.94	1.93	1.80	1.22	2.05	3.08	3.18	3.17	2.85	2.66
4	2.79	2.80	1.94	1.93	1.76	1.20	2.13	3.13	3.18	3.12	2.84	2.65
5	2.72	2.76	1.96	1.90	1.74	1.18	2.24	3.17	3.14	3.09	2.83	2.61
6	2.69	2.74	1.97	1.92	1.72	1.17	2.37	3.25	3.12	3.05	2.83	2.61
7	2.70	2.70	1.98	1.91	1.69	1.14	2.48	3.29	3.10	3.01	2.81	2.60
8	2.70	2.68	1.98	1.90	1.67	1.13	2.57	3.35	3.09	2.99	2.78	2.63
9	2.69	2.64	1.98	1.91	1.64	1.13	2.70	3.37	3.10	3.00	2.78	2.70
10	2.72	2.60	1.97	1.89	1.63	1.11	2.76	3.42	3.05	3.00	2.78	2.67
11	2.77	2.55	1.96	1.89	1.60	1.09	2.78	3.44	3.00	3.00	2.77	2.65
12	2.75	2.45	1.96	1.89	1.58	1.07	2.78	3.45	2.94	3.05	2.76	2.65
13	2.77	2.40	1.96	1.89	1.55	1.05	2.78	3.48	2.97	3.04	2.77	2.65
14	2.77	2.40	1.96	1.88	1.53	1.04	2.80	3.47	2.97	3.01	2.76	2.68
15	2.81	2.34	1.96	1.88	1.53	1.03	2.87	3.47	2.99	3.06	2.77	2.75
16	2.78	2.28	1.96	1.88	1.53	1.01	2.92	3.44	3.01	3.10	2.77	2.82
17	2.82	2.28	1.95	1.88	1.51	.99	2.92	3.39	3.01	3.04	2.77	2.76
18	2.97	2.26	1.94	1.88	1.47	1.01	2.90	3.38	3.00	3.04	2.73	2.80
19	3.21	2.20	1.94	1.87	1.46	1.01	2.87	3.38	3.00	2.99	2.72	2.75
20	3.26	2.18	1.94	1.86	1.43	1.01	2.84	3.38	2.97	2.99	2.73	2.77
21	3.30	2.18	1.94	1.86	1.41	1.05	2.82	3.38	2.98	3.02	2.73	2.79
22	3.35	2.21	1.95	1.87	1.39	1.07	2.79	3.40	2.97	3.06	2.70	2.81
23	3.38	---	---	1.88	1.36	1.17	2.84	3.43	2.98	3.04	2.70	2.73
24	3.33	---	1.98	1.89	1.37	1.24	2.87	3.37	2.99	2.97	2.70	2.71
25	3.29	---	1.97	1.90	1.34	1.28	2.92	3.35	2.98	2.90	2.72	2.78
26	3.25	---	1.97	1.90	1.32	1.35	2.92	3.44	3.00	2.89	2.74	2.70
27	3.18	---	1.97	1.89	1.30	1.54	2.95	3.44	3.00	2.88	2.71	2.69
28	3.10	2.00	1.94	1.90	1.28	1.74	2.96	3.43	2.98	2.90	2.69	2.71
29	3.09	2.01	1.94	1.88	---	1.83	2.99	3.43	3.09	2.90	2.70	2.71
30	3.01	2.00	1.93	1.87	---	1.91	3.15	3.38	3.10	2.92	2.66	2.75
31	2.95	---	1.93	1.85	---	1.97	---	3.33	---	2.92	2.60	---
MEAN	2.95	---	---	1.89	1.54	1.23	2.70	3.36	3.05	3.01	2.76	2.70
MAX	3.38	---	---	1.93	1.81	1.97	3.15	3.48	3.29	3.17	2.90	2.82
MIN	2.69	---	---	1.85	1.28	.99	1.99	3.08	2.94	2.88	2.60	2.60



STREAMS TRIBUTARY TO LAKE SUPERIOR

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04036000 WEST BRANCH ONTONAGON RIVER NEAR BERGLAND, MI

LOCATION.--Lat 46°35'15", long 89°32'30", in SW1/4 NE1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.4 mi downstream from dam at outlet of Lake Gogebic, and 1.5 mi east of Bergland.

DRAINAGE AREA.--162 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,290.81 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 5, 1942, nonrecording gage 0.4 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 12, Dec. 26, and Jan. 29. Records good except those below 5.0 ft<sup>3</sup>/s, which are fair. Flow regulated by Lake Gogebic (station 04035995). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 171 ft<sup>3</sup>/s, 14.33 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,400 ft<sup>3</sup>/s, Apr. 26, 1960, gage height, 5.98 ft; minimum daily, 0.38 ft<sup>3</sup>/s, Nov. 16, 17, 1989.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 791 ft<sup>3</sup>/s, May 29, gage height, 4.53 ft; minimum daily, 0.61 ft<sup>3</sup>/s, Oct. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.61	339	150	61	136	148	213	46	653	174	49	1.8
2	.61	392	142	60	134	143	219	9.8	625	218	31	1.6
3	.85	356	106	60	134	141	233	8.8	424	251	16	1.8
4	.93	328	76	59	132	139	255	8.7	257	365	14	1.7
5	.68	300	77	56	157	137	295	9.6	244	352	13	1.6
6	.63	296	75	56	172	135	339	10	237	339	13	1.5
7	.65	280	74	54	167	132	378	12	172	323	6.0	1.4
8	.65	276	73	55	165	130	402	12	139	313	3.8	1.3
9	.64	258	74	55	156	129	455	13	144	171	3.1	1.4
10	16	234	70	54	152	127	476	15	148	94	2.8	1.5
11	77	217	68	53	144	126	481	17	130	51	2.6	1.4
12	32	260	69	53	140	122	481	17	120	29	2.6	1.4
13	.82	311	70	53	136	121	485	31	24	168	2.6	1.4
14	.93	309	69	53	134	120	493	108	23	249	2.7	1.6
15	.82	287	66	52	135	118	521	167	22	116	2.8	1.6
16	.71	274	67	52	133	116	536	165	21	28	2.9	1.7
17	1.0	258	67	53	128	114	538	148	21	123	3.2	1.5
18	1.4	256	67	54	159	85	532	146	21	174	2.8	1.4
19	86	238	66	53	185	60	515	146	20	167	2.7	1.3
20	142	233	66	51	183	57	502	71	21	75	2.5	1.3
21	151	251	66	51	179	59	493	19	22	25	2.4	1.3
22	232	257	72	53	172	64	413	19	22	25	2.4	1.3
23	411	234	71	55	167	73	34	82	22	24	2.2	1.3
24	416	208	70	58	167	82	29	126	22	22	2.1	1.2
25	405	176	68	58	163	86	23	132	23	80	2.1	1.3
26	412	181	66	55	158	95	17	249	23	99	2.2	1.2
27	395	188	64	55	156	116	16	412	23	67	2.3	1.2
28	358	188	63	56	152	148	14	430	22	65	2.4	1.1
29	355	182	63	117	---	170	16	658	24	65	2.4	1.0
30	322	175	61	158	---	192	71	690	62	66	2.2	1.2
31	310	---	61	148	---	205	---	671	---	67	2.0	---
TOTAL	4131.93	7742	2317	1961	4296	3690	9475	4648.9	3731	4385	203.8	42.3
MEAN	133	258	74.7	63.3	153	119	316	150	124	141	6.57	1.41
MAX	416	392	150	158	185	205	538	690	653	365	49	1.8
MIN	.61	175	61	51	128	57	14	8.7	20	22	2.0	1.0

CAL YR 1990 TOTAL 48393.52 MEAN 133 MAX 426 MIN .56 CFSM .82 IN 11.11  
WTR YR 1991 TOTAL 46623.93 MEAN 128 MAX 690 MIN .61 CFSM .79 IN 10.71

04037400 CISCO LAKE NEAR WATERSMEET, MI

LOCATION.--Lat 46°15'10", long 89°27'07", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on right bank at outlet, 100 ft upstream from dam, 13 mi west of Watersmeet. Prior to Oct. 23, 1989, at site 90 ft downstream.

DRAINAGE AREA.--50.6 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,679.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 28, 1969, nonrecording gage at same site and datum.

REMARKS.--Cisco Lake (capacity 15,600 acre-ft) is the downstream lake in a chain of lakes used as storage reservoirs by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam of two bays with removable flash boards. The major inlet to Cisco Lake is the combined outlet from Lindsley Lake and Thousand Island Lake. Streamflow records are currently collected at the outlet, Cisco Branch Ontonagon River (station 04037500). The lake level is maintained at an elevation of about 1,683.5 ft, above NGVD, during winter months and 1,684.0 ft, above NGVD, during summer months. Surface area of lake is 506 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 4.69 ft, July 19, 1942; minimum, 1.72 ft, Mar. 20-22, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.21 ft, May 29; minimum, 3.39 ft, Nov. 10.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.93	3.71	3.53	3.53	3.48	3.48	3.53	3.97	4.07	4.02	4.00	3.92
2	3.96	3.66	3.50	3.53	3.47	3.48	3.51	4.00	4.02	3.97	4.02	3.92
3	4.01	3.63	3.48	3.53	3.45	3.48	3.51	4.05	3.98	3.95	4.02	4.05
4	3.98	3.60	3.48	3.53	3.45	3.47	3.50	4.10	3.98	3.95	4.02	4.08
5	3.99	3.57	3.46	3.52	3.44	3.47	3.49	4.12	3.98	3.95	4.02	4.07
6	3.97	3.54	3.44	3.52	3.45	3.46	3.50	4.12	3.99	3.96	4.03	4.05
7	3.98	3.51	3.43	3.52	3.45	3.47	3.51	4.10	3.99	3.97	4.02	4.06
8	3.98	3.53	3.43	3.52	3.46	3.47	3.57	4.09	4.01	3.97	4.02	4.07
9	3.98	3.50	3.43	3.52	3.47	3.47	3.63	4.06	4.02	3.98	4.00	4.09
10	3.97	3.47	3.43	3.51	3.47	3.47	3.64	4.02	4.00	3.98	4.00	4.04
11	4.01	3.46	3.44	3.50	3.48	3.46	3.65	3.99	4.00	3.98	4.00	4.02
12	4.00	3.45	3.45	3.50	3.49	3.45	3.68	3.99	4.01	4.03	4.00	3.98
13	4.03	3.47	3.46	3.51	3.49	3.43	3.68	3.98	4.03	4.01	3.99	3.94
14	4.04	3.49	3.47	3.51	3.51	3.43	3.69	3.97	4.03	4.00	3.99	4.00
15	4.04	3.49	3.48	3.51	3.54	3.42	3.69	3.99	4.07	3.99	3.99	4.02
16	4.04	3.48	3.51	3.51	3.55	3.42	3.68	4.06	4.03	3.98	4.00	4.03
17	4.11	3.51	3.51	3.52	3.55	3.42	3.69	4.07	4.01	4.00	4.04	4.03
18	4.12	3.52	3.52	3.53	3.55	3.43	3.67	4.06	3.97	3.99	4.03	4.01
19	4.17	3.52	3.52	3.53	3.55	3.44	3.65	4.04	3.94	3.96	4.01	4.01
20	4.16	3.55	3.53	3.53	3.55	3.45	3.62	4.03	3.94	3.97	4.00	4.02
21	4.14	3.61	3.52	3.53	3.53	3.51	3.60	4.02	3.97	3.97	3.99	4.04
22	4.12	3.60	3.54	3.53	3.52	3.52	3.59	4.01	3.96	3.95	3.95	4.01
23	4.05	3.57	3.54	3.53	3.52	3.55	3.63	4.01	3.96	3.92	3.97	3.97
24	3.99	3.59	3.54	3.51	3.53	3.53	3.66	3.99	3.96	3.91	3.97	3.98
25	3.95	3.58	3.54	3.50	3.52	3.51	3.68	3.98	3.96	3.90	3.97	4.00
26	3.94	3.61	3.54	3.49	3.52	3.52	3.70	4.10	3.97	3.90	3.97	3.98
27	3.86	3.60	3.54	3.49	3.51	3.52	3.76	4.12	3.97	3.91	3.96	4.01
28	3.83	3.60	3.53	3.49	3.51	3.57	3.77	4.12	4.07	3.95	3.96	4.02
29	3.81	3.58	3.53	3.49	---	3.57	3.86	4.14	4.09	4.01	3.96	4.04
30	3.75	3.56	3.53	3.48	---	3.57	3.95	4.13	4.04	4.02	3.93	4.03
31	3.73	---	3.53	3.48	---	3.55	---	4.11	---	4.01	3.92	---
MEAN	3.99	3.55	3.50	3.51	3.50	3.48	3.64	4.05	4.00	3.97	3.99	4.02
MAX	4.17	3.71	3.54	3.53	3.55	3.57	3.95	4.14	4.09	4.03	4.04	4.09
MIN	3.73	3.45	3.43	3.48	3.44	3.42	3.49	3.97	3.94	3.90	3.92	3.92
CAL YR 1990	MEAN	3.75	MAX	4.17	MIN	3.43						
WTR YR 1991	MEAN	3.77	MAX	4.17	MIN	3.42						

STREAMS TRIBUTARY TO LAKE SUPERIOR

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04037500 CISCO BRANCH ONTONAGON RIVER AT CISCO LAKE OUTLET, MI

LOCATION.--Lat 46°15'12", long 89°27'05", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank 80 ft downstream from Cisco Lake Dam, 2.5 mi upstream from Langford Creek, 5.0 mi upstream from U.S. Highway 2, and 13 mi west of Watersmeet.

DRAINAGE AREA.--50.7 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,672.69 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 4.00 ft higher.

REMARKS.--No estimated daily discharges. Records good except those below 3.0 ft<sup>3</sup>/s, which are poor. Flow regulated by Cisco Lake (station 04037400). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 46.3 ft<sup>3</sup>/s, 12.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 288 ft<sup>3</sup>/s, May 1-4, 1951, gage height, 6.10 ft, present datum; minimum daily, 0.08 ft<sup>3</sup>/s, July 21, Aug. 2, 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 192 ft<sup>3</sup>/s, May 29, gage height, 5.65 ft; minimum daily, 0.52 ft<sup>3</sup>/s, Apr. 26, 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.0	100	71	24	36	37	92	14	179	129	1.1	.68
2	2.6	95	70	24	35	37	97	2.5	173	125	1.1	.68
3	2.4	92	66	24	35	37	82	2.9	98	93	1.0	1.3
4	1.8	91	65	24	35	36	91	3.9	18	26	1.0	32
5	1.7	88	64	23	19	36	92	43	5.0	15	1.1	53
6	1.6	85	62	23	5.2	36	66	110	4.2	1.8	1.1	52
7	1.5	58	41	23	5.4	37	58	136	3.1	1.5	1.0	52
8	1.4	38	20	23	5.5	36	112	135	2.3	1.3	1.0	53
9	1.4	36	20	23	5.5	36	118	132	1.3	1.2	1.0	79
10	1.4	33	14	23	5.8	36	121	129	.91	1.2	1.0	100
11	1.6	33	5.8	23	5.8	36	112	98	.86	1.1	1.0	98
12	1.6	21	5.9	24	5.9	35	112	75	.78	15	1.0	95
13	1.8	6.4	6.1	24	6.1	35	122	50	.94	28	1.0	53
14	1.8	6.7	6.1	24	6.6	34	123	28	1.1	28	1.0	1.8
15	16	6.7	6.7	24	6.7	34	123	15	45	28	1.0	1.6
16	31	6.1	7.3	24	7.1	16	121	3.6	76	27	.98	6.7
17	75	6.7	15	24	7.1	4.3	119	20	75	28	15	15
18	128	7.5	23	24	21	4.5	112	56	72	28	28	14
19	126	7.1	23	24	40	4.6	112	55	37	26	27	14
20	117	8.2	23	24	40	4.9	110	54	2.1	26	27	14
21	142	10	23	32	40	38	97	53	1.9	26	26	15
22	181	9.5	24	40	39	87	45	51	1.8	15	24	14
23	174	8.7	24	40	39	91	2.5	52	1.6	1.1	10	6.3
24	157	9.1	24	39	39	89	1.6	50	1.1	1.1	1.0	1.2
25	147	8.7	24	39	39	86	.80	50	1.2	1.2	1.0	1.2
26	129	25	24	38	39	82	.52	97	.84	1.2	.90	1.2
27	118	60	24	37	38	83	.55	184	.83	1.1	.80	1.2
28	135	75	24	38	38	75	.52	186	12	1.1	.74	1.2
29	122	74	24	38	---	69	.98	188	77	1.2	.69	1.3
30	108	73	24	38	---	82	16	186	131	1.2	.67	1.3
31	102	---	24	37	---	76	---	183	---	1.2	.70	---
TOTAL	2033.6	1178.4	877.9	889	644.7	1430.3	2260.47	2442.9	1024.86	681.5	179.88	780.66
MEAN	65.6	39.3	28.3	28.7	23.0	46.1	75.3	78.8	34.2	22.0	5.80	26.0
MAX	181	100	71	40	40	91	123	188	179	129	28	100
MIN	1.4	6.1	5.8	23	5.2	4.3	.52	2.5	.78	1.1	.67	.68
CAL YR 1990	TOTAL	10792.16	MEAN	29.6	MAX	181	MIN	.25	CFSM	.58	IN	7.92
WTR YR 1991	TOTAL	14424.17	MEAN	39.5	MAX	188	MIN	.52	CFSM	.78	IN	10.58

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI  
(National stream quality accounting network station)

LOCATION.--Lat 46°43'15", long 89°12'25", in NE1/4 sec.20, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 150 ft downstream from bridge on Victoria Road, 1.8 mi southwest of Rockland, and 2.4 mi downstream from confluence of Middle and West Branches.

DRAINAGE AREA.--1,340 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1387: 1943, 1946-47. WSP 1911: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 638.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 23, 1943, nonrecording gage and Nov. 23, 1943, to Oct. 17, 1967, water-stage recorder at site 50 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 21 to Mar. 26. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by Victoria powerplant on West Branch 5 mi upstream; Bond Falls Reservoir (station 04034000) 34 mi upstream; Lake Gogebic (station 04035995) and Cisco Lake (station 04037400), in headwaters.

AVERAGE DISCHARGE.--49 years, 1,400 ft<sup>3</sup>/s, 14.19 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 42,000 ft<sup>3</sup>/s, Aug. 22, 1942, gage height, 28.6 ft, from floodmark, from rating curve extended above 14,000 ft<sup>3</sup>/s on basis of slope-area measurement of peak flow; minimum daily, 170 ft<sup>3</sup>/s, Aug. 13, 14, 1991.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,940 ft<sup>3</sup>/s, Mar. 28, gage height, 12.82 ft, no peak discharge above base discharge of 9,000 ft<sup>3</sup>/s; maximum gage height, 16.55 ft, Mar. 26, backwater from ice; minimum daily discharge, 170 ft<sup>3</sup>/s, Aug. 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	388	1030	1080	600	650	690	2190	1920	2760	1740	806	241
2	439	1060	996	640	650	700	2010	1750	2300	1810	684	239
3	474	1060	731	610	650	690	3050	1260	1960	2010	655	311
4	456	1030	741	550	670	660	5610	1040	1270	2360	633	397
5	422	860	647	600	680	680	6080	1140	1230	1540	613	422
6	436	909	702	630	690	700	5910	2580	976	1290	595	357
7	493	904	884	550	700	700	4870	3590	943	950	563	334
8	424	895	953	580	710	650	4080	2370	885	854	532	342
9	414	858	895	620	720	600	4280	1870	842	853	421	375
10	417	723	858	620	720	670	3880	1410	1060	786	444	416
11	363	785	781	620	690	670	3530	1250	805	768	342	471
12	541	650	787	570	610	650	3300	1130	780	881	277	461
13	661	582	836	580	540	650	2890	957	727	1870	170	447
14	603	799	769	600	550	650	3180	862	631	1450	170	452
15	607	892	737	630	530	660	4710	898	676	1330	181	593
16	625	914	884	550	540	650	3840	963	799	1040	293	567
17	970	806	821	570	530	650	3090	1040	786	849	364	466
18	3490	799	740	550	620	650	2510	984	792	842	383	456
19	3410	825	660	600	660	650	2140	912	781	892	352	466
20	2740	809	692	620	670	800	1880	849	745	922	315	442
21	3830	747	730	620	690	1900	1670	885	744	917	306	414
22	3240	841	580	620	640	3500	1530	1080	727	860	307	387
23	2520	896	450	530	660	4500	1230	932	727	762	304	361
24	2080	883	350	580	670	4400	959	831	664	676	306	340
25	1770	793	360	540	670	3500	933	882	667	648	316	370
26	1560	636	520	610	670	4500	725	3280	651	694	310	438
27	1440	875	470	610	670	8230	648	4700	626	731	300	433
28	1430	1030	530	610	680	7620	696	3340	708	732	283	620
29	1350	1100	650	615	---	5240	987	3940	1020	1160	270	304
30	1260	1030	640	640	---	3650	1760	4130	1220	1190	259	383
31	1220	---	630	650	---	2830	---	3300	---	879	248	---
TOTAL	40073	26021	22104	18515	18130	63290	84168	56075	29502	34286	12002	12305
MEAN	1293	867	713	597	648	2042	2806	1809	983	1106	387	410
MAX	3830	1100	1080	650	720	8230	6080	4700	2760	2360	806	620
MIN	363	582	350	530	530	600	648	831	626	648	170	239
CAL YR 1990	TOTAL	376518	MEAN	1032	MAX	14100	MIN	253	CFSM	.77	IN	10.45
WTR YR 1991	TOTAL	416471	MEAN	1141	MAX	8230	MIN	170	CFSM	.85	IN	11.56



## STREAMS TRIBUTARY TO LAKE SUPERIOR

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04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: October 1974 to September 1981.

WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1977.

REMARKS.--Quarterly samples were collected at or near Victoria Road bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-80): Maximum recorded (more than 20 percent missing record), 192 microsiemens, Mar. 26, 1977, May 28, 1978; minimum recorded, 45 microsiemens, Dec. 2, 1975.

WATER TEMPERATURE (water years 1975-77, 1979-80): Maximum, 28.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED SATUR-ATION (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 17...	1430	1390	175	8.11	8.0	70	10.6	93	K62	92
JAN 09...	1200	779	162	7.35	0.5	12	12.2	85	K5	K4
APR 25...	1200	774	113	7.81	9.5	33	10.6	95	K13	K3
JUL 16...	1300	1030	118	7.95	21.5	28	8.2	95	50	K770
DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARE DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD HCO3 (00453)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CACO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
OCT 17...	83	1	23	6.1	3.6	1.3	99	81	6.2	5.2
JAN 09...	80	9	22	6.0	2.9	1.0	86	70	5.3	1.6
APR 25...	54	6	15	4.0	2.4	1.0	59	48	4.8	2.3
JUL 16...	57	0	16	4.1	2.4	1.0	74	61	2.8	2.3
DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 17...	0.2	10	107	0.15	402	0.02	<0.01	<0.10	<0.10	0.04
JAN 09...	<0.1	12	100	0.14	210	<0.01	<0.01	0.20	0.10	0.04
APR 25...	<0.1	7.1	70	0.09	146	0.03	0.01	<0.05	<0.05	0.03
JUL 16...	0.1	7.4	77	0.10	214	0.01	<0.01	<0.05	<0.05	0.02

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
OCT 17...	0.01	0.5	0.07	<0.01	0.02	0.02	30	<1	31	<0.5
JAN 09...	0.04	0.3	0.03	0.01	<0.01	<0.01	30	<1	37	<0.5
APR 25...	0.01	0.4	0.07	0.01	0.04	<0.01	50	<1	29	<0.5
JUL 16...	0.03	0.7	0.07	0.03	0.02	<0.01	70	<1	30	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 17...	<1	<1	<3	2	96	<1	<4	27	<0.1	<10
JAN 09...	<1	<1	<3	3	140	<1	<4	8	<0.1	<10
APR 25...	<1	<1	<3	3	110	<1	<4	20	<0.1	<10
JUL 16...	1	<1	<3	4	220	<1	<4	6	<0.1	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	
OCT 17...	2	<1	<1	53	<6	7	110	413	98	
JAN 09...	1	<2	<1	47	<6	31	21	44	88	
APR 25...	<1	<1	<1	38	<6	7	39	82	98	
JUL 16...	<1	<1	<1	40	<6	26	36	100	98	

STREAMS TRIBUTARY TO LAKE SUPERIOR

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04040500 STURGEON RIVER NEAR SIDNAW, MI

LOCATION.--Lat 46°35'03", long 88°34'33", in NE1/4 SE1/4 sec.5, T.48 N., R.34 W., Baraga County, Hydrologic Unit 04020104, on right bank 30 ft downstream from highway bridge, 3.0 mi downstream from Rock River, 3.5 mi northwest of Covington, 6.5 mi upstream from Perch River, 8.5 mi northeast of Sidnaw, and at mile 71.

DRAINAGE AREA.--171 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1912 to September 1915, April 1943 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1507: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,214.40 ft above National Geodetic Vertical Datum of 1929. October 1912 to September 1915, nonrecording gage at site 200 ft upstream at different datum. Apr. 2, 1943, to Oct. 1, 1946, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 3-5, and Dec. 13 to Mar. 26. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--51 years, 214 ft<sup>3</sup>/s, 16.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,630 ft<sup>3</sup>/s, Apr. 24, 1960, gage height, 11.63 ft; minimum, 2.7 ft<sup>3</sup>/s, Sept. 13, 1976; minimum gage height, 2.97 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,020 ft<sup>3</sup>/s, Apr. 9, gage height, 8.35 ft; minimum, 14 ft<sup>3</sup>/s, Sept. 1, 2, gage height, 3.23 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	69	226	202	42	35	38	498	453	265	397	146	15
2	75	215	178	41	35	38	452	438	215	413	107	15
3	77	193	150	40	36	39	503	382	172	941	85	33
4	81	175	130	39	40	39	729	334	138	853	74	42
5	80	156	150	37	47	40	927	318	114	650	65	32
6	77	145	145	36	54	41	1240	447	99	445	64	27
7	73	137	134	35	56	41	1620	576	83	308	67	24
8	65	129	129	35	55	41	1890	539	74	230	55	25
9	58	119	124	35	52	41	1920	463	67	177	45	25
10	50	111	122	36	50	40	1420	393	59	140	38	29
11	52	101	117	36	46	40	1130	338	53	114	43	31
12	62	97	115	36	44	40	920	299	47	120	36	33
13	69	88	112	37	43	40	766	266	44	256	31	33
14	73	93	110	37	43	40	699	231	43	194	25	33
15	82	93	105	37	42	40	768	202	68	139	23	40
16	86	95	100	38	40	39	736	189	161	109	26	38
17	216	95	96	38	39	39	718	188	214	107	30	38
18	587	92	94	38	38	40	680	185	183	96	32	51
19	635	88	90	39	38	43	624	168	141	82	32	72
20	656	85	84	39	39	50	564	147	109	80	29	73
21	800	109	81	38	39	72	493	129	101	136	25	65
22	796	149	68	37	39	172	424	116	94	234	24	57
23	716	157	54	37	39	270	371	107	85	154	22	56
24	607	140	70	36	40	280	333	101	75	105	23	48
25	499	115	62	36	40	270	305	102	65	82	24	51
26	416	118	55	36	40	420	281	280	60	70	23	100
27	355	129	49	36	40	765	264	486	54	62	22	126
28	338	257	46	36	39	773	262	396	61	72	21	110
29	311	249	45	36	---	659	261	407	245	208	19	91
30	276	256	44	36	---	617	362	373	388	233	18	84
31	244	---	43	36	---	548	---	314	---	200	16	---
TOTAL	8581	4212	3104	1151	1188	5655	22160	9367	3577	7407	1290	1497
MEAN	277	140	100	37.1	42.4	182	739	302	119	239	41.6	49.9
MAX	800	257	202	42	56	773	1920	576	388	941	146	126
MIN	50	85	43	35	35	38	261	101	43	62	16	15
CFSM	1.62	.82	.59	.22	.25	1.06	4.32	1.77	.70	1.40	.24	.29
IN.	1.87	.92	.68	.25	.26	1.23	4.82	2.04	.78	1.61	.28	.33

CAL YR 1990 TOTAL 63370 MEAN 174 MAX 1400 MIN 13 CFSM 1.02 IN 13.79  
WTR YR 1991 TOTAL 69189 MEAN 190 MAX 1920 MIN 15 CFSM 1.11 IN 15.05

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04041500 STURGEON RIVER NEAR ALSTON, MI

LOCATION.--Lat 46°43'35", long 88°39'43", in SE1/4 sec.15, T.50 N., R.35 W., Baraga County, Hydrologic Unit 04020104, on right bank in powerhouse of Upper Peninsula Power Co. at Prickett Dam, 4.0 mi upstream from Clear Creek, 5.0 mi southeast of Alston, and at mile 45.

DRAINAGE AREA.--346 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1932 to June 1941, October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Datum of gage is 710.3 ft mean tide at New York City datum (levels by U.S. Army Corps of Engineers). Prior to Jan. 5, 1948, nonrecording gage, and Jan. 5, 1948, to Sept. 30, 1963, water-stage recorder at same site at datum 40.00 ft lower.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant at station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--57 years (water years 1933-40, 1943-91), 418 ft<sup>3</sup>/s, 16.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,360 ft<sup>3</sup>/s, Apr. 24, 1960, gage height, 13.09 ft, present datum; minimum daily, about 1 ft<sup>3</sup>/s, Aug. 14-19, 1960, caused by draining of pond for dam repair.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,170 ft<sup>3</sup>/s, Apr. 13, gage height, 8.27 ft; minimum daily, 94 ft<sup>3</sup>/s, Feb. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	226	512	524	191	140	200	838	468	639	470	422	110
2	225	482	379	192	140	101	845	628	638	630	275	130
3	225	460	287	190	140	102	843	524	635	853	275	147
4	224	446	253	191	155	150	1160	668	516	1390	273	147
5	224	433	253	191	168	227	1550	767	422	1180	269	147
6	224	433	253	191	168	221	1940	711	338	988	235	148
7	198	350	442	191	168	255	2210	988	231	774	196	148
8	163	276	313	189	167	293	2400	968	231	365	196	147
9	177	266	227	189	166	259	2740	983	232	300	196	146
10	177	264	246	188	166	257	2330	678	231	301	196	128
11	179	254	265	161	209	244	1760	629	231	299	164	115
12	196	223	265	161	193	178	1510	629	197	300	140	154
13	196	188	266	161	193	230	1640	508	165	301	140	169
14	181	187	208	160	193	243	1140	518	165	482	143	169
15	169	185	161	161	181	255	1310	413	166	496	147	168
16	169	186	198	160	166	254	1180	386	242	455	148	168
17	246	186	250	160	167	241	1080	443	316	306	148	183
18	413	186	280	161	155	245	1010	404	330	234	148	201
19	1390	218	307	160	141	260	1000	438	331	168	132	199
20	1100	243	281	162	142	258	919	421	332	169	115	199
21	977	288	235	162	156	260	787	430	331	170	111	200
22	1140	319	259	174	168	294	681	251	330	213	111	201
23	1120	318	259	181	169	326	632	192	259	301	110	199
24	907	319	224	171	133	496	633	196	207	331	111	183
25	926	318	198	131	172	621	516	234	198	264	110	170
26	940	246	172	97	159	620	509	485	198	203	109	169
27	718	194	146	97	94	970	528	852	198	201	110	168
28	628	240	145	118	207	1470	575	903	251	241	110	213
29	467	284	172	137	---	1600	482	706	294	390	109	229
30	318	475	193	137	---	1340	543	664	294	423	110	247
31	427	---	193	138	---	1020	---	588	---	435	111	---
TOTAL	14870	8979	7854	5053	4576	13490	35291	17673	9148	13633	5170	5102
MEAN	480	299	253	163	163	435	1176	570	305	440	167	170
MAX	1390	512	524	192	209	1600	2740	988	639	1390	422	247
MIN	163	185	145	97	94	101	482	192	165	168	109	110
CFSM	1.39	.86	.73	.47	.47	1.26	3.40	1.65	.88	1.27	.48	.49
IN.	1.60	.97	.84	.54	.49	1.45	3.79	1.90	.98	1.47	.56	.55

CAL YR 1990 TOTAL 123335 MEAN 338 MAX 2260 MIN 15 CFSM .98 IN 13.26  
WTR YR 1991 TOTAL 140839 MEAN 386 MAX 2740 MIN 94 CFSM 1.12 IN 15.14



STREAMS TRIBUTARY TO LAKE SUPERIOR

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04043050 TRAP ROCK RIVER NEAR LAKE LINDEN, MI

LOCATION.--Lat 47°13'43", long 88°23'07", in SE1/4 SE1/4 sec.20, T.56 N., R.32 W., Houghton County, Hydrologic Unit 04020103, on right bank 20 ft upstream from bridge on county highway, 2.0 mi northeast of Lake Linden, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--28.0 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 621.7 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 30, Dec. 3, Feb. 10, Aug. 28-30, and Sept. 3-30. Records excellent except for periods of estimated daily record, Nov. 30, Dec. 3, and Feb. 10, which are good, and periods of estimated daily record, Aug. 28-30, and Sept. 3-30, which are poor. Small diversions for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 45.9 ft<sup>3</sup>/s, 22.26 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft<sup>3</sup>/s, May 10, 1979, gage height, 10.72 ft; minimum, 1.7 ft<sup>3</sup>/s, Jan. 18, 1990, gage height, 3.52 ft, caused by ice jam upstream from station.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 380 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Apr. 7	0200	*645	*8.63	No other peak greater than base discharge.			

Minimum discharge, 7.4 ft<sup>3</sup>/s, Sept. 1, gage height, 3.71 ft, but may have been less during periods of indefinite stage-discharge relation, Aug. 28-30, and Sept. 3-30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	29	27	17	17	15	78	106	51	52	13	8.9
2	13	27	24	17	17	15	74	76	38	54	12	9.2
3	13	24	23	17	17	15	118	57	31	36	12	12
4	13	24	21	17	17	15	256	50	26	27	11	12
5	13	23	21	17	19	15	423	46	23	22	11	11
6	13	22	20	17	20	16	524	134	22	20	11	10
7	12	21	20	17	21	16	552	257	20	18	10	10
8	12	20	20	17	22	15	497	150	19	21	10	10
9	11	20	19	17	24	16	251	95	18	20	10	13
10	11	20	22	16	24	15	153	75	18	17	10	18
11	14	19	23	16	22	15	122	63	18	16	10	14
12	16	18	23	16	20	15	104	54	16	16	10	12
13	17	18	22	16	19	15	92	48	16	25	9.9	12
14	18	17	24	16	18	15	128	42	18	22	9.9	13
15	22	18	21	16	17	15	294	36	18	18	9.8	25
16	22	18	20	16	18	15	192	34	17	16	10	20
17	49	18	20	16	16	16	287	30	16	15	14	15
18	122	17	19	16	16	16	196	27	15	15	13	16
19	78	17	19	16	16	18	138	25	15	15	12	18
20	60	17	19	16	16	22	100	24	15	13	11	15
21	113	25	19	16	15	27	81	23	15	14	11	13
22	112	33	19	16	15	27	72	23	15	15	11	12
23	76	26	18	16	15	35	66	24	14	16	11	11
24	56	23	19	16	16	50	59	24	13	15	11	11
25	45	21	18	16	15	53	54	26	13	14	12	11
26	38	19	17	16	15	91	51	113	18	13	11	17
27	34	28	17	17	15	179	46	135	23	13	11	13
28	46	47	17	17	15	198	46	68	20	13	10	12
29	37	39	17	16	---	153	45	52	21	15	9.6	12
30	32	34	17	16	---	126	85	131	21	14	9.2	16
31	32	---	17	17	---	91	---	78	---	14	9.4	---
TOTAL	1162	702	622	508	497	1345	5184	2126	603	614	335.8	402.1
MEAN	37.5	23.4	20.1	16.4	17.8	43.4	173	68.6	20.1	19.8	10.8	13.4
MAX	122	47	27	17	24	198	552	257	51	54	14	25
MIN	11	17	17	16	15	15	45	23	13	13	9.2	8.9
CFSM	1.34	.84	.72	.59	.64	1.55	6.18	2.45	.72	.71	.39	.48
IN.	1.54	.93	.83	.67	.66	1.79	6.89	2.82	.80	.82	.45	.53

CAL YR 1990	TOTAL	12456.2	MEAN	34.1	MAX	487	MIN	8.3	CFSM	1.22	IN	16.55
WTR YR 1991	TOTAL	14100.9	MEAN	38.6	MAX	552	MIN	8.9	CFSM	1.38	IN	18.73

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 04043800 McCLURE STORAGE BASIN RELEASE NEAR MARQUETTE, MI

LOCATION.--Lat 46°34'19", long 87°28'35", in SW1/4 NE1/4 sec.7, T.48 N., R.25 W., Marquette County, Hydrologic Unit 04020105, on left bank in power house of Upper Peninsula Power Co., 600 ft upstream from Reany Creek, 2.5 mi downstream from McClure Dam, and 4.3 mi northwest of Marquette.

PERIOD OF RECORD.--April 1990 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 785 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Sept. 17-26, 28-30. Records excellent except for estimated daily discharges, Sept. 17-20, 23-26, 28, 30, which are good, and estimated daily discharges, Sept. 21, 22, 29, and records below 1.0 ft<sup>3</sup>/s, which are poor. Flow completely regulated by powerplant at station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 357 ft<sup>3</sup>/s, Apr. 23, May 1, 3, 1991; minimum daily, 0.02 ft<sup>3</sup>/s, Aug. 16, 24, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	200	337	344	165	162	176	290	357	164	112	167	.18
2	199	337	355	165	161	178	287	356	163	109	149	.17
3	197	344	351	166	160	179	288	357	223	120	.39	108
4	89	348	291	166	166	178	287	356	204	113	.42	111
5	196	351	170	165	128	178	295	354	167	118	170	112
6	.27	350	166	165	185	169	183	353	166	115	169	109
7	.43	350	164	167	176	182	182	353	112	115	170	.11
8	177	339	164	166	177	182	309	352	.11	118	171	.10
9	192	341	165	165	181	180	295	348	.09	116	171	89
10	194	341	166	167	182	179	308	342	61	116	.16	109
11	196	341	167	165	178	180	348	342	102	116	.14	92
12	220	136	167	165	178	182	347	341	111	115	125	105
13	2.2	.58	168	166	177	182	348	293	60	30	113	107
14	.39	.67	170	164	177	182	354	168	59	.13	113	.18
15	219	.72	168	164	180	181	356	201	1.0	210	112	.18
16	223	113	167	163	179	181	353	198	2.4	210	112	107
17	229	339	167	163	178	179	351	207	62	170	.19	90
18	175	337	167	164	177	179	323	173	50	167	.33	105
19	272	340	169	162	176	179	351	172	64	141	118	105
20	181	347	168	165	179	180	348	241	57	.63	119	90
21	182	343	167	167	179	181	347	281	65	.60	116	.15
22	289	344	167	168	180	183	351	211	.18	115	116	.15
23	270	350	172	166	179	60	357	215	.12	115	118	90
24	337	352	170	168	178	185	356	217	67	174	.22	105
25	339	350	169	168	179	271	352	166	67	207	.13	143
26	338	346	170	167	180	291	351	166	54	172	111	206
27	337	342	168	165	180	296	350	165	63	.45	154	303
28	338	343	165	185	179	298	347	244	64	.95	109	161
29	338	344	165	168	---	295	353	221	2.4	165	103	.15
30	339	343	167	166	---	187	331	218	.74	172	103	105
31	340	---	168	174	---	186	---	220	---	168	.12	---
TOTAL	6609.29	8849.97	5862	5160	4891	6019	9698	8188	2212.04	3601.76	2911.10	2553.37
MEAN	213	295	189	166	175	194	323	264	73.7	116	93.9	85.1
MAX	340	352	355	185	185	298	357	357	223	210	171	303
MIN	.27	.58	164	162	128	60	182	165	.09	.13	.12	.10

WTR YR 1991 TOTAL 66555.53 MEAN 182 MAX 357 MIN .09

LOCATION.--Lat 46°29'14", long 87°07'30", in SW1/4 NE1/4 sec.12, T.47 N., R.23 W., Marquette County, Hydrologic Unit 04020201, on right bank at dam at Sand River, 1.2 mi upstream from mouth.

PERIOD OF RECORD.--October 1983 to current year (gage heights only).

GAGE.--Water-stage recorder. Datum of gage is 600.0 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark).

REMARKS.--Pond level regulated by concrete dam with two 20-foot stop-log bays and a 20-foot radial gate. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 11.84 ft, Nov. 6, 1988; minimum, 4.89 ft, Feb. 1, 2, 1991.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.96 ft, Oct. 23; minimum, 4.89 ft, Feb. 1, 2.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.34	9.71	5.21	4.99	4.90	4.95	6.12	9.69	9.61	8.68	9.08	7.75
2	7.37	9.68	5.15	4.99	4.91	4.98	6.00	9.67	9.57	8.73	9.04	7.74
3	7.42	9.65	5.12	4.98	4.94	4.99	6.07	9.65	9.52	8.77	9.00	7.73
4	7.44	9.63	5.08	4.97	4.98	5.00	6.26	9.64	9.46	8.87	8.97	7.72
5	7.45	9.60	5.10	4.95	5.00	5.00	6.71	9.62	9.40	8.95	8.93	7.70
6	7.47	9.57	5.10	4.96	5.01	5.07	6.98	9.64	9.34	9.07	8.89	7.69
7	7.47	9.54	5.10	4.96	5.03	5.09	6.95	9.66	9.29	9.16	8.84	7.68
8	7.48	9.52	5.09	4.96	5.05	5.11	6.71	9.68	9.24	9.20	8.79	7.67
9	7.49	9.50	5.10	4.96	5.07	5.14	6.90	9.68	9.20	9.23	8.74	7.70
10	7.51	9.46	5.12	4.96	5.07	5.14	6.76	9.67	9.13	9.24	8.69	7.70
11	7.59	9.42	5.12	4.96	5.05	5.11	6.44	9.64	9.08	9.22	8.61	7.70
12	7.65	9.38	5.12	4.97	5.03	5.09	6.25	9.61	9.01	9.19	8.53	7.69
13	7.71	9.35	5.15	4.98	5.02	5.08	6.12	9.59	8.98	9.15	8.46	7.69
14	7.77	9.35	5.10	4.98	5.02	5.07	6.23	9.60	8.93	9.11	8.39	7.70
15	7.82	9.34	5.11	4.98	4.99	5.06	6.74	9.59	8.91	9.07	8.33	7.75
16	7.87	9.30	5.11	4.98	4.98	5.06	6.79	9.57	8.95	9.03	8.27	7.75
17	8.02	9.29	5.10	4.99	4.98	5.09	6.82	9.55	8.92	9.03	8.24	7.74
18	8.41	9.28	5.11	5.00	4.96	5.13	6.73	9.54	8.88	9.01	8.21	7.76
19	9.11	9.25	5.10	5.01	4.96	5.19	7.80	9.52	8.83	8.96	8.17	7.76
20	9.53	9.23	5.09	5.01	4.97	5.27	8.51	9.50	8.77	8.93	8.13	7.76
21	9.78	9.27	5.12	5.00	4.97	5.41	8.94	9.47	8.75	8.93	8.10	7.76
22	9.92	9.26	5.14	4.99	4.99	5.60	9.22	9.44	8.73	8.98	8.05	7.76
23	9.95	9.24	5.08	4.98	4.98	5.94	9.42	9.40	8.69	9.11	8.02	7.73
24	9.91	9.24	5.06	4.96	4.98	6.21	9.56	9.39	8.66	9.15	8.01	7.72
25	9.87	9.22	5.03	4.95	4.97	6.18	9.66	9.39	8.61	9.16	7.99	7.73
26	9.85	9.21	4.97	4.94	4.96	6.41	9.69	9.43	8.58	9.15	7.96	7.72
27	9.79	9.06	4.94	4.93	4.95	6.86	9.72	9.50	8.54	9.12	7.92	7.73
28	9.76	8.13	4.95	4.93	4.94	7.34	9.71	9.53	8.48	9.09	7.88	7.74
29	9.77	6.73	4.98	4.92	---	7.09	9.71	9.60	8.55	9.10	7.85	7.73
30	9.73	5.29	4.99	4.92	---	6.56	9.73	9.62	8.62	9.12	7.81	7.74
31	9.72	---	4.99	4.91	---	6.30	---	9.62	---	9.12	7.77	---
MEAN	8.52	9.12	5.08	4.97	4.99	5.53	7.64	9.57	8.97	9.05	8.38	7.72
MAX	9.95	9.71	5.21	5.01	5.07	7.34	9.73	9.69	9.61	9.24	9.08	7.76
MIN	7.34	5.29	4.94	4.91	4.90	4.95	6.00	9.39	8.48	8.68	7.77	7.67

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 46°34'30", long 85°16'10", in NE1/4 sec.11, T.48 N., R.8 W., Luce County, Hydrologic Unit 04020202, on left bank 0.7 mi upstream from Tahquamenon (Big) Falls, 11.5 mi west of Paradise, and 19 mi northeast of Newberry.

DRAINAGE AREA.--790 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1953 to current year. Prior to October 1989, published as "near Tahquamenon Paradise".

GAGE.--Water-stage recorder. Datum of gage is 698.03 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Water-discharge records good.

AVERAGE DISCHARGE.--38 years, 925 ft<sup>3</sup>/s, 15.90 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,990 ft<sup>3</sup>/s, May 10, 1960, gage height, 10.26 ft; minimum, 157 ft<sup>3</sup>/s, July 26, 1955, July 8, 1988; minimum gage height, 2.75 ft, July 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,790 ft<sup>3</sup>/s, Apr. 17, 18, gage height, 8.87 ft; minimum, 180 ft<sup>3</sup>/s, Sept. 3; minimum gage height, 2.91 ft, June 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	816	1180	1120	477	353	384	2150	1920	820	229	241	190
2	828	1090	1120	460	350	439	2170	1740	743	235	239	187
3	839	1010	1020	448	351	507	2200	1580	655	243	236	185
4	869	943	856	429	352	556	2300	1460	589	245	233	190
5	885	876	842	409	362	589	2470	1330	522	240	233	197
6	877	827	852	394	376	603	2780	1240	468	249	231	207
7	866	788	860	384	386	614	3280	1150	424	266	226	210
8	844	757	843	376	398	619	3780	1090	387	278	222	211
9	799	739	813	369	410	613	4100	1040	366	286	217	222
10	754	756	782	365	424	608	4170	985	332	287	214	226
11	748	774	755	364	427	600	4230	923	314	292	210	250
12	733	775	737	364	422	593	4190	855	297	282	208	257
13	718	766	730	365	416	580	4110	847	294	261	202	254
14	716	763	703	364	419	562	4090	956	279	251	197	256
15	766	748	684	365	421	547	4270	1090	288	246	195	289
16	839	751	700	368	417	538	4670	1180	294	236	205	338
17	914	788	695	375	403	534	4750	1260	306	219	209	364
18	1100	796	676	381	398	542	4770	1340	298	224	215	401
19	1300	777	653	386	401	575	4670	1350	273	217	226	426
20	1460	765	634	386	396	634	4530	1320	264	214	233	455
21	1590	766	637	392	394	693	4360	1250	254	215	231	470
22	1720	819	682	381	394	737	4150	1170	247	225	219	459
23	1780	861	736	373	394	793	3930	1090	246	245	219	436
24	1780	904	721	372	394	896	3650	989	245	272	219	424
25	1750	914	692	372	391	994	3380	961	235	279	220	414
26	1710	922	665	369	394	1120	3100	961	231	277	215	412
27	1620	938	618	364	392	1330	2820	971	223	264	211	446
28	1500	1020	571	362	389	1590	2550	969	209	254	203	480
29	1450	1080	539	362	---	1760	2310	951	216	248	206	487
30	1350	1120	514	360	---	1950	2150	915	221	242	193	493
31	1260	---	500	358	---	2090	---	871	---	246	188	---
TOTAL	35181	26013	22950	11894	11024	25190	106080	35754	10540	7767	6716	9836
MEAN	1135	867	740	384	394	813	3536	1153	351	251	217	328
MAX	1780	1180	1120	477	427	2090	4770	1920	820	292	241	493
MIN	716	739	500	358	350	384	2150	847	209	214	188	185
CFSM	1.44	1.10	.94	.49	.50	1.03	4.48	1.46	.44	.32	.28	.42
IN.	1.66	1.22	1.08	.56	.52	1.19	5.00	1.68	.50	.37	.32	.46

CAL YR 1990 TOTAL 345111 MEAN 946 MAX 3000 MIN 215 CFSM 1.20 IN 16.25  
WTR YR 1991 TOTAL 308945 MEAN 846 MAX 4770 MIN 185 CFSM 1.07 IN 14.55



## STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: October 1974 to September 1981.

WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at cableway 40 ft downstream from gage or at wading section 600 ft downstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1976-77, 1979-81): Maximum recorded (more than 20 percent missing record), 238 microsiemens, Jan. 24, 1977; minimum, 34 microsiemens, Apr. 17, 18, 1976.

WATER TEMPERATURE (water years 1976-77, 1979-81): Maximum, 26.5°C, May 21, 1977; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED SATUR- ATION (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 15...	1630	773	126	7.66	8.5	3.6	8.4	74	K10	K20
JAN 08...	1245	377	162	7.36	0.0	2.3	7.4	51	K39	K16
MAY 01...	1430	1900	80	7.27	12.0	1.8	6.6	64	K6	K8
JUL 23...	1400	240	192	8.02	23.5	2.0	7.0	85	K13	K8

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
OCT 15...	68	--	19	4.9	1.9	0.6	--	--	11	4.1
JAN 08...	83	15	23	6.1	2.2	0.7	82	67	11	1.8
MAY 01...	42	11	12	2.9	1.3	0.6	38	31	6.3	1.0
JUL 23...	99	9	28	7.0	2.2	0.6	109	89	12	0.7

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED TOTAL (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED TOTAL (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 15...	0.2	7.2	108	0.15	225	<0.01	<0.01	<0.10	<0.10	0.05
JAN 08...	<0.1	10	109	0.15	111	<0.01	<0.01	0.10	0.20	0.08
MAY 01...	<0.1	2.6	61	0.08	313	0.01	0.02	<0.05	0.06	0.07
JUL 23...	<0.1	6.5	118	0.16	76.5	<0.01	<0.01	<0.05	<0.05	0.02

STREAMS TRIBUTARY TO LAKE SUPERIOR  
04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
OCT 15...	0.01	0.9	<0.01	<0.01	<0.01	<0.01	110	<1	20	<0.5
JAN 08...	0.09	0.7	0.01	<0.01	<0.01	<0.01	70	<1	24	<0.5
MAY 01...	0.07	0.7	0.04	0.02	<0.01	<0.01	90	<1	22	<0.5
JUL 23...	0.03	0.5	<0.01	<0.01	<0.01	<0.01	20	<1	28	<0.5

DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 15...	1	<1	<3	1	600	2	<4	31	<0.1	<10
JAN 08...	<1	<1	<3	<1	540	1	<4	59	<0.1	<10
MAY 01...	<1	<1	<3	1	310	1	<4	21	<0.1	<10
JUL 23...	<1	<1	<3	1	76	<1	<4	5	<0.1	<10

DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 15...	<1	<1	<1	45	<6	8	6	13	77
JAN 08...	1	<1	<1	52	<6	22	5	5.1	95
MAY 01...	1	<1	<1	33	<6	11	7	36	65
JUL 23...	<1	<1	<1	66	<6	6	3	1.9	--

## STREAMS TRIBUTARY TO ST. MARYS RIVER

51

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI  
(National stream quality accounting network and radiochemical station)

LOCATION.--Lat 46°29'29", long 84°25'17", in NW1/4 sec.10, T.47 N., R.1 W., Chippewa County, Hydrologic Unit 04020300, at Sault Ste. Marie municipal raw-water intake at Big Point, 2.6 mi west of the International Bridge, at Sault Ste. Marie.

DRAINAGE AREA.--80,900 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: March 1974 to September 1981.

WATER TEMPERATURE: March 1974 to September 1981.

REMARKS.--Quarterly samples were collected at the raw-water tap in Sault Ste. Marie municipal water plant at Big Point. Intake is 1,500 ft from water plant at a depth of 30 ft, 10 ft above bottom of channel. Water temperatures published this year were measured at the raw-water tap during sampling. Temperatures stored in the computer file are those obtained streamside during dissolved oxygen measurement and are used for computations of dissolved oxygen percent saturation. Water temperatures reported for 1983-90 water years were measured in the stream near the water plant, and therefore, are not comparable with those in "EXTREMES FOR PERIOD OF DAILY RECORD." Water-quality table includes some of the radiochemical data collected in the 1990 water year.

COOPERATION.--Discharges are monthly means provided by U.S. Army Corps of Engineers, Sault Ste. Marie.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 113 microsiemens, Oct. 26, 1980; minimum daily, 76 microsiemens, Apr. 24, 1975.

WATER TEMPERATURE (water years 1975-81): Maximum daily, 24.0°C, July 25, 1979; minimum daily, 0.0°C, Mar. 14, 15, 1974, Feb. 1, 1979.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A water temperature of 27.0°C was measured July 12, 1988.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 16...	1405	59000	94	7.76	12.5	0.4	12.0	110	<2	<2
JAN 09...	1515	55500	96	7.57	3.0	0.3	13.1	91	<2	<2
MAY 02...	1245	75700	95	7.88	5.5	1.0	12.0	100	K5	K2
JUL 24...	1330	77100	98	8.11	20.0	0.3	8.9	104	K2	K3

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
OCT 16...	47	--	14	2.9	1.5	0.5	--	--	3.9	2.1
JAN 09...	47	1	14	3.0	1.5	0.6	56	46	3.4	1.2
MAY 02...	47	4	14	2.9	1.6	0.4	52	43	3.4	1.3
JUL 24...	46	4	14	2.7	1.4	0.5	51	42	3.3	0.8

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 16...	0.1	2.2	49	0.07	7810	<0.01	<0.01	0.30	0.30	<0.01
JAN 09...	<0.1	2.5	53	0.07	7940	<0.01	<0.01	0.30	0.30	<0.01
MAY 02...	<0.1	2.4	48	0.06	9810	0.01	<0.01	0.30	0.32	<0.01
JUL 24...	<0.1	2.1	58	0.08	12100	<0.01	<0.01	0.28	0.28	0.03

## STREAMS TRIBUTARY TO ST. MARYS RIVER

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
OCT 16...	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	<10	<1	12
JAN 09...	<0.01	<0.2	<0.01	<0.01	<0.01	<0.01	<10	<1	14
MAY 02...	0.02	<0.2	<0.01	<0.01	<0.01	<0.01	10	<1	13
JUL 24...	<0.01	<0.2	<0.01	<0.01	<0.01	<0.01	<10	<1	15
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)
OCT 16...	<0.5	<1	<1	<3	4	4	1	<4	<1
JAN 09...	<0.5	<1	<1	<3	4	11	<1	<4	1
MAY 02...	<0.5	<1	<1	<3	1	10	<1	<4	1
JUL 24...	<0.5	<1	<1	<3	3	<3	<1	<4	1
DATE	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	
OCT 16...	<0.1	<10	<1	<1	<1	23	<6	62	
JAN 09...	<0.1	<10	2	<2	<1	25	<6	130	
MAY 02...	<0.1	<10	<1	<1	<1	23	<6	76	
JUL 24...	<0.1	<10	<1	<1	<1	23	<6	48	
DATE	TIME	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)	URANIUM NATURAL DIS- SOLVED (UG/L AS U) (22703)
APR 1990 25...	0745	<0.4	<0.4	1.3	<0.4	1.2	<0.4	0.06	0.05
OCT 1990 16...	1405	<0.4	<0.4	1.4	<0.4	1.3	<0.4	0.09	0.05
MAY 1991 02...	1245	<0.4	<0.4	1.0	<0.4	0.9	<0.4	0.07	0.06



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04047200 MANISTIQUE LAKE NEAR CURTIS, MI

LOCATION.--Lat 46°14'47", long 85°51'06", in SW1/4 SE1/4 sec.31, T.45 N., R.12 W., Luce County, Hydrologic Unit 04060106, at lake outlet, 5.8 mi northwest of Curtis.

DRAINAGE AREA.--118 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--April 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 683.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Apr. 15, 1943, and Oct. 1, 1968, to Oct. 4, 1976, nonrecording gage at same datum.

REMARKS.--Lake level controlled by concrete dam with removable flash boards constructed in 1978 on the outlet, and by a dam on Portage Creek, one of the inlets. From 1948 to 1978 lake level controlled by timber dam with removable flash boards on outlet. Occasionally during periods of high flow, backwater from Fox River raises the lake level. Major inlets to Manistique Lake are Helmer Creek from North Manistique Lake, Portage Creek from South Manistique Lake, and Fork Lake Outlet. The outlet is Manistique River. Streamflow records were collected for South Manistique Lake Outlet (station 04046500) from May 1942 to September 1944, for North Manistique Lake Outlet (station 04047000) from August 1942 to September 1944, and for Manistique River (station 04047500) from April 1942 to June 1950. Established legal level; 686.00 ft above NGVD, established by Circuit Court, January 1948. Surface area of lake is 10,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 6.28 ft, May 14, 15, or 16, 1960, from floodmark; minimum, 1.33 ft, Aug. 10, 1948, result of dam construction.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.91 ft, April 27; minimum, 2.38 ft, Aug. 15, result of seiche action.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.17	3.21	2.96	2.90	2.76	2.62	3.00	3.75	3.27	2.85	2.79	2.62
2	3.20	3.19	2.93	2.89	2.75	2.66	3.01	3.71	3.23	2.82	2.81	2.60
3	3.22	3.17	3.02	2.89	2.75	2.67	3.01	3.72	3.18	2.81	2.80	2.57
4	3.19	3.15	3.02	2.88	2.74	2.66	3.02	3.73	3.13	2.81	2.77	2.60
5	3.20	3.18	3.01	2.87	2.73	2.65	3.04	3.73	3.09	2.80	2.77	2.60
6	3.18	3.11	3.00	2.86	2.73	2.64	3.06	3.72	3.05	2.83	2.77	2.62
7	3.18	3.10	2.99	2.85	2.72	2.65	3.11	3.64	3.02	2.86	2.76	2.62
8	3.17	3.10	2.98	2.85	2.71	2.65	3.15	3.67	2.99	2.82	2.75	2.63
9	3.15	3.11	2.97	2.85	2.70	2.64	3.25	3.67	2.95	2.84	2.73	2.60
10	3.15	3.05	2.96	2.84	2.69	2.64	3.39	3.65	2.94	2.83	2.72	2.61
11	3.13	3.01	2.95	2.84	2.70	2.63	3.44	3.62	2.92	2.83	2.71	2.65
12	3.13	3.00	2.95	2.83	2.69	2.62	3.48	3.61	2.91	2.83	2.70	2.66
13	3.12	3.06	2.94	2.82	2.69	2.62	3.50	3.58	2.91	2.80	2.69	2.65
14	3.12	3.06	2.94	2.83	2.68	2.61	3.54	3.61	2.91	2.78	2.68	2.70
15	3.11	3.05	2.92	2.82	2.68	2.60	3.62	3.61	2.92	2.77	2.66	2.76
16	3.12	3.03	2.92	2.81	2.67	2.60	3.72	3.59	2.89	2.74	2.68	2.76
17	3.15	3.04	2.92	2.80	2.67	2.58	3.78	3.60	2.91	2.72	2.68	2.78
18	3.15	3.03	2.97	2.79	2.66	2.58	3.83	3.59	2.90	2.78	2.68	2.75
19	3.22	3.02	2.97	2.79	2.66	2.57	3.85	3.55	2.88	2.76	2.72	2.78
20	3.26	3.02	2.96	2.78	2.66	2.57	3.87	3.52	2.87	2.78	2.71	2.80
21	3.25	3.04	2.95	2.77	2.65	2.59	3.88	3.49	2.87	2.80	2.69	2.81
22	3.28	3.00	2.95	2.77	2.64	2.62	3.87	3.47	2.86	2.81	2.66	2.80
23	3.29	2.96	2.96	2.79	2.64	2.68	3.88	3.44	2.84	2.79	2.68	2.75
24	3.25	2.98	2.95	2.79	2.65	2.74	3.86	3.41	2.83	2.78	2.70	2.82
25	3.26	2.89	2.94	2.79	2.64	2.76	3.86	3.41	2.80	2.77	2.67	2.82
26	3.27	3.02	2.93	2.78	2.64	2.78	3.85	3.41	2.78	2.77	2.65	2.74
27	3.19	3.00	2.93	2.77	2.63	2.82	3.87	3.36	2.74	2.77	2.66	2.82
28	3.19	2.93	2.92	2.77	2.63	2.89	3.84	3.32	2.75	2.77	2.66	2.86
29	3.23	2.96	2.93	2.78	---	2.93	3.85	3.30	2.83	2.78	2.66	2.88
30	3.22	2.96	2.92	2.77	---	2.96	3.79	3.31	2.83	2.75	2.63	2.90
31	3.22	---	2.91	2.77	---	2.98	---	3.30	---	2.77	2.62	---
MEAN	3.19	3.05	2.95	2.82	2.68	2.68	3.54	3.55	2.93	2.79	2.71	2.72
MAX	3.29	3.21	3.02	2.90	2.76	2.98	3.88	3.75	3.27	2.86	2.81	2.90
MIN	3.11	2.89	2.91	2.77	2.63	2.57	3.00	3.30	2.74	2.72	2.62	2.57

WTR YR 1991 MEAN 2.97 MAX 3.88 MIN 2.57

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04056500 MANISTIQUE RIVER NEAR MANISTIQUE, MI

LOCATION.--Lat 46°01'50", long 86°09'40", in SE1/4 sec.15, T.42 N., R.15 W., Schoolcraft County, Hydrologic Unit 04060106, on left bank 1.0 mi downstream from West Branch, 6.0 mi northeast of Manistique, and at mile 19.5.

DRAINAGE AREA.--1,100 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1938 to current year.

REVISED RECORDS.--WSP 1387: 1940-42(M), 1943, 1945. WSP 1627, 1727: 1938, 1939.

GAGE.--Water-stage recorder. Datum of gage is 608.46 ft above National Geodetic Vertical Datum of 1929. Prior to July 15, 1939, non-recording gage at site 1,600 ft upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 5 to Mar. 29. Records good except for estimated daily discharges, which are fair. Since July 1948, slight regulation by dam on outlet of Manistique Lake (station 04047200). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--53 years, 1,430 ft<sup>3</sup>/s, 17.65 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,900 ft<sup>3</sup>/s, May 11, 1960, gage height, 12.85 ft; minimum, 288 ft<sup>3</sup>/s, Oct. 4, 1948; minimum gage height, 1.01 ft, Aug. 23, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,600 ft<sup>3</sup>/s, Apr. 12, gage height, 10.36 ft; minimum, 358 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 2.29 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	835	1420	1170	650	650	600	3480	2120	1700	634	674	368
2	850	1370	1110	630	660	660	3420	2040	1680	651	664	362
3	867	1330	1010	610	670	740	3320	1960	1570	656	642	372
4	889	1300	805	600	670	820	3270	1870	1370	652	610	402
5	894	1260	900	590	680	860	3310	1800	1240	638	575	416
6	885	1220	1000	580	690	890	3440	1840	1130	655	553	432
7	861	1190	1000	580	700	900	3660	1910	1060	723	534	429
8	834	1150	1000	570	710	900	3950	1920	1010	738	528	418
9	816	1120	970	570	720	900	4350	1890	961	695	512	418
10	807	1160	950	560	720	900	4940	1810	925	650	493	460
11	817	1190	930	560	710	890	5420	1730	846	618	476	489
12	841	1190	900	560	690	870	5560	1650	797	597	459	497
13	864	1150	870	570	670	850	5350	1570	758	572	446	481
14	881	1110	850	580	660	830	5140	1540	737	549	441	467
15	897	1090	840	580	640	800	5140	1580	743	531	440	555
16	940	1070	840	590	610	790	5290	1630	762	521	449	639
17	1020	1060	830	590	580	790	5420	1690	754	548	467	674
18	1200	1050	820	600	590	800	5450	1750	725	554	471	702
19	1430	1040	800	600	600	850	5310	1750	694	557	477	713
20	1590	1020	760	600	610	950	4990	1680	667	546	478	687
21	1710	1030	780	610	630	1000	4620	1560	651	545	459	664
22	1870	1100	810	600	650	1100	4300	1460	648	592	444	654
23	1990	1150	850	590	660	1200	3970	1360	639	693	431	633
24	2040	1150	850	590	650	1300	3620	1290	624	729	425	601
25	2040	1120	830	590	640	1500	3270	1300	605	753	423	587
26	1970	1080	800	600	630	1800	2920	1320	586	712	421	598
27	1860	1080	750	610	610	2200	2650	1370	568	646	418	629
28	1750	1110	710	620	600	3000	2440	1390	561	644	417	699
29	1640	1160	700	630	---	3300	2300	1440	570	674	406	738
30	1560	1160	670	640	---	3490	2200	1520	610	681	393	717
31	1490	---	660	650	---	3470	---	1650	---	664	381	---
TOTAL	38938	34630	26765	18500	18300	39950	122500	51390	26191	19618	15007	16501
MEAN	1256	1154	863	597	654	1289	4083	1658	873	633	484	550
MAX	2040	1420	1170	650	720	3490	5560	2120	1700	753	674	738
MIN	807	1020	660	560	580	600	2200	1290	561	521	381	362
CFSM	1.14	1.05	.79	.54	.60	1.17	3.71	1.51	.79	.58	.44	.50
IN.	1.32	1.17	.91	.63	.62	1.35	4.14	1.74	.89	.66	.51	.56

CAL YR 1990 TOTAL 485799 MEAN 1331 MAX 5200 MIN 489 CFSM 1.21 IN 16.43  
WTR YR 1991 TOTAL 428290 MEAN 1173 MAX 5560 MIN 362 CFSM 1.07 IN 14.48

STREAMS TRIBUTARY TO LAKE MICHIGAN

55

04057000 INDIAN LAKE NEAR MANISTIQUE, MI

LOCATION.--Lat 45°59'30", long 86°17'15", in SW1/4 NE1/4 sec.34, T.42 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, on east shore, just upstream from highway bridge over outlet of Indian Lake, 2.0 mi northwest of Manistique.

DRAINAGE AREA.--302 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1938 to current year.

GAGE.--Water-stage recorder. Datum of gage is 608.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1942, nonrecording gage at site 0.5 mi northwest at same datum.

REMARKS.--Indian lake is regulated by two vertical lift gates in concrete and earth-fill dam 1.5 mi downstream from lake on outlet. Major inlets to Indian Lake are Silver Creek, Dufour Creek, Indian River, Dead Creek, Smith Creek and Big Spring. Streamflow records for Indian River (station 04057000), at lake outlet, were collected from March 1938 to September 1971; annual peak discharge 1972-82. Established legal level; 613.27 ft, above NGVD. Surface area of lake is 8,660 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 7.79 ft, June 24, 1943; minimum daily, 3.01 ft, Feb. 20, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.96 ft, Sept. 9; minimum, 3.04 ft, Feb. 18.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.54	4.53	3.57	3.31	3.10	3.08	3.99	4.46	4.59	4.74	4.72	4.66
2	4.53	4.49	3.55	3.31	3.10	3.15	4.00	4.39	4.58	4.77	4.69	4.66
3	4.51	4.45	3.52	3.29	3.09	3.16	4.01	4.32	4.56	4.79	4.71	4.70
4	4.54	4.41	3.60	3.28	3.09	3.16	4.02	4.31	4.55	4.76	4.72	4.73
5	4.49	4.34	3.57	3.26	3.10	3.15	4.05	4.34	4.56	4.75	4.72	4.73
6	4.47	4.30	3.55	3.25	3.09	3.16	4.08	4.49	4.55	4.76	4.72	4.74
7	4.44	4.22	3.53	3.23	3.09	3.17	4.12	4.56	4.56	4.76	4.73	4.75
8	4.42	4.15	3.52	3.21	3.10	3.17	4.18	4.57	4.59	4.72	4.73	4.76
9	4.39	4.13	3.51	3.23	3.10	3.16	4.27	4.61	4.62	4.69	4.74	4.81
10	4.37	4.10	3.50	3.22	3.11	3.16	4.37	4.64	4.66	4.68	4.74	4.87
11	4.40	4.06	3.48	3.21	3.11	3.16	4.41	4.67	4.67	4.69	4.74	4.82
12	4.38	3.99	3.47	3.20	3.10	3.15	4.42	4.70	4.68	4.69	4.74	4.78
13	4.37	3.92	3.47	3.20	3.09	3.15	4.42	4.71	4.68	4.70	4.75	4.76
14	4.36	3.88	3.44	3.20	3.09	3.16	4.47	4.75	4.72	4.69	4.75	4.75
15	4.37	3.85	3.43	3.19	3.10	3.15	4.61	4.76	4.76	4.69	4.77	4.84
16	4.37	3.82	3.43	3.19	3.07	3.15	4.66	4.79	4.74	4.70	4.76	4.86
17	4.38	3.78	3.42	3.18	3.06	3.16	4.76	4.86	4.70	4.72	4.77	4.80
18	4.45	3.75	3.46	3.18	3.05	3.16	4.80	4.87	4.67	4.73	4.73	4.82
19	4.42	3.72	3.45	3.18	3.08	3.18	4.83	4.89	4.67	4.74	4.67	4.71
20	4.41	3.68	3.42	3.17	3.08	3.19	4.83	4.91	4.68	4.75	4.65	4.65
21	4.47	3.70	3.42	3.17	3.08	3.23	4.81	4.92	4.70	4.77	4.66	4.59
22	4.51	3.74	3.45	3.16	3.09	3.28	4.78	4.93	4.66	4.83	4.68	4.57
23	4.52	3.72	3.45	3.16	3.08	3.40	4.74	4.93	4.67	4.85	4.66	4.59
24	4.54	3.67	3.42	3.14	3.10	3.49	4.70	4.90	4.68	4.81	4.67	4.53
25	4.54	3.68	3.39	3.13	3.11	3.54	4.65	4.88	4.68	4.80	4.69	4.55
26	4.55	3.58	3.40	3.11	3.10	3.61	4.60	4.83	4.69	4.77	4.71	4.60
27	4.58	3.61	3.35	3.11	3.09	3.70	4.53	4.77	4.71	4.73	4.71	4.57
28	4.57	3.67	3.32	3.12	3.08	3.83	4.52	4.71	4.72	4.73	4.71	4.58
29	4.56	3.63	3.34	3.12	---	3.87	4.47	4.70	4.73	4.75	4.71	4.55
30	4.56	3.58	3.34	3.12	---	3.91	4.49	4.67	4.74	4.76	4.72	4.56
31	4.55	---	3.33	3.12	---	3.95	---	4.64	---	4.74	4.68	---
MEAN	4.47	3.94	3.45	3.19	3.09	3.32	4.45	4.69	4.66	4.74	4.71	4.70
MAX	4.58	4.53	3.60	3.31	3.11	3.95	4.83	4.93	4.76	4.85	4.77	4.87
MIN	4.36	3.58	3.32	3.11	3.05	3.08	3.99	4.31	4.55	4.68	4.65	4.53

CAL YR 1990 MEAN 4.13 MAX 5.18 MIN 3.11  
WTR YR 1991 MEAN 4.12 MAX 4.93 MIN 3.05

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04057510 STURGEON RIVER NEAR NAHMA JUNCTION, MI

LOCATION.--Lat 45°56'35", long 86°42'20", in SW1/4 SE1/4 sec.17, T.41 N., R.19 W., Delta County, Hydrologic Unit 04030112, Hiawatha National Forest, on left bank 30 ft upstream from bridge on Forest Service Road 2231, 500 ft downstream from Mormon Creek, 0.1 mi east of Federal Forest Highway 13, and 3.2 mi north of Nahma Junction.

DRAINAGE AREA.--183 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 610.99 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 3 to Mar. 27. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 200 ft<sup>3</sup>/s, 14.84 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,120 ft<sup>3</sup>/s, Apr. 21, 1985, gage height, 11.50 ft; minimum, 32 ft<sup>3</sup>/s, July 8, 1988, gage height, 3.55 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 993 ft<sup>3</sup>/s, Apr. 16, gage height, 7.87 ft; minimum, 35 ft<sup>3</sup>/s, Aug. 31 to Sept. 3, gage height, 3.58 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	166	119	67	67	90	440	295	407	79	94	35
2	93	161	107	66	67	100	393	274	343	84	81	35
3	94	155	100	64	68	125	427	250	289	100	74	39
4	92	151	90	63	70	130	462	228	239	93	69	44
5	91	146	95	62	72	130	521	213	203	86	64	42
6	87	139	105	62	75	130	620	314	177	83	59	47
7	83	133	103	62	82	130	691	348	158	85	56	47
8	80	128	101	63	79	130	730	308	146	81	53	45
9	78	129	100	64	75	128	782	276	136	74	51	54
10	79	136	98	64	72	127	746	249	129	69	49	77
11	83	132	96	65	69	123	660	225	121	66	47	74
12	83	125	94	66	67	120	659	206	117	63	45	69
13	81	121	91	67	66	115	627	191	108	61	43	64
14	83	116	89	69	66	113	666	176	104	58	43	69
15	89	117	87	70	65	110	914	171	118	56	46	105
16	90	119	86	71	63	110	981	186	109	53	46	110
17	103	117	85	72	60	110	894	400	102	57	48	100
18	172	113	84	72	70	120	784	393	95	59	55	94
19	237	112	82	71	76	130	685	321	89	54	53	84
20	234	110	80	70	82	140	598	273	84	53	49	77
21	286	118	82	70	87	190	519	229	83	60	46	71
22	362	137	86	69	88	240	449	200	84	89	45	67
23	322	138	88	68	89	300	401	181	79	132	43	63
24	287	127	88	67	88	350	382	174	74	110	45	59
25	257	118	84	66	87	400	348	207	71	110	44	61
26	231	110	81	66	85	600	318	277	68	97	43	75
27	213	121	78	66	84	700	294	358	66	85	41	76
28	204	129	75	66	84	676	280	306	68	85	39	76
29	193	128	73	66	---	608	280	341	79	120	38	73
30	182	118	71	66	---	520	306	476	80	130	38	73
31	173	---	69	66	---	506	---	497	---	111	36	---
TOTAL	4828	3870	2767	2066	2103	7501	16857	8543	4026	2543	1583	2005
MEAN	156	129	89.3	66.6	75.1	242	562	276	134	82.0	51.1	66.8
MAX	362	166	119	72	89	700	981	497	407	132	94	110
MIN	78	110	69	62	60	90	280	171	66	53	36	35
CFSM	.85	.71	.49	.36	.41	1.32	3.07	1.51	.73	.45	.28	.37
IN.	.98	.79	.56	.42	.43	1.52	3.43	1.74	.82	.52	.32	.41

CAL YR 1990 TOTAL 60869 MEAN 167 MAX 1140 MIN 56 CFSM .91 IN 12.37  
WTR YR 1991 TOTAL 58692 MEAN 161 MAX 981 MIN 35 CFSM .88 IN 11.93



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04057800 MIDDLE BRANCH ESCANABA RIVER AT HUMBOLDT, MI

LOCATION.--Lat 46°29'57", long 87°53'11", in SW1/4 sec.1, T.47 N., R.29 W., Marquette County, Hydrologic Unit 04030110, on left bank 15 ft upstream from county highway, 1.5 mi downstream from Halfway Creek, and 0.3 mi north of Humboldt.

DRAINAGE AREA.--46.0 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1959 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. V-notch sharp-crested weir since Oct. 3, 1960. Datum of gage is 1,521.20 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Sept. 1, 1960, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 29 to Feb. 2 and Feb. 15, 16, 23-28. Records good except for estimated daily discharges, which are fair. From July 1960 to June 1972, some diversion 100 ft upstream by industry for iron ore processing; figures of runoff adjusted. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 61.1 ft<sup>3</sup>/s, 18.04 in/yr, adjusted for diversion 1960 to 1972.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,930 ft<sup>3</sup>/s, Apr. 20, 1985, gage height, 9.21 ft; minimum, 4.0 ft<sup>3</sup>/s, Sept. 12, 1976; minimum gage height, 1.07 ft, Aug. 24, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 546 ft<sup>3</sup>/s, Apr. 9, gage height, 5.81 ft; minimum, 8.1 ft<sup>3</sup>/s, Sept. 1, 2, gage height, 1.66 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	31	70	51	21	17	16	111	130	55	73	43	8.6
2	36	66	46	19	17	17	110	114	47	92	33	8.6
3	30	62	42	18	18	17	115	98	41	111	28	12
4	30	58	48	17	20	17	157	93	36	99	25	12
5	27	53	50	17	19	17	215	95	30	77	22	11
6	24	52	46	17	21	18	306	107	27	67	18	10
7	23	50	43	17	20	19	431	115	24	53	18	10
8	21	46	42	17	20	18	504	102	22	47	17	10
9	22	45	40	17	21	18	518	92	20	36	15	12
10	22	44	39	17	21	17	403	84	20	31	13	18
11	31	43	38	17	19	17	309	77	18	25	13	14
12	39	41	39	17	19	17	240	71	17	20	11	12
13	39	37	38	17	17	17	188	67	16	21	11	12
14	36	37	38	18	17	16	186	62	19	19	10	12
15	37	40	36	18	17	16	258	54	40	16	10	16
16	34	44	36	18	17	16	285	60	47	14	14	15
17	87	41	35	18	17	16	248	71	41	20	14	14
18	169	38	36	18	17	16	220	62	31	18	14	26
19	196	37	35	18	17	17	198	55	25	18	13	27
20	162	36	34	18	17	21	171	50	21	23	12	23
21	183	55	34	17	17	27	145	45	24	47	11	19
22	228	66	34	17	17	34	126	43	22	40	11	17
23	198	56	35	16	17	43	111	41	19	42	11	17
24	146	48	34	16	16	50	101	42	17	28	12	15
25	121	45	33	16	16	53	93	43	14	21	12	19
26	106	41	33	17	16	76	86	58	15	18	11	30
27	95	47	30	17	17	112	82	102	13	19	11	27
28	90	68	27	17	17	154	84	88	12	29	10	23
29	83	65	26	17	---	155	88	87	57	93	9.6	20
30	77	59	24	17	---	167	119	78	76	101	9.4	20
31	73	---	22	17	---	132	---	66	---	64	9.0	---
TOTAL	2496	1490	1144	538	501	1346	6208	2352	866	1382	471.0	490.2
MEAN	80.5	49.7	36.9	17.4	17.9	43.4	207	75.9	28.9	44.6	15.2	16.3
MAX	228	70	51	21	21	167	518	130	76	111	43	30
MIN	21	36	22	16	16	16	82	41	12	14	9.0	8.6
CFSM	1.75	1.08	.80	.38	.39	.94	4.50	1.65	.63	.97	.33	.35
IN.	2.02	1.20	.93	.44	.41	1.09	5.02	1.90	.70	1.12	.38	.40

CAL YR 1990 TOTAL 19484.0 MEAN 53.4 MAX 470 MIN 11 CFSM 1.16 IN 15.76  
WTR YR 1991 TOTAL 19284.2 MEAN 52.8 MAX 518 MIN 8.6 CFSM 1.15 IN 15.59

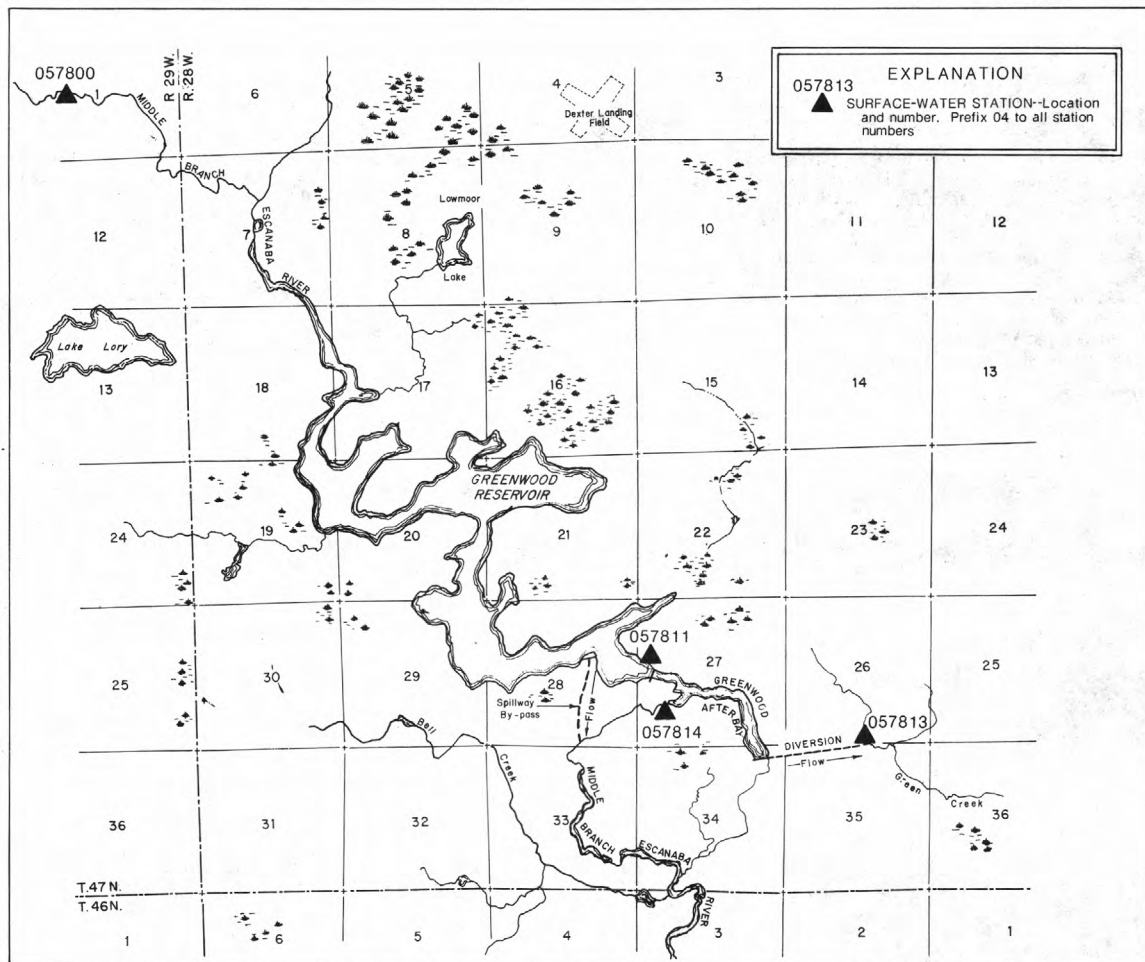


Figure 8.--Identification number and location of active surface-water gaging stations in and around the Greenwood Reservoir Complex.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04057811 GREENWOOD RESERVOIR NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'32", long 87°48'02", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, at downstream side of dam on Middle Branch Escanaba River, 3.7 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi<sup>2</sup>.

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,400.00 ft above National Geodetic Vertical Datum of 1929 (levels by Cleveland-Cliffs Iron Co.); gage readings have been converted to elevations NGVD. Prior to Feb. 20, 1973, nonrecording gage at same site and datum.

REMARKS.--The reservoir is formed by an earth/rockfill main dam and several earthfill dikes surrounding the storage area. Storage began Dec. 22, 1972. The fixed-crest concrete spillway was completed in September 1973. Capacity of reservoir, 23,300 acre-ft at spillway elevation 1,515 ft. Above elevation 1,515 ft, water flows over concrete spillway into Middle Branch Escanaba River about 2,000 ft downstream from Greenwood Release (station 04057814). The main dam is equipped with an outlet structure with 4 valves to control flow to afterbay (conservation pool) which has a capacity of 420 acre-ft at elevation 1,480 ft. Two outlet systems from the afterbay provide for diversion and release flow. Diverted flow to Green Creek gaged at Greenwood Diversion (station 04057813); released flow to Middle Branch Escanaba River gaged at Greenwood Release (station 04057814). Reservoir impounds water for diversion to Schweitzer Reservoir (station 04058190), for use in iron ore processing.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 26,520 acre-ft, Apr. 21, 22, 23, 1985, elevation, 1,517.3 ft; minimum since first filling, 3,240 acre-ft, Mar. 12, 1977, elevation, 1,491.1 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 24,420 acre-ft, Apr. 9, elevation, 1,515.8 ft; minimum, 18,420 acre-ft, Mar. 20, 21, elevation, 1,511.1 ft.

## MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre- feet)	Change in contents (equivalent in ft <sup>3</sup> /s)
Sept. 30 . . . . .	1,513.1	20,830	--	--
Oct. 31 . . . . .	1,515.2	23,580	+2,750	+44.7
Nov. 30 . . . . .	1,515.1	23,440	-140	-2.4
Dec. 31 . . . . .	1,514.6	22,780	-660	-10.7
CAL YR 1990 . . . . .	--	--	+6,010	+8.3
Jan. 31 . . . . .	1,513.3	21,090	-1,690	-27.5
Feb. 28 . . . . .	1,512.0	19,500	-1,590	-28.6
Mar. 31 . . . . .	1,513.0	20,700	+1,200	+19.5
Apr. 30 . . . . .	1,515.3	23,720	+3,020	+50.8
May 31 . . . . .	1,515.3	23,720	0	0
June 30 . . . . .	1,514.5	22,650	-1,070	-18.0
July 31 . . . . .	1,514.9	23,170	+520	+8.5
Aug. 31 . . . . .	1,513.3	21,090	-2,080	-33.8
Sept. 30 . . . . .	1,512.0	19,500	-1,590	-26.7
WTR YR 1991 . . . . .	--	--	-1,330	-1.8

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04057813 GREENWOOD DIVERSION NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'04", long 87°46'10", in NW1/4 NE1/4 sec.35, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at downstream end of pipeline, 200 ft upstream from Green Creek, 0.7 mi downstream from Greenwood Afterbay, and 3.6 mi south of Greenwood.

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,454.57 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug. 22, 1973, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records excellent. Flow completely regulated. A pipeline, 0.7 mi long, diverts water from Greenwood Reservoir (station 04057811) into Green Creek, tributary to Schweitzer Reservoir (station 04058190). Water is used for iron ore processing; some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek; some returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 30 ft<sup>3</sup>/s, June 25-28, 1977, Nov. 9, 1979; no flow, Dec. 27, 1972, to Jan. 6, 1973; minimum daily discharge since diversion began Jan. 7, 1973, 0.01 ft<sup>3</sup>/s, Apr. 16, 17, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.5	3.7	3.9	24	24	24	.93	6.2	16	25	25	25
2	4.5	3.6	3.9	24	24	25	.87	6.2	16	25	25	25
3	4.4	3.6	3.9	24	24	25	.86	6.2	16	26	25	25
4	4.4	3.6	3.9	24	24	25	.86	6.2	16	26	26	25
5	4.4	3.6	3.9	24	24	24	.88	6.3	16	24	26	25
6	4.4	4.5	3.9	24	24	25	.93	6.3	16	22	26	25
7	4.4	3.7	3.9	24	24	25	.93	6.3	16	21	25	25
8	4.4	3.7	3.9	24	24	25	.93	6.4	16	21	25	25
9	4.3	3.7	3.9	24	24	25	.93	6.5	17	21	25	25
10	4.3	3.7	7.2	24	24	25	.87	6.5	17	20	25	25
11	4.3	3.7	11	24	24	25	.86	6.5	18	20	25	25
12	4.3	3.7	13	24	24	25	.88	6.6	22	20	25	25
13	4.3	3.7	16	24	24	25	.93	6.6	25	20	25	25
14	4.3	3.7	15	24	24	25	.93	6.6	25	20	25	25
15	4.3	3.7	15	24	24	25	.92	6.6	25	20	25	25
16	4.0	3.8	15	24	24	25	.92	6.6	25	21	25	25
17	3.7	3.8	16	24	24	25	.93	6.6	25	21	25	25
18	3.8	3.8	21	24	24	25	.87	6.6	25	21	25	25
19	3.8	3.8	23	24	24	25	.86	6.6	25	22	25	25
20	3.8	3.8	24	24	24	25	.82	6.6	25	25	25	25
21	3.8	3.8	24	24	25	25	.86	6.6	25	25	25	25
22	3.8	3.9	24	24	25	25	.86	6.6	25	25	25	25
23	3.8	3.9	24	24	25	25	6.4	11	25	25	25	25
24	3.8	3.9	24	24	25	25	8.7	17	25	25	25	25
25	3.8	3.9	24	24	25	25	6.2	16	25	25	25	25
26	3.8	3.9	24	24	25	25	6.2	16	25	25	26	25
27	3.8	3.9	24	24	25	9.4	6.2	16	25	25	26	25
28	3.8	3.9	24	24	24	.93	6.2	16	25	25	26	25
29	3.7	3.9	24	24	---	.93	6.2	16	25	25	25	25
30	3.7	3.9	24	24	---	.93	6.2	16	25	25	25	25
31	3.7	---	24	24	---	.93	---	16	---	25	25	---
TOTAL	126.1	113.8	475.3	744	679	661.12	71.93	282.2	652	716	781	750
MEAN	4.07	3.79	15.3	24.0	24.3	21.3	2.40	9.10	21.7	23.1	25.2	25.0
MAX	4.5	4.5	24	24	25	25	8.7	17	25	26	26	25
MIN	3.7	3.6	3.9	24	24	.93	.82	6.2	16	20	25	25
CAL YR 1990	TOTAL	5346.77	MEAN	14.6	MAX	27	MIN	.09				
WTR YR 1991	TOTAL	6052.45	MEAN	16.6	MAX	26	MIN	.82				



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04057814 GREENWOOD RELEASE NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'22", long 87°47'52", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at outlet of Greenwood Afterbay releasing to Middle Branch Escanaba River, 2.6 mi upstream from Bell Creek and 3.8 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,473.77 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Nov. 7, 1973, nonrecording gage at same site and different datum.

REMARKS.--No estimated daily discharges. Records excellent. Since December 1972, flow from Greenwood Reservoir (station 04057811) below spillway elevation 1,515 ft is completely regulated by the afterbay release structure into the Middle Branch Escanaba River. Since January 1973, water diverted immediately upstream from station via Greenwood Diversion (station 04057813) to Green Creek for iron ore processing and some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Overflow from reservoir spillway bypasses and returns to the Middle Branch Escanaba River 0.5 mi downstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge (prior to regulation), 290 ft<sup>3</sup>/s, Oct. 1, 1972; (since regulation began), 63 ft<sup>3</sup>/s, July 10, 11, 1974; minimum daily, 6.4 ft<sup>3</sup>/s, Nov. 10, 1987, release structure closed for trash rack cleaning and flume inspection.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	25	25	27	25	24	24	25	24	26	25	25
2	25	25	25	27	25	24	24	25	24	26	25	25
3	25	24	25	26	25	24	24	25	23	26	25	25
4	24	24	25	25	25	24	24	25	23	26	25	25
5	24	24	25	25	25	24	23	25	23	26	25	25
6	24	24	25	25	25	24	24	26	24	26	25	25
7	24	25	25	24	24	25	24	26	25	25	25	25
8	24	25	25	24	24	25	24	25	25	25	25	25
9	25	25	25	24	24	25	24	25	26	25	25	25
10	25	25	25	24	24	25	24	25	26	24	25	25
11	25	25	25	24	24	25	24	25	26	24	25	25
12	25	25	25	24	24	25	24	25	26	24	25	25
13	25	25	25	24	24	25	24	26	26	24	25	25
14	24	26	24	24	25	25	24	26	26	24	25	25
15	24	26	23	24	25	25	24	26	26	24	25	25
16	24	26	23	25	25	25	24	26	26	24	25	25
17	25	26	24	25	24	25	24	26	26	25	25	25
18	25	26	26	25	24	25	24	26	26	25	25	25
19	25	26	25	25	24	25	24	26	25	25	25	25
20	25	26	25	25	24	25	24	26	25	25	25	25
21	26	27	25	25	24	25	24	26	25	25	25	25
22	26	27	25	25	24	25	24	26	25	25	25	25
23	26	27	25	25	24	25	23	26	25	25	25	25
24	26	27	25	25	24	25	24	25	25	25	25	25
25	26	27	25	25	24	25	25	25	25	25	25	26
26	26	26	25	25	24	25	25	25	25	25	25	26
27	25	25	25	25	24	25	25	25	25	25	25	26
28	25	25	25	25	24	26	25	24	25	25	25	26
29	25	25	26	25	---	25	25	24	25	26	25	26
30	25	25	26	25	---	25	25	24	26	26	25	26
31	25	---	26	25	---	24	---	24	---	25	25	---
TOTAL	773	764	773	771	681	769	724	784	752	776	775	756
MEAN	24.9	25.5	24.9	24.9	24.3	24.8	24.1	25.3	25.1	25.0	25.0	25.2
MAX	26	27	26	27	25	26	25	26	26	26	25	26
MIN	24	24	23	24	24	24	23	24	23	24	25	25
CAL YR 1990	TOTAL	9187	MEAN	25.2	MAX	29	MIN	22				
WTR YR 1991	TOTAL	9098	MEAN	24.9	MAX	27	MIN	23				

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04058100 MIDDLE BRANCH ESCANABA RIVER NEAR PRINCETON, MI

LOCATION.--Lat 46°19'02", long 87°30'07", in NW1/4 sec.12, T.45 N., R.26 W., Marquette County, Hydrologic Unit 04030110, on right bank 400 ft downstream from powerplant, 0.3 mi upstream from Green Creek, and 2.2 mi northwest of Princeton.

DRAINAGE AREA.--210 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1961 to September 1982, October 1989 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,102.68 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant upstream from station. Since December 1972, additional regulation 27 mi upstream by Greenwood Release (station 04057814). Since January 1973, some flow diverted to Green Creek via Greenwood Diversion 27 mi upstream (station 04057813) by industry for iron ore processing and some returned 0.3 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 5.0 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 220 ft<sup>3</sup>/s, 14.23 in/yr, adjusted for storage and diversion since December 1972.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,580 ft<sup>3</sup>/s, May 6, 1972, gage height, 7.85 ft; maximum gage height, 8.37 ft, Apr. 27, 1979; minimum discharge recorded, 2.2 ft<sup>3</sup>/s, Oct. 5, 1964; minimum daily, 4.1 ft<sup>3</sup>/s, Feb. 4, 1967.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 22, 1985, reached a stage of 11.84 ft, from floodmark, discharge, 4,200 ft<sup>3</sup>/s, from rating curve extended above 2,400 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,180 ft<sup>3</sup>/s, Apr. 10, gage height, 5.38 ft; minimum, 7.2 ft<sup>3</sup>/s, Feb. 26, Mar. 1, 12, 15, gage height, 0.81 ft; minimum daily, 15 ft<sup>3</sup>/s, Sept. 1, 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	110	239	204	96	112	38	397	377	316	207	236	15
2	110	224	202	96	104	65	338	330	227	146	170	68
3	108	213	189	96	98	91	304	393	316	151	125	96
4	111	213	133	96	96	91	312	370	244	293	151	96
5	108	207	99	94	94	91	344	392	52	439	142	96
6	103	193	161	94	92	90	382	410	77	353	118	96
7	100	173	183	92	92	90	501	404	170	270	106	95
8	96	159	162	92	92	89	615	403	137	220	84	80
9	94	156	149	92	92	89	906	401	122	191	99	96
10	95	151	149	134	92	89	1160	362	122	149	98	44
11	110	145	149	150	92	89	1140	328	109	110	94	25
12	102	145	147	133	92	87	1010	282	103	118	97	96
13	103	135	140	124	92	89	845	257	84	109	97	113
14	103	128	128	116	88	89	754	264	98	109	97	113
15	104	127	118	110	86	83	799	241	100	107	96	57
16	43	127	118	102	86	89	826	189	114	101	96	15
17	116	128	122	97	86	89	839	232	173	101	96	71
18	290	128	122	97	59	89	781	234	175	101	96	101
19	385	127	122	96	59	103	694	233	159	101	96	107
20	387	126	122	96	82	95	619	232	114	102	96	110
21	372	126	116	97	82	133	548	205	149	103	68	258
22	337	127	111	98	83	147	482	179	136	166	64	181
23	369	147	111	97	85	156	438	131	118	167	97	96
24	360	192	104	97	90	200	409	157	125	141	97	95
25	373	207	96	98	89	251	259	163	117	122	96	96
26	365	174	96	99	81	251	347	163	103	103	96	90
27	353	156	90	98	89	313	344	180	127	103	96	101
28	330	180	99	97	89	358	310	212	93	104	95	101
29	285	202	96	105	---	382	360	221	88	165	94	97
30	234	202	96	108	---	404	378	260	196	107	94	101
31	225	---	96	108	---	391	---	260	---	225	50	---
TOTAL	6381	4957	4030	3205	2474	4711	17441	8465	4264	4984	3237	2806
MEAN	206	165	130	103	88.4	152	581	273	142	161	104	93.5
MAX	387	239	204	150	112	404	1160	410	316	439	236	258
MIN	43	126	90	92	59	38	259	131	52	101	50	15

CAL YR 1990 TOTAL 57753.1 MEAN 158 MAX 733 MIN 6.1 MEAN+ 181 CFSM+ .86 IN+ 11.71  
WTR YR 1991 TOTAL 66955.0 MEAN 183 MAX 1160 MIN 15 MEAN+ 198 CFSM+ .94 IN+ 12.82

+ Adjusted for diversion and change in contents in Greenwood Reservoir.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04058190 SCHWEITZER RESERVOIR NEAR PALMER, MI

LOCATION.--Lat 46°25'00", long 87°38'48", in SE1/4 NW1/4 sec.2, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on left bank 120 ft upstream from dam on Schweitzer Creek, 3.0 mi southwest of Palmer.

DRAINAGE AREA.--23.1 mi<sup>2</sup>.

PERIOD OF RECORD.--January 1963 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,300.00 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. reference mark); gage readings have been converted to elevations NGVD. Prior to Oct. 25, 1967, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by an earthfill dam with fixed crest concrete spillway completed in 1963. Capacity of reservoir, 5,300 acre-ft at spillway elevation, 1,338.00 ft. The dam includes a discharge pipe equipped with valve to control release flow to Schweitzer Creek (station 04058200). An average of 1.3 ft<sup>3</sup>/s was diverted from the headwaters of basin by the City of Ishpeming for municipal supply (furnished by City of Ishpeming) and the effluent discharged to the Carp River basin. An average of 29 ft<sup>3</sup>/s was diverted from reservoir for iron ore processing (furnished by Cleveland Cliffs Iron Co.), some returned to Middle Branch Escanaba River basin via Green Creek and some returned to the East Branch Escanaba River basin via Goose Lake Outlet. Since January 1973, controlled diversion from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813) into Schweitzer Reservoir. Controlled inflow averaged 16.6 ft<sup>3</sup>/s for the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents recorded, 5,900 acre-ft, May 31, 1970, Apr. 20, 1985, elevation, 1,339.5 ft; minimum recorded since first filling, 2,920 acre-ft, Apr. 10, 1974, elevation, 1,329.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,500 acre-ft, Apr. 6, elevation, 1,338.5 ft; minimum, 4,500 acre-ft, Sept. 7-9, elevation, 1,335.5 ft.

## MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre- feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 . . . . .	1,337.6	5,160	--	--
Oct. 31 . . . . .	1,338.1	5,340	+180	+2.9
Nov. 30 . . . . .	1,337.9	5,260	-80	-1.3
Dec. 31 . . . . .	1,336.4	4,770	-490	-8.0
CAL YR 1990 . . . . .	--	--	-250	-0.3
Jan. 31 . . . . .	1,336.1	4,680	-90	-1.5
Feb. 28 . . . . .	1,335.7	4,560	-120	-2.2
Mar. 31 . . . . .	1,338.1	5,340	+780	+12.7
Apr. 30 . . . . .	1,338.1	5,340	0	0
May 31 . . . . .	1,337.4	5,090	-250	-4.1
June 30 . . . . .	1,336.3	4,740	-350	-5.9
July 31 . . . . .	1,336.8	4,890	+150	+2.4
Aug. 31 . . . . .	1,335.7	4,560	-330	-5.4
Sept. 30 . . . . .	1,335.6	4,530	-30	-0.5
WTR YR 1991 . . . . .	--	--	-630	-0.9

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04058200 SCHWEITZER CREEK NEAR PALMER, MI

LOCATION.--Lat 46°24'40", long 87°37'27", in SW1/4 sec.1, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on right bank 10 ft upstream from highway bridge, 2.5 mi southwest of Palmer.

DRAINAGE AREA.--23.6 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Concrete control since Oct. 1, 1963. Datum of gage is 1,268.28 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug 21, 1961, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 24-27, Dec. 31 to Jan. 5, Jan. 7, 10, 22-26, Jan. 29 to Feb. 1, and Feb. 15, 16, 26, 28. Records good except for estimated daily discharges, which are fair. Since August 1962, flow completely regulated by Schweitzer Reservoir (station 04058190) 1.0 mi upstream. An average of 1.3 ft<sup>3</sup>/s was diverted from headwaters of basin by the City of Ishpeming for municipal supply (furnished by City of Ishpeming) and the effluent discharged to the Carp River basin. An average of 29 ft<sup>3</sup>/s was diverted from Schweitzer Reservoir by industry for iron ore processing (furnished by Cleveland Cliffs Iron Co.), some returned to the Middle Branch Escanaba River via Green Creek and some returned via Goose Lake Outlet and East Branch Escanaba River. Diversion into Schweitzer Reservoir from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813). Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 860 ft<sup>3</sup>/s, May 31, 1970, gage height, 6.50 ft; minimum, 0.4 ft<sup>3</sup>/s, Sept. 6, 1962, gage height, 1.22 ft; minimum daily, 1.0 ft<sup>3</sup>/s, Apr. 9-18, May 5, 6, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 116 ft<sup>3</sup>/s, Oct. 18, gage height, 4.05 ft; minimum daily, 3.9 ft<sup>3</sup>/s, Aug. 30, 31, Sept. 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.1	15	6.1	5.6	4.6	4.7	15	44	4.8	5.0	4.4	4.0
2	6.1	16	6.0	5.6	4.6	4.8	8.9	28	4.7	4.8	4.4	4.0
3	6.0	16	6.0	5.6	4.7	4.6	10	12	4.6	4.9	4.3	4.5
4	5.9	15	6.1	5.6	4.8	4.6	24	6.7	4.6	5.1	4.3	4.0
5	6.0	14	6.0	5.6	4.7	4.7	49	5.7	4.6	5.0	4.3	4.0
6	6.0	11	5.8	5.6	4.8	4.9	78	6.4	4.6	4.7	4.3	4.1
7	6.0	8.1	5.8	5.6	4.8	4.6	82	9.6	4.5	4.6	4.3	4.0
8	6.0	6.4	5.8	5.5	4.8	4.2	78	7.1	4.4	4.6	4.2	4.0
9	6.0	8.0	5.8	5.6	4.8	4.2	97	5.7	4.5	4.5	4.2	5.8
10	6.1	6.4	5.8	5.6	4.7	4.2	64	5.1	4.5	4.5	4.2	4.4
11	6.8	6.5	5.8	5.6	4.6	4.2	33	5.0	4.5	4.5	4.2	4.2
12	11	6.1	5.8	5.6	4.7	4.2	22	5.0	4.6	4.4	4.2	4.1
13	19	6.0	5.8	5.6	4.6	4.2	14	5.0	4.6	4.4	4.1	4.1
14	21	6.0	5.8	5.5	4.7	4.2	25	4.9	4.8	4.4	4.1	4.3
15	20	6.1	5.8	5.2	4.7	4.3	99	4.9	5.8	4.3	4.2	4.2
16	18	6.1	5.8	5.1	4.7	4.3	79	5.2	5.4	4.3	4.5	4.0
17	40	5.9	5.8	5.1	4.6	4.3	49	5.2	4.7	4.5	4.4	4.1
18	97	5.9	5.8	5.1	4.7	4.3	31	4.9	4.7	4.3	4.2	4.2
19	79	6.0	5.8	5.2	4.7	4.6	20	4.9	4.6	4.3	4.2	4.1
20	58	6.0	5.8	5.1	4.6	4.6	11	4.8	4.7	4.8	4.1	4.1
21	63	6.5	5.8	5.1	4.7	5.5	6.4	4.9	4.9	4.6	4.1	4.1
22	61	6.1	5.9	5.1	4.7	5.0	5.4	4.9	4.6	4.6	4.1	4.0
23	46	6.0	5.8	5.0	4.7	6.8	5.3	4.9	4.4	4.4	4.2	4.0
24	34	5.9	5.8	4.8	4.7	5.6	5.3	4.8	4.5	4.3	4.2	4.0
25	29	6.0	5.8	4.7	4.8	5.5	5.1	4.8	4.5	4.4	4.1	4.3
26	26	6.0	5.7	4.6	4.7	6.2	5.1	5.2	4.4	4.4	4.0	4.1
27	28	6.2	5.6	4.6	4.6	8.2	5.2	5.5	4.5	4.5	4.0	4.0
28	24	6.6	5.6	4.6	4.7	34	5.7	4.6	4.5	5.1	4.1	3.9
29	21	6.1	5.7	4.6	---	62	5.9	5.0	5.3	5.9	4.1	4.0
30	18	6.1	5.6	4.6	---	39	13	5.2	4.6	4.6	3.9	4.1
31	15	---	5.5	4.6	---	25	---	4.8	---	4.4	3.9	---
TOTAL	795.0	238.0	180.0	161.3	131.5	291.5	951.3	234.7	140.4	143.1	129.8	124.7
MEAN	25.6	7.93	5.81	5.20	4.70	9.40	31.7	7.57	4.68	4.62	4.19	4.16
MAX	97	16	6.1	5.6	4.8	62	99	44	5.8	5.9	4.5	5.8
MIN	5.9	5.9	5.5	4.6	4.6	4.2	5.1	4.6	4.4	4.3	3.9	3.9
CAL YR 1990	TOTAL	2829.1	MEAN	7.75	MAX	123	MIN	3.5				
WTR YR 1991	TOTAL	3521.3	MEAN	9.65	MAX	99	MIN	3.9				



LOCATION.--Lat 45°58'45", long 87°16'13", in SW1/4 NE1/4 sec.2, T.41 N., R.24 W., Delta County, Hydrologic Unit 04030110, on right bank 600 ft downstream from Boney Falls Dam, 2.1 mi west of St. Nicholas, and 23.1 mi upstream from mouth.

PERIOD OF RECORD.--December 1987 to current year (gage heights only).

REMARKS.--Diurnal fluctuation caused by hydroelectric plant 600 ft upstream. Some regulation by Schweitzer Reservoir (station 04058190) about 40 mi upstream and Greenwood Reservoir (station 04057811) about 50 mi upstream. Gage-height telemeter at station.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.82 ft, Apr. 9; minimum daily, 1.89 ft, Sept. 2.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.10	2.55	2.54	2.12	2.09	2.10	3.62	3.55	3.01	2.52	2.75	1.90
2	2.16	2.53	2.35	2.13	2.10	2.05	3.47	3.49	2.93	2.48	2.57	1.89
3	2.15	2.48	2.27	2.11	2.11	2.04	3.50	3.39	2.67	2.47	2.38	1.92
4	2.18	2.61	2.14	2.11	2.11	2.12	3.56	3.27	2.77	2.81	2.31	2.06
5	2.19	2.42	2.19	2.09	2.12	2.15	3.80	3.19	2.48	3.05	2.29	2.11
6	2.16	2.31	2.29	2.10	2.12	2.15	4.04	3.32	2.24	3.17	2.24	2.09
7	2.13	2.40	2.35	2.09	2.15	2.16	4.18	3.38	2.36	2.89	2.16	2.07
8	2.11	2.36	2.40	2.08	2.14	2.15	4.31	3.33	2.35	2.62	2.15	2.04
9	2.08	2.35	2.35	2.09	2.14	2.14	4.51	3.23	2.30	2.47	2.09	2.06
10	2.09	2.33	2.33	2.09	2.16	2.14	4.45	3.14	2.29	2.39	2.10	2.23
11	2.17	2.29	2.33	2.13	2.15	2.15	4.45	3.02	2.25	2.29	2.08	2.30
12	2.26	2.27	2.34	2.17	2.14	2.14	4.30	2.93	2.21	2.23	2.07	2.19
13	2.25	2.27	2.26	2.16	2.11	2.15	4.08	2.86	2.20	2.20	2.05	2.29
14	2.25	2.28	2.11	2.14	2.12	2.14	4.06	2.84	2.15	2.17	2.05	2.26
15	2.26	2.28	2.27	2.13	2.08	2.14	4.35	2.80	2.21	2.15	2.06	2.34
16	2.25	2.29	2.30	2.14	2.09	2.13	4.43	2.71	2.29	2.14	2.07	2.34
17	2.30	2.29	2.25	2.12	2.10	2.17	4.34	2.80	2.34	2.15	2.05	2.22
18	2.94	2.28	2.24	2.13	2.10	2.19	4.21	2.88	2.37	2.15	2.17	2.26
19	3.20	2.27	2.21	2.14	2.05	2.22	4.04	2.79	2.30	2.15	2.15	2.28
20	3.33	2.30	2.24	2.14	2.04	2.30	3.86	2.71	2.26	2.11	2.13	2.29
21	3.25	2.11	2.31	2.13	2.09	2.36	3.70	2.65	2.22	2.13	2.11	2.29
22	3.21	2.44	2.27	2.12	2.10	2.48	3.52	2.56	2.36	2.32	2.05	2.43
23	3.13	2.45	2.04	2.12	2.09	2.67	3.41	2.52	2.32	2.50	2.03	2.29
24	3.06	2.46	2.08	2.13	2.09	2.87	3.31	2.48	2.26	2.34	2.09	2.20
25	2.96	2.45	2.12	2.11	2.09	3.00	3.22	2.57	2.25	2.33	2.09	2.19
26	2.91	2.36	2.09	2.12	2.09	3.20	2.99	2.67	2.17	2.26	2.11	2.17
27	2.84	2.43	2.11	2.14	2.07	3.50	3.15	2.91	2.18	2.21	2.04	2.19
28	2.79	2.46	2.12	2.10	2.08	3.83	3.14	2.89	2.20	2.18	2.04	2.21
29	2.71	2.53	2.17	2.11	---	3.86	3.32	3.03	2.23	2.48	2.05	2.19
30	2.63	2.44	2.13	2.09	---	3.84	3.48	3.12	2.36	2.90	2.07	2.15
31	2.54	---	2.12	2.09	---	3.83	---	3.13	---	2.80	1.95	---
MEAN	2.54	2.38	2.24	2.12	2.10	2.53	3.83	2.97	2.35	2.42	2.15	2.18
MAX	3.33	2.61	2.54	2.17	2.16	3.86	4.51	3.55	3.01	3.17	2.75	2.43
MIN	2.08	2.11	2.04	2.08	2.04	2.04	2.99	2.48	2.15	2.11	1.95	1.89

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04059000 ESCANABA RIVER AT CORNELL, MI  
(National stream quality accounting network station)

LOCATION.--Lat 45°54'31", long 87°12'49", in NW1/4 sec.32, T.41 N., R.23 W., Delta County, Hydrologic Unit 04030110, on right bank 50 ft downstream from bridge on County Road 519, 0.4 mi downstream from Bobs Creek, 0.7 mi northeast of Cornell, and 16 mi upstream from mouth.

DRAINAGE AREA.--870 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1903 to December 1912, January 1913 to November 1915 (gage heights only), October 1950 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Escanaba" 1903-15.

REVISED RECORDS.--WSP 1387: 1904. WDR MI-85: 1970 (M).

GAGE.--Water-stage recorder. Datum of gage is 749.26 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). August 1903 to November 1915, nonrecording gage at site 10 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 3 to Mar. 26. Water-discharge records good except for estimated daily discharges, which are fair. Since 1950, diurnal fluctuation and occasional slight regulation by Boney Falls powerplant 7 mi upstream. Since August 1962, some regulation by Schweitzer Reservoir (station 04058190) about 50 mi upstream. Since December 1972, some regulation by Greenwood Reservoir (station 04057811) about 60 mi upstream. Gage-height telemeter at station.

AVERAGE DISCHARGE.--50 years (water years 1904-12, 1951-91), 875 ft<sup>3</sup>/s, 13.66 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft<sup>3</sup>/s, Apr. 26, 1979, gage height, 5.00 ft; maximum gage height, 6.40 ft, Apr. 9, 1971, backwater from ice; minimum discharge observed, 90 ft<sup>3</sup>/s, July 5, 1910, gage height, 1.5 ft, site and datum then in use, but may have been less during extended periods of no gage-height record during winter periods of 1903-12, or periods of ice effect in 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,580 ft<sup>3</sup>/s, Apr. 9, gage height, 3.60 ft; maximum gage height, 3.84 ft, Mar. 25, backwater from ice; minimum daily discharge, 176 ft<sup>3</sup>/s, Sept. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	276	614	621	295	275	285	1870	1850	1440	605	803	188
2	307	605	542	300	285	255	1810	1760	1250	583	628	176
3	315	574	396	290	290	250	1860	1560	924	605	488	191
4	307	652	308	290	290	295	2010	1440	965	882	422	249
5	316	544	340	275	295	315	2390	1350	668	1130	408	289
6	301	429	410	280	295	315	2970	1520	483	1230	377	292
7	284	482	456	275	315	320	3340	1600	513	963	331	272
8	275	458	496	270	310	315	3590	1530	520	701	318	258
9	258	448	496	275	310	310	4220	1400	472	564	286	301
10	263	439	440	275	320	310	3940	1290	443	500	286	353
11	291	424	440	300	315	315	3870	1150	411	427	276	429
12	360	454	450	325	310	310	3510	1050	392	376	278	350
13	359	435	390	320	290	315	3000	961	370	351	266	393
14	368	417	280	305	295	310	3010	949	357	328	270	402
15	362	398	395	300	270	310	3940	897	392	314	268	445
16	362	394	415	310	275	300	4050	827	437	310	268	458
17	389	407	380	295	285	325	3640	1130	461	316	268	356
18	956	395	375	300	285	340	3210	1170	486	311	331	371
19	1380	390	355	310	255	360	2760	1030	424	313	324	375
20	1500	538	375	310	250	420	2370	893	404	309	312	383
21	1450	299	425	300	275	465	2070	804	381	309	296	378
22	1390	512	395	295	285	565	1810	706	473	435	264	463
23	1270	555	250	295	275	750	1660	660	450	579	243	404
24	1190	536	270	300	275	975	1530	616	403	456	288	323
25	1060	540	295	290	275	1140	1440	702	385	451	283	316
26	1000	501	275	295	275	1420	1170	890	348	393	303	303
27	929	527	290	310	265	2180	1290	1160	336	362	268	311
28	862	565	295	285	270	2670	1310	1150	374	344	263	320
29	787	754	325	290	---	2690	1520	1330	383	551	272	301
30	702	671	300	275	---	2490	1750	1590	479	946	282	285
31	627	---	295	275	---	2280	---	1690	---	850	221	---
TOTAL	20496	14957	11775	9110	8010	23900	76910	36655	15824	16794	10191	9935
MEAN	661	499	380	294	286	771	2564	1182	527	542	329	331
MAX	1500	754	621	325	320	2690	4220	1850	1440	1230	803	463
MIN	258	299	250	270	250	250	1170	616	336	309	221	176
CFSM	.76	.57	.44	.34	.33	.89	2.95	1.36	.61	.62	.38	.38
IN.	.88	.64	.50	.39	.34	1.02	3.29	1.57	.68	.72	.44	.42

CAL YR 1990 TOTAL 219552 MEAN 602 MAX 4230 MIN 223 CFSM .69 IN 9.39  
WTR YR 1991 TOTAL 254557 MEAN 697 MAX 4220 MIN 176 CFSM .80 IN 10.88

## 04059000 ESCANABA RIVER AT CORNELL, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1969-73, 1975 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: February 1975 to September 1981.

WATER TEMPERATURE: February 1975 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. From October 1975 to September 1981, instrument-recorded specific conductance below 200 microsiemens does not represent the conductance of the cross section. Results of a study of conductance in the cross section are available in the District files.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum daily recorded (more than 20 percent missing record), 360 microsiemens, Sept. 10, 1975; minimum measured, 114 microsiemens, Apr. 15, 1981.

WATER TEMPERATURE (water years 1975, 1977-81): Maximum daily recorded (more than 20 percent missing record), 35.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 72 microsiemens was measured Apr. 24, 1985.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED SATURATION (00301)	COLIFORM, FECA, 0.7 UM-MF (COLS./100 ML) (31625)	STREPTOCOCCI, FECA, KF AGAR (COLS. PER 100 ML) (31673)
NOV 07...	1300	425	172	8.14	3.5	2.7	13.6	104	K5	K4
JAN 17...	1330	305	279	7.97	0.0	2.0	10.6	75	K2	K3
MAR 20...	1415	567	279	8.17	0.0	2.5	13.9	98	K7	K45
MAY 07...	1215	1540	142	7.98	7.5	1.9	11.6	100	<5	K5
JUL 01...	1345	604	252	8.49	18.5	3.2	9.5	105	K11	220
SEP 17...	1040	353	232	8.47	18.5	1.7	10.2	112	K22	370

DATE	HARDNESS TOTAL (MG/L AS CaCO3) (00900)	HARDNESS NONCARB DISSOLV FLD. AS CaCO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS Ca) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS Mg) (00925)	SODIUM, DIS-SOLVED (MG/L AS Na) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	BICARBONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	CARBONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	ALKALINITY WAT DIS TOT IT FIELD (MG/L AS CaCO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
NOV 07...	86	14	21	8.1	4.3	0.9	87	--	71	11
JAN 17...	95	0	23	9.0	23	1.6	131	--	107	19
MAR 20...	110	0	25	11	17	2.4	134	--	110	14
MAY 07...	67	3	16	6.6	4.0	0.8	78	--	64	8.2
JUL 01...	100	0	25	10	14	1.5	121	6	109	15
SEP 17...	100	0	24	9.8	8.6	1.4	123	1	103	16

DATE	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, SOLVED AS SiO2 (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00615)	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
NOV 07...	4.8	<0.1	7.4	103	0.14	118	<0.01	<0.01	<0.10	<0.10
JAN 17...	9.6	<0.1	11	166	0.23	137	<0.01	<0.01	0.20	0.20
MAR 20...	9.1	0.1	8.5	169	0.23	259	<0.01	<0.01	0.34	0.29
MAY 07...	3.3	<0.1	4.3	103	0.14	428	<0.01	<0.01	0.13	0.06
JUL 01...	7.8	0.1	7.2	144	0.20	235	<0.01	<0.01	0.09	0.11
SEP 17...	9.0	0.2	7.6	134	0.18	128	<0.01	<0.01	0.08	0.10

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
NOV 07...	<0.01	0.01	0.6	<0.01	<0.01	<0.01	--	30	<1	12
JAN 17...	0.05	0.07	0.4	0.18	<0.01	<0.01	<0.01	30	<1	14
MAR 20...	0.04	0.04	0.3	0.02	<0.01	<0.01	<0.01	--	--	--
MAY 07...	0.03	0.01	0.5	0.01	<0.01	<0.01	<0.01	40	<1	13
JUL 01...	0.03	<0.01	0.5	0.02	<0.01	0.01	<0.01	30	<1	14
SEP 17...	<0.01	0.01	0.4	0.01	<0.01	<0.01	0.01	--	--	--
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
NOV 07...	<0.5	<1	<1	<3	1	480	<1	<4	13	<0.1
JAN 17...	<0.5	<1	<1	<3	2	530	2	<4	8	0.1
MAR 20...	--	--	--	--	--	--	--	--	--	--
MAY 07...	<0.5	<1	<1	<3	2	320	1	<4	12	<0.1
JUL 01...	<0.5	<1	<1	<3	3	340	1	<4	19	<0.1
SEP 17...	--	--	--	--	--	--	--	--	--	--
DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 07...	<10	<1	<1	<1	48	<6	13	2	2.3	65
JAN 17...	<10	1	<2	<1	39	<6	45	5	4.1	78
MAR 20...	--	--	--	--	--	--	--	4	6.1	82
MAY 07...	<10	2	<1	<1	35	<6	<3	3	12	61
JUL 01...	<10	<1	<1	<1	56	<6	5	7	11	100
SEP 17...	--	--	--	--	--	--	--	5	4.8	92



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04059500 FORD RIVER NEAR HYDE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 45°45'20", long 87°12'05", in SW1/4 sec.19, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030109, on right bank 40 ft downstream from bridge on County Road 533, 1.4 mi downstream from Tenmile Creek, and 1.5 mi north of Hyde.

DRAINAGE AREA.--450 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1954 to current year.

GAGE.--Water-stage recorder. Datum of gage is 681.77 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 1 to Mar. 28. Water-discharge records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--37 years, 379 ft<sup>3</sup>/s, 11.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,590 ft<sup>3</sup>/s, May 7, 1960, gage height, 8.27 ft; minimum, 18 ft<sup>3</sup>/s, Aug. 30, 1976, July 7, 8, 1988; minimum gage height, 1.30 ft, July 7, 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,000 ft<sup>3</sup>/s, Apr. 15, gage height, 5.70 ft; maximum gage height, 6.86 ft, Mar. 25, backwater from ice; minimum discharge, 32 ft<sup>3</sup>/s, Sept. 3, gage height, 1.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	245	240	67	43	37	1520	1050	1680	171	257	34
2	89	229	220	64	43	39	1420	991	1410	196	213	33
3	92	222	210	62	43	39	1320	928	1190	295	175	49
4	95	210	150	60	44	38	1250	846	927	419	144	40
5	97	198	160	58	45	38	1250	768	694	490	121	38
6	101	187	175	56	50	39	1380	823	541	499	104	50
7	98	178	190	54	54	39	1470	852	441	501	93	56
8	93	166	180	52	54	40	1580	821	366	461	83	59
9	88	162	165	50	52	41	1990	783	309	344	75	71
10	85	157	155	49	50	41	1950	722	272	268	69	84
11	87	147	150	48	47	40	1970	654	237	208	64	83
12	88	132	145	47	45	40	2010	592	210	171	58	108
13	97	119	140	47	44	40	1900	543	186	147	54	111
14	112	141	140	47	43	40	2110	544	177	128	52	107
15	127	159	138	47	41	40	2930	494	190	112	49	126
16	127	152	137	46	40	40	2700	515	194	98	46	128
17	140	145	135	47	39	42	2360	933	169	96	50	149
18	242	145	133	48	38	45	2100	919	166	170	55	147
19	451	143	133	47	38	60	1870	792	164	126	57	131
20	532	141	133	46	37	100	1580	693	150	101	64	117
21	641	146	132	46	37	275	1320	586	147	101	68	103
22	696	167	122	45	37	1000	1100	507	142	126	64	97
23	647	207	112	44	37	1150	936	455	127	145	57	91
24	584	231	108	44	36	1100	837	429	118	129	56	83
25	522	236	100	43	36	1030	775	502	114	123	52	83
26	457	157	94	43	36	1200	732	892	102	106	54	87
27	404	232	88	44	37	1350	696	1120	91	102	49	85
28	358	270	82	43	37	1730	728	1040	116	96	46	89
29	317	245	80	43	---	1820	831	1530	131	180	47	91
30	289	208	74	43	---	1680	1020	2030	129	236	48	89
31	267	---	70	43	---	1590	---	1960	---	262	39	---
TOTAL	8112	5477	4291	1523	1183	14803	45635	26314	10890	6607	2463	2619
MEAN	262	183	138	49.1	42.3	478	1521	849	363	213	79.5	87.3
MAX	696	270	240	67	54	1820	2930	2030	1680	501	257	149
MIN	85	119	70	43	36	37	696	429	91	96	39	33
CFSM	.58	.41	.31	.11	.09	1.06	3.38	1.89	.81	.47	.18	.19
IN.	.67	.45	.35	.13	.10	1.22	3.77	2.18	.90	.55	.20	.22

CAL YR 1990 TOTAL 96914 MEAN 266 MAX 2860 MIN 39 CFSM .59 IN 8.01  
WTR YR 1991 TOTAL 129917 MEAN 356 MAX 2930 MIN 33 CFSM .79 IN 10.74

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: December 1974 to September 1981.

WATER TEMPERATURE: July 1956 to September 1981.

INSTRUMENTATION.--Water-temperature recorder from July 20, 1956 to Sept. 30, 1975. Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-77, 1979-81): Maximum, 482 microsiemens, Dec. 2, 1976; minimum recorded, 131 microsiemens, May 22, 1976, but may have been lower during instrument malfunction May 18-21, 1976.

WATER TEMPERATURE (water years 1956-81): Maximum, 31.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 06...	1400	187	287	8.40	4.0	1.2	12.9	100	K42	K21
JAN 15...	1125	47	426	7.79	0.0	1.4	6.3	44	K6	K3
MAY 06...	1400	851	236	8.20	7.5	1.0	11.4	99	K11	K20
JUL 30...	1130	225	347	8.33	17.5	1.0	9.4	101	190	260

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	ALKA- LITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)
NOV 06...	170	28	39	17	1.6	0.5	150	10	139	13
JAN 15...	240	24	58	24	2.2	0.9	268	--	220	18
MAY 06...	140	19	33	13	1.6	0.6	143	--	117	9.3
JUL 30...	210	21	54	18	1.6	0.9	221	4	187	6.2

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
NOV 06...	4.1	<0.1	7.1	191	0.26	96.4	<0.01	<0.01	<0.10	<0.10
JAN 15...	4.7	<0.1	12	256	0.35	32.5	<0.01	<0.01	0.20	0.20
MAY 06...	2.5	<0.1	3.1	149	0.20	342	<0.01	0.01	<0.05	<0.05
JUL 30...	1.8	<0.1	7.9	223	0.30	135	<0.01	0.02	<0.05	<0.05

STREAMS TRIBUTARY TO LAKE MICHIGAN  
04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
NOV 06...	<0.01	0.01	0.7	<0.01	<0.01	<0.01	--	10	<1	12
JAN 15...	0.04	0.05	0.3	0.04	<0.01	<0.01	<0.01	<10	<1	19
MAY 06...	0.02	0.01	0.5	0.02	<0.01	<0.01	<0.01	20	<1	15
JUL 30...	0.02	0.02	0.9	<0.01	0.02	<0.01	<0.01	<10	<1	18
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
NOV 06...	<0.5	<1	<1	<3	2	250	<1	<4	10	<0.1
JAN 15...	<0.5	<1	<1	<3	1	120	1	6	18	<0.1
MAY 06...	<0.5	<1	<1	<3	4	100	4	<4	12	<0.1
JUL 30...	<0.5	<1	<1	<3	3	82	<1	<4	15	<0.1
DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 06...	<10	<1	<1	<1	48	<6	5	2	1.0	100
JAN 15...	<10	<1	<1	<1	72	<6	11	5	0.63	88
MAY 06...	<10	<1	<1	<1	40	<6	42	7	16	49
JUL 30...	<10	<1	<2	<1	71	<6	3	3	1.8	100

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04061000 BRULE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'31", long 88°15'57", in SE1/4 SE1/4 sec.11, T.41 N., R.32 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, on left bank 40 ft upstream from highway bridge, 1.0 mi upstream from Paint River, 2.5 mi north of Florence, WI, and 5.0 mi upstream from confluence with Michigamme River.

DRAINAGE AREA.--389 mi<sup>2</sup>.

PERIOD OF RECORD.--January 1914 to February 1916, June 1944 to current year.

REVISED RECORDS.--WSP 1387: 1914-16. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,200.55 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to Aug. 29, 1944, nonrecording gage at bridge 40 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 30 to Mar. 31. Records excellent except for estimated daily discharges, which are fair. Discharge includes some mine pumpage prior to August 1977. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years (water years 1915, 1945-91), 355 ft<sup>3</sup>/s, 12.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,700 ft<sup>3</sup>/s, July 2, 1953, gage height, 6.57 ft; maximum gage height, 8.60 ft, Dec. 20, 1983, backwater from ice; minimum discharge, 118 ft<sup>3</sup>/s, Dec. 2, 1963 (discharge measurement); minimum gage height, 1.76 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,490 ft<sup>3</sup>/s, Apr. 9, 10, gage height, 3.83 ft; maximum gage height, 5.24 ft, Mar. 30, backwater from ice; minimum daily discharge, 156 ft<sup>3</sup>/s, Jan. 2-4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	230	241	280	160	185	180	439	754	722	416	264	180
2	228	236	250	156	195	182	399	657	591	458	245	177
3	212	231	220	156	200	183	405	558	534	428	255	210
4	215	228	190	156	215	185	470	500	454	406	260	239
5	223	236	190	157	225	190	570	485	400	389	235	217
6	206	226	230	160	236	196	662	544	362	365	219	231
7	195	221	240	163	235	198	695	611	338	330	213	266
8	189	225	240	167	225	199	915	555	320	310	205	245
9	184	224	240	170	215	195	1410	489	304	298	199	259
10	187	217	235	174	205	190	1400	458	289	276	197	292
11	204	210	225	177	200	185	1100	430	275	261	195	271
12	205	238	220	180	190	180	867	414	275	250	190	237
13	206	237	210	182	185	180	712	398	267	248	188	227
14	267	224	180	183	175	180	659	399	290	237	194	225
15	231	221	195	185	170	182	738	369	402	226	217	265
16	219	218	210	186	170	185	705	359	407	221	215	251
17	320	219	220	186	170	188	639	518	343	233	267	232
18	568	215	220	187	175	193	574	543	298	249	279	238
19	567	205	210	187	180	202	524	440	275	235	246	240
20	456	202	200	186	180	235	482	385	263	228	226	227
21	463	241	195	185	180	370	447	351	314	233	212	220
22	503	283	190	185	180	500	415	334	367	230	203	219
23	449	263	160	185	180	580	404	331	319	220	196	216
24	385	234	160	185	180	680	419	325	283	211	201	209
25	342	228	170	183	178	550	407	322	267	226	202	216
26	314	240	170	182	178	630	394	406	261	221	195	241
27	291	245	165	182	178	770	383	612	248	212	191	238
28	286	282	170	182	178	1050	391	603	492	221	187	226
29	283	300	175	182	---	970	406	767	536	382	182	233
30	262	290	175	182	---	500	669	1090	442	364	179	225
31	274	---	165	182	---	470	---	958	---	304	178	---
TOTAL	9164	7080	6300	5473	5363	10878	18700	15965	10938	8888	6635	6972
MEAN	296	236	203	177	192	351	623	515	365	287	214	232
MAX	568	300	280	187	236	1050	1410	1090	722	458	279	292
MIN	184	202	160	156	170	180	383	322	248	211	178	177
CFSM	.76	.61	.52	.46	.49	.90	1.60	1.32	.94	.74	.55	.60
IN.	.88	.68	.60	.52	.51	1.04	1.79	1.53	1.05	.85	.63	.67

CAL YR 1990 TOTAL 86019 MEAN 236 MAX 700 MIN 160 CFSM .61 IN 8.23  
WTR YR 1991 TOTAL 112356 MEAN 308 MAX 1410 MIN 156 CFSM .79 IN 10.74



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04061500 PAINT RIVER AT CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'21", long 88°20'05", in SE1/4 sec.20, T.43 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 150 ft downstream from municipal powerplant at Crystal Falls, 14.5 mi upstream from mouth.

DRAINAGE AREA.--597 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1174: 1947-48(m). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,306.1 ft above National Geodetic Vertical Datum of 1929 (Wisconsin Electric Power Co. bench mark).

REMARKS.--Estimated daily discharges: Dec. 25-31, Jan. 2, Jan. 6 to Feb. 15, Feb. 20-23, 25-28, Mar. 2-4, 9, 10, 17-19, and July 17 to Aug. 16. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplant immediately upstream; since storage capacity is small, daily flows are not affected appreciably. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 592 ft<sup>3</sup>/s, 13.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft<sup>3</sup>/s, Apr. 25, 1960, gage height, 9.82 ft; minimum, 7.7 ft<sup>3</sup>/s, Sept. 17, 1950, gage height, 0.89 ft; minimum daily, 81 ft<sup>3</sup>/s, Nov. 1, 1947.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,210 ft<sup>3</sup>/s, Apr. 9, gage height, 5.89 ft; minimum, 29 ft<sup>3</sup>/s, Nov. 12, gage height, 1.11 ft, caused by freeze-up of grates leading to generator suction tubes; minimum daily, 140 ft<sup>3</sup>/s, Sept. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	269	500	524	231	205	210	1090	1670	1350	563	320	140
2	225	494	382	230	205	210	988	1490	1160	543	330	145
3	250	466	329	224	202	210	1030	1250	917	588	305	260
4	238	437	288	218	215	210	1300	1090	777	630	235	246
5	262	417	333	200	218	211	1880	1020	660	581	285	265
6	240	396	388	200	221	214	2150	1050	568	603	265	278
7	222	380	376	200	216	218	2340	1320	529	487	245	210
8	246	364	388	200	220	215	2730	1330	456	496	235	182
9	202	358	368	199	218	220	3840	1180	376	450	245	325
10	232	352	356	200	215	220	3810	1050	418	397	235	306
11	203	330	339	202	210	219	3040	956	367	361	220	331
12	264	307	335	205	207	224	2390	873	337	352	280	293
13	208	317	320	210	203	221	1930	811	326	354	215	293
14	277	322	265	210	200	223	1680	727	344	345	210	262
15	360	329	286	210	198	216	1790	628	430	332	210	239
16	298	329	321	210	199	218	1750	604	489	314	215	324
17	379	319	321	213	205	220	1550	766	531	300	244	271
18	717	311	308	215	205	220	1410	820	473	290	275	271
19	1160	316	304	217	206	240	1270	730	460	280	261	321
20	1050	303	285	219	205	276	1130	612	426	270	249	316
21	1120	338	313	210	205	371	984	559	436	250	216	263
22	1290	417	286	209	205	516	893	490	422	320	214	209
23	1230	435	227	205	205	679	826	484	400	300	239	329
24	1090	409	236	205	208	657	808	483	343	280	176	258
25	864	350	240	205	205	614	767	446	372	260	182	249
26	857	314	245	200	206	746	710	548	331	250	235	279
27	702	425	240	200	206	1250	641	1080	319	200	266	331
28	686	475	240	207	206	1970	628	1240	656	180	212	309
29	614	504	245	203	---	1800	679	1280	554	450	158	265
30	547	463	245	206	---	1480	1120	1420	530	450	216	337
31	509	---	235	205	---	1270	---	1360	---	350	159	---
TOTAL	16811	11477	9568	6468	5819	15768	47154	29367	15757	11826	7352	8107
MEAN	542	383	309	209	208	509	1572	947	525	381	237	270
MAX	1290	504	524	231	221	1970	3840	1670	1350	630	330	337
MIN	202	303	227	199	198	210	628	446	319	180	158	140
CFSM	.91	.64	.52	.35	.35	.85	2.63	1.59	.88	.64	.40	.45
IN.	1.05	.72	.60	.40	.36	.98	2.94	1.83	.98	.74	.46	.51

CAL YR 1990 TOTAL 141767 MEAN 388 MAX 1560 MIN 119 CFSM .65 IN 8.83  
WTR YR 1991 TOTAL 185474 MEAN 508 MAX 3840 MIN 140 CFSM .85 IN 11.56

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04062000 PAINT RIVER NEAR ALPHA, MI

LOCATION.--Lat 46°00'40", long 88°15'30", in NW1/4 NW1/4 sec.25, T.42 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 0.6 mi downstream from Lower Paint Dam, 5.5 mi upstream from Brule River, and 6.0 mi southeast of Alpha.

DRAINAGE AREA.--631 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1952 to current year. Monthly discharge only for period October 1953 to September 1960, published in WSP 1727.

REVISED RECORDS.--WSP 1727: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,260 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-18, Dec. 2, 13, 14, 17-20, Dec. 22 to Mar. 16, Mar. 23-25, 28-30, and Apr.2. Records good. Flow completely regulated by power plant and Lower Paint Dam, 0.6 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 170 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,050 ft<sup>3</sup>/s, July 2, 1953, gage height, 10.50 ft; minimum daily, 62 ft<sup>3</sup>/s, Mar. 22, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,950 ft<sup>3</sup>/s, Apr. 9, gage height, 6.12 ft; minimum daily, 79 ft<sup>3</sup>/s, May 4, 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	93	88	89	87	86	84	93	678	544	95	92	85
2	93	88	88	87	86	84	93	676	528	94	92	85
3	93	88	88	87	86	84	90	362	90	95	92	85
4	93	88	90	87	86	84	91	79	90	96	92	85
5	93	88	88	87	86	84	92	79	90	93	92	85
6	93	88	88	87	86	84	93	90	90	94	92	86
7	93	88	88	87	86	84	106	90	90	95	92	87
8	93	88	88	87	86	84	215	90	90	94	92	87
9	93	88	88	87	85	84	1240	339	90	92	92	88
10	93	88	86	87	85	84	1650	635	90	91	92	88
11	93	88	86	87	85	85	1300	346	90	92	92	89
12	93	88	86	87	85	85	1290	90	90	93	92	89
13	93	88	86	87	85	85	1010	90	90	93	92	89
14	93	87	88	87	85	86	342	89	91	95	92	92
15	93	86	88	87	85	87	92	88	92	93	92	92
16	93	87	88	86	85	88	90	89	91	94	93	92
17	93	88	86	86	85	89	90	90	90	95	93	92
18	295	87	88	86	85	88	90	90	90	95	91	91
19	708	88	88	86	85	87	90	90	91	95	89	92
20	718	88	88	86	85	86	89	90	92	94	89	92
21	712	88	88	86	85	86	88	89	93	93	89	92
22	716	88	88	86	85	86	88	90	93	93	87	93
23	940	88	88	86	84	86	88	90	93	93	87	94
24	1300	88	88	86	84	86	88	88	93	93	87	94
25	1390	88	88	86	84	87	89	84	93	90	87	94
26	1370	88	88	86	84	89	90	86	93	90	87	95
27	1350	88	88	86	84	89	90	86	93	90	87	94
28	1350	88	88	86	84	460	90	86	96	92	87	94
29	891	90	88	86	---	950	90	92	95	93	87	92
30	89	89	88	86	---	810	251	94	95	90	87	109
31	88	---	88	86	---	119	---	92	---	90	85	---
TOTAL	13498	2638	2721	2681	2382	4654	9298	5247	3636	2885	2792	2722
MEAN	435	87.9	87.8	86.5	85.1	150	310	169	121	93.1	90.1	90.7
MAX	1390	90	90	87	86	950	1650	678	544	96	93	109
MIN	88	86	86	86	84	84	88	79	90	90	85	85
CAL YR 1990	TOTAL	44113	MEAN	121	MAX	1390	MIN	75				
WTR YR 1991	TOTAL	55154	MEAN	151	MAX	1650	MIN	79				

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04062011 BRULE RIVER NEAR COMMONWEALTH, WI

LOCATION.--Lat 45°56'51", long 88°12'55", in NW1/4 sec. 14, T.40 N., R.18 E., Wisconsin Meridian, Florence County, Hydrologic Unit 04030106, on right bank 900 ft downstream from Brule Island Dam, 1.5 mi upstream from confluence with Michigamme River, and 2.8 mi north of Commonwealth, WI.

DRAINAGE AREA.--1,020 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1989 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.-- No estimated daily discharges. Records excellent. Flow regulated by powerplant 900 ft upstream and by Lower Paint Dam 8.2 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,430 ft<sup>3</sup>/s, Apr. 9, 1991, gage height, 10.22 ft; minimum daily, 190 ft<sup>3</sup>/s, Oct. 9, 1989.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,430 ft<sup>3</sup>/s, Apr. 9, gage height, 10.22 ft; minimum daily, 210 ft<sup>3</sup>/s, Dec. 27.

REVISIONS.--The maximum discharge for the water year 1990 has been revised to 1,860 ft<sup>3</sup>/s, Feb. 23, 1990, gage height, 8.51 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	324	346	393	254	256	263	511	1520	1260	473	355	237
2	345	305	326	367	261	238	492	1380	1260	725	279	256
3	294	240	320	237	278	246	477	835	544	481	340	298
4	346	265	259	222	284	268	607	593	567	369	322	322
5	301	311	262	216	283	253	742	516	492	468	305	285
6	286	426	229	218	264	280	766	670	482	471	302	298
7	281	247	283	234	305	265	829	731	398	428	327	348
8	286	329	323	297	266	285	1260	778	398	396	293	378
9	304	311	340	235	328	290	2600	715	395	368	275	339
10	217	292	299	220	289	251	3060	1180	445	398	275	399
11	242	298	312	225	295	235	2330	822	304	329	269	352
12	334	370	326	262	287	256	2150	512	368	324	272	307
13	257	295	312	264	297	278	1770	505	345	325	292	297
14	388	287	234	263	228	287	1010	484	432	373	289	311
15	333	254	245	268	218	258	826	456	552	286	315	371
16	307	340	276	262	236	269	842	392	643	260	270	351
17	480	274	299	289	255	265	831	515	438	287	389	323
18	749	305	298	319	330	334	750	641	397	296	394	289
19	1330	308	306	241	238	278	561	498	395	404	305	287
20	1230	285	258	264	261	352	482	485	358	330	303	315
21	1190	383	280	269	269	432	512	476	383	294	296	310
22	1250	388	281	267	282	622	512	435	487	348	316	284
23	1280	386	258	239	247	658	492	431	419	284	262	296
24	1560	335	233	278	277	792	547	442	435	246	275	293
25	1630	319	220	291	230	628	495	400	410	281	327	322
26	1470	324	240	253	253	596	477	546	322	338	324	323
27	1540	427	210	243	268	829	561	707	343	299	271	308
28	1450	367	257	251	264	1740	484	712	574	286	251	351
29	1190	404	278	268	---	2070	479	941	688	626	264	295
30	374	343	309	264	---	1290	934	1430	581	444	237	271
31	492	---	268	242	---	568	---	1190	---	367	238	---
TOTAL	22060	9764	8734	8022	7549	15676	28420	21952	15141	11802	9279	9416
MEAN	712	325	282	259	270	506	947	708	505	381	299	314
MAX	1630	427	393	367	330	2070	3060	1520	1260	725	394	399
MIN	217	240	210	216	218	235	477	392	304	246	237	237

CAL YR 1990 TOTAL 132946 MEAN 364 MAX 1630 MIN 198  
WTR YR 1991 TOTAL 167815 MEAN 460 MAX 3060 MIN 210

LOCATION.--Lat 46°31'39", long 88°00'15", in NE1/4 SW1/4 sec.25, T.48 N., R.30 W., Marquette County, Hydrologic Unit 04030107, on left bank 60 ft downstream from railroad bridge, at mouth of Peshekee River, 2.1 mi northwest of Champion.

DRAINAGE AREA.--193 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,548.83 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 8, 1962, nonrecording gage at same site and datum.

REMARKS.--Major inlets to Lake Michigamme are Peshekee River and Spurr River. The outlet is Michigamme River. Streamflow records were collected for Michigamme River (station 04062230) from October 1968 to September 1982 and for Peshekee River (station 04062200) from July 1961 to September 1978. It has been determined that the gage records river stage rather than lake stage when the lake stage falls below a gage height of about 0.10 ft. This last occurred during the 1976 and 1977 water years. Lake stage for this period was determined on the basis of stage-discharge relation at the lake outlet using discharge figures from station 04062230. Surface area of lake is 4,260 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 8.49 ft, Apr. 21, 22 or 23, 1985, from floodmark; minimum, -0.50 ft, Sept. 30, Oct. 1, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 5.08 ft, Apr. 10; minimum, 1.07 ft, Sept. 14.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.81	2.85	2.09	1.75	1.51	1.46	2.57	3.28	2.33	1.78	2.19	1.20
2	1.80	2.79	2.08	1.74	1.50	1.49	2.61	3.25	2.29	1.91	2.15	1.18
3	1.81	2.74	2.06	1.74	1.49	1.48	2.66	3.19	2.23	2.10	2.11	1.21
4	1.84	2.66	2.08	1.73	1.48	1.46	2.74	3.16	2.17	2.26	2.08	1.20
5	1.78	2.59	2.06	1.72	1.48	1.45	2.88	3.11	2.11	2.43	2.03	1.16
6	1.76	2.53	2.06	1.70	1.47	1.50	3.15	3.12	2.05	2.55	1.99	1.14
7	1.74	2.47	2.04	1.69	1.47	1.52	3.54	3.11	2.00	2.61	1.94	1.12
8	1.72	2.40	2.02	1.68	1.47	1.51	4.20	3.10	1.94	2.62	1.89	1.11
9	1.70	2.36	2.01	1.67	1.46	1.51	4.86	3.08	1.90	2.59	1.84	1.13
10	1.67	2.31	1.99	1.66	1.45	1.49	5.07	3.06	1.86	2.54	1.80	1.14
11	1.67	2.25	1.97	1.65	1.44	1.47	5.02	3.02	1.80	2.47	1.76	1.12
12	1.65	2.18	1.97	1.64	1.44	1.45	4.88	2.96	1.73	2.40	1.72	1.11
13	1.65	2.12	1.96	1.63	1.44	1.44	4.67	2.90	1.69	2.36	1.68	1.10
14	1.66	2.09	1.93	1.62	1.45	1.43	4.49	2.83	1.67	2.31	1.65	1.09
15	1.68	2.05	1.92	1.61	1.50	1.42	4.41	2.77	1.69	2.26	1.63	1.11
16	1.66	2.03	1.91	1.59	1.50	1.41	4.35	2.72	1.73	2.21	1.63	1.16
17	1.79	2.00	1.90	1.59	1.50	1.40	4.29	2.66	1.72	2.19	1.61	1.10
18	2.13	1.98	1.90	1.59	1.49	1.40	4.21	2.60	1.72	2.16	1.56	1.21
19	2.42	1.95	1.88	1.59	1.49	1.39	4.14	2.56	1.70	2.13	1.52	1.17
20	2.65	1.93	1.87	1.58	1.49	1.39	4.07	2.51	1.66	2.11	1.49	1.15
21	2.91	1.98	1.86	1.56	1.49	1.44	3.97	2.45	1.64	2.14	1.47	1.15
22	3.12	2.01	1.86	1.55	1.52	1.51	3.85	2.40	1.60	2.15	1.44	1.18
23	3.26	2.02	1.84	1.56	1.52	1.63	3.73	2.35	1.58	2.13	1.41	1.15
24	3.31	1.99	1.84	1.55	1.53	1.72	3.61	2.30	1.56	2.06	1.40	1.11
25	3.30	1.99	1.82	1.55	1.51	1.78	3.50	2.24	1.53	2.01	1.39	1.16
26	3.26	1.95	1.82	1.54	1.49	1.90	3.40	2.24	1.52	1.97	1.37	1.22
27	3.20	1.97	1.82	1.55	1.48	2.03	3.32	2.29	1.51	1.93	1.35	1.24
28	3.12	2.08	1.79	1.55	1.47	2.28	3.27	2.31	1.47	1.92	1.32	1.26
29	3.05	2.08	1.79	1.54	---	2.38	3.21	2.36	1.60	2.04	1.31	1.25
30	2.98	2.08	1.77	1.52	---	2.44	3.25	2.37	1.70	2.13	1.28	1.28
31	2.92	---	1.76	1.52	---	2.50	---	2.36	---	2.18	1.22	---
MEAN	2.29	2.21	1.92	1.62	1.48	1.63	3.80	2.73	1.79	2.21	1.65	1.16
MAX	3.31	2.85	2.09	1.75	1.53	2.50	5.07	3.28	2.33	2.62	2.19	1.28
MIN	1.65	1.93	1.76	1.52	1.44	1.39	2.57	2.24	1.47	1.78	1.22	1.09
CAL YR 1990	MEAN	2.13	MAX	3.69	MIN	1.18						
WTR YR 1991	MEAN	2.05	MAX	5.07	MIN	1.09						



STREAMS TRIBUTARY TO LAKE MICHIGAN

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04062500 MICHIGAMME RIVER NEAR CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'50", long 88°12'57", in NW1/4 sec.20, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, on right bank 400 ft upstream from highway bridge, 5.0 mi downstream from Michigamme Reservoir, 6.0 mi east of Crystal Falls, and 15 mi upstream from confluence with Brule River.

DRAINAGE AREA.--656 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,300 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 23, 24. Records excellent. Flow regulated by powerplant and by Michigamme Reservoir, capacity, 119,950 acre-ft, 5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 708 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,260 ft<sup>3</sup>/s, Apr. 28, 1960, gage height, 10.73 ft; minimum daily, 71 ft<sup>3</sup>/s, Nov. 26, 1950.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,070 ft<sup>3</sup>/s, Oct. 27, gage height, 6.15 ft; minimum daily, 180 ft<sup>3</sup>/s, Mar. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	518	215	223	727	937	910	228	1150	1380	571	810	1420
2	753	217	220	724	932	903	228	1130	1120	764	806	1340
3	753	216	531	785	899	895	233	1120	921	777	806	1310
4	596	217	740	845	928	889	241	1120	908	774	800	1240
5	203	216	741	843	932	880	248	1110	903	767	796	1130
6	209	214	739	841	930	873	256	1150	444	763	797	1100
7	208	214	457	852	927	868	265	1240	274	759	790	1120
8	209	212	216	842	924	868	313	1240	269	816	790	1020
9	208	215	216	936	921	877	340	1190	269	966	575	1130
10	210	214	578	1040	917	841	302	1170	269	963	233	1200
11	213	213	872	1030	913	829	279	1150	269	956	233	1150
12	212	212	871	1020	909	623	586	1140	523	955	233	1100
13	211	216	868	559	866	517	526	1180	532	951	234	1140
14	215	218	869	712	773	512	268	1140	276	947	250	1220
15	213	562	834	713	767	376	294	1130	280	1110	236	1210
16	211	612	789	817	765	180	285	1110	342	1400	235	1200
17	566	215	787	918	766	184	708	1100	336	1330	243	1190
18	496	215	785	976	771	186	908	1010	303	1180	235	1180
19	258	216	783	974	768	190	909	503	979	1170	232	1170
20	253	215	783	973	766	193	911	346	811	1170	229	1160
21	256	226	511	968	834	210	901	344	564	1160	218	1140
22	249	226	218	968	959	188	895	343	259	1160	217	1110
23	633	224	215	965	956	209	900	342	257	1150	361	1110
24	877	221	470	961	950	208	788	343	253	1140	1180	851
25	1050	219	739	957	943	207	993	343	250	1130	1430	556
26	1510	220	735	955	936	220	1080	356	250	1130	1530	473
27	2000	225	734	952	929	254	1080	355	252	1120	1750	456
28	1730	626	734	950	921	266	1180	974	295	1120	1690	413
29	1390	879	733	946	---	253	1190	966	276	977	1620	413
30	856	488	729	945	---	239	1200	1130	266	817	1560	413
31	545	---	729	940	---	233	---	1480	---	814	1490	---
TOTAL	17811	8598	19449	27634	24739	15081	18535	28405	14330	30807	22609	30665
MEAN	575	287	627	891	884	486	618	916	478	994	729	1022
MAX	2000	879	872	1040	959	910	1200	1480	1380	1400	1750	1420
MIN	203	212	215	559	765	180	228	342	250	571	217	413

CAL YR 1990 TOTAL 200361 MEAN 549 MAX 2000 MIN 182  
WTR YR 1991 TOTAL 258663 MEAN 709 MAX 2000 MIN 180

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04063000 MENOMINEE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'04", long 88°11'13", in NE1/4 sec.16, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030108, on left bank 0.5 mi downstream from confluence of Brule and Michigamme Rivers, 3.5 mi northeast of Florence, WI, and at mile 117.

DRAINAGE AREA.--1,780 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1950 to current year. Published as "at Twin Falls near Iron Mountain, MI" January 1914 to June 1950. Records published for both sites July 1950 to September 1957.

REVISED RECORDS.--WSP 1707: 1953(M). WSP 1911: Drainage area of former site.

GAGE.--Water-stage recorder. Datum of gage is 1,119.23 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to July 1950, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees at the Twin Falls Powerplant of Wisconsin Electric Power Co., 10.4 mi downstream.

REMARKS.--No estimated daily discharges. Records excellent. Prior to July 1950, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 1,833 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,500 ft<sup>3</sup>/s, Apr. 26, 1960, gage height, 14.15 ft; minimum, 38 ft<sup>3</sup>/s, Aug. 21, 1962, Sept. 26, 1975; minimum gage height, 1.18 ft, Aug. 21, 1962, Nov. 4, 1965; minimum daily discharge, 57 ft<sup>3</sup>/s, Sept. 26, 1975.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,740 ft<sup>3</sup>/s, Apr. 9, gage height, 7.40 ft; minimum, 231 ft<sup>3</sup>/s, Nov. 15, gage height, 1.95 ft; minimum daily, 557 ft<sup>3</sup>/s, Aug. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	925	1340	1380	1290	1300	1570	1930	3680	4540	1680	1560	1550
2	1150	1390	1320	1220	1300	1540	1910	3400	3720	2010	1380	1590
3	1110	1110	1310	1280	1320	1550	1900	2940	2380	1900	1420	1680
4	1130	985	1250	1250	1320	1570	1910	2800	1670	1980	1460	1740
5	965	1030	1250	1240	1320	1510	1790	2720	1540	1880	1390	1550
6	812	1010	1230	1240	1300	1570	1820	2860	1510	1920	1390	1740
7	701	923	1270	1260	1340	1550	1690	2910	1430	1950	1400	1720
8	824	992	1310	1250	1290	1580	2070	2960	1370	2040	1380	1800
9	896	915	1300	1260	1360	1570	4380	2880	1340	2110	1090	1700
10	702	860	1290	1240	1320	1530	5320	3310	1190	1980	868	1810
11	781	622	1190	1250	1320	1510	4450	3020	994	1770	798	1830
12	759	989	933	1280	1320	1540	4270	2700	1080	1630	792	1800
13	752	1000	1270	1290	1320	1560	3890	2700	1100	1410	750	1730
14	836	1110	1160	1290	1250	1580	3150	2370	1100	1460	807	1670
15	947	829	1250	1270	1250	1540	2670	2110	1260	1660	620	1790
16	840	1050	1280	1270	1260	1560	2440	2020	1410	1960	557	2070
17	1140	1220	1220	1300	1280	1550	2440	2070	1340	1900	814	2400
18	1570	687	1220	1360	1350	1620	2360	2090	1440	1750	719	2200
19	2170	709	1300	1270	1250	1560	2200	1870	1460	1930	891	1610
20	2240	798	1270	1290	1270	1460	2130	1590	1420	1870	892	1410
21	2210	840	1280	1290	1420	1440	2040	1580	1430	1830	828	1640
22	2250	914	1290	1300	1600	1640	1740	1530	946	1810	848	1570
23	2290	823	1300	1270	1570	2060	1610	1520	899	1640	1220	1360
24	2570	952	1290	1300	1590	2450	1650	1320	1080	1600	1970	925
25	2800	915	1260	1320	1540	2180	1750	1400	1250	1610	1990	1510
26	2910	924	1270	1290	1560	2000	2060	1530	948	1680	1990	1300
27	2860	1090	1230	1280	1580	2190	2640	1760	1040	1650	1930	1230
28	2480	1060	1290	1280	1570	3420	2660	2360	1220	1630	1860	1100
29	2250	1390	1310	1300	---	3960	2670	3260	1750	1950	1820	1050
30	1370	1210	1340	1300	---	2350	3010	4680	1630	1880	1830	1170
31	1580	---	1300	1280	---	1760	---	5040	---	1720	1760	---
TOTAL	46820	29687	39163	39610	38470	56470	76550	78980	45487	55790	39024	48245
MEAN	1510	990	1263	1278	1374	1822	2552	2548	1516	1800	1259	1608
MAX	2910	1390	1380	1360	1600	3960	5320	5040	4540	2110	1990	2400
MIN	701	622	933	1220	1250	1440	1610	1320	899	1410	557	925
CAL YR 1990	TOTAL	470520	MEAN	1289	MAX	3380	MIN	527				
WTR YR 1991	TOTAL	594296	MEAN	1628	MAX	5320	MIN	557				

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04063500 MENOMINEE RIVER AT TWIN FALLS NEAR IRON MOUNTAIN, MI

LOCATION.--Lat 46°52'17", long 88°04'12", in NE1/4 SE1/4 sec. 12, T.40 N., R.31 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank in powerhouse of Wisconsin Electric Power Co. at Twin Falls Dam, 3.6 mi north of Iron Mountain, and at mile 106.6.

DRAINAGE AREA.--1,800 mi<sup>2</sup>.

PERIOD OF RECORD.--January 1914 to September 1957, October 1989 to current year. Published as "near Florence, WI" October 1957 to September 1989. Records published for both sites July 1950 to September 1957.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 1,062 ft above National Geodetic Vertical Datum of 1929 (levels by Wisconsin Electric Power Co.). Prior to September 1957, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees.

REMARKS.--Estimated daily discharges: Dec. 5, 6. Records good. Prior to September 1957, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 1,792 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16,700 ft<sup>3</sup>/s, Apr. 23, 24, 1916; minimum daily, 154 ft<sup>3</sup>/s, Aug. 9, 1925.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,550 ft<sup>3</sup>/s, May. 30, gage height, 9.76 ft; minimum, 503 ft<sup>3</sup>/s, Nov. 1, gage height, 6.21 ft; minimum daily, 583 ft<sup>3</sup>/s, Nov. 18.

REVISIONS.--The maximum discharge for the water year 1990 has been revised to 3,590 ft<sup>3</sup>/s, Mar. 15, 1990, gage height, 8.55 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	945	1310	1340	1340	1460	1720	2000	3630	4240	1830	1560	1520
2	1130	1320	1340	1270	1440	1700	1830	3410	4040	1860	1300	1480
3	1060	830	1440	1370	1390	1660	1910	3030	2380	1820	1090	1670
4	1110	955	1290	1360	1350	1660	1930	2740	1700	1970	1420	1710
5	1030	1110	1300	1290	1300	1630	1880	2750	1520	1810	1360	1560
6	733	1130	1300	1310	1330	1660	1790	2870	1430	1770	1410	1560
7	869	966	1290	1310	1340	1550	1620	3010	1430	1850	1260	1740
8	842	997	1280	1340	1320	1670	1990	2970	1340	2030	1260	1770
9	796	923	1370	1360	1290	1680	4250	2920	1270	1930	1070	1720
10	701	703	1220	1350	1440	1620	5340	3300	1180	1860	856	1820
11	769	641	1200	1360	1390	1640	4370	2930	1010	1750	796	1760
12	747	948	1070	1270	1360	1560	4210	2650	1060	1520	765	1700
13	779	808	1160	1270	1400	1610	3930	2760	1070	1270	700	1700
14	842	830	1180	1390	1330	1640	3300	2400	1080	1350	684	1640
15	1330	903	1230	1330	1410	1600	2790	1980	1270	1600	668	1750
16	1270	1010	1290	1370	1310	1600	2480	1990	1490	1730	660	2090
17	1130	630	1290	1410	1320	1580	2570	2100	1310	1920	708	2370
18	1570	583	1300	1330	1390	1620	2330	1970	1470	1610	737	2090
19	1930	699	1280	1460	1420	1700	2320	2000	1380	1700	803	1560
20	2270	793	1290	1250	1290	1610	2110	1680	1440	1810	885	1400
21	2220	821	1220	1340	1390	1490	1930	1600	1360	1820	809	1500
22	1960	924	1310	1410	1640	1680	1850	1530	1060	1680	795	1540
23	2260	831	1310	1400	1670	2130	1620	1370	804	1580	1150	1360
24	2500	982	1310	1390	1680	2570	1620	1440	1150	1520	1930	962
25	2560	981	1270	1540	1660	2420	1670	1350	1240	1460	2050	1410
26	2680	1060	1300	1450	1650	1860	2060	1480	992	1680	2040	1170
27	2660	1080	1370	1450	1680	2300	2720	1670	973	1610	1770	1190
28	2390	1140	1320	1360	1720	3490	2680	2330	1170	1600	1880	1190
29	2130	1460	1310	1390	---	4080	2560	3360	1670	1930	1790	1070
30	1570	1240	1330	1470	---	2450	2890	4530	1420	2090	1740	1120
31	1420	---	1370	1430	---	1740	---	5090	---	1470	1680	---
TOTAL	46203	28608	39880	42370	40370	58920	76550	78840	44949	53430	37626	47122
MEAN	1490	954	1286	1367	1442	1901	2552	2543	1498	1724	1214	1571
MAX	2680	1460	1440	1540	1720	4080	5340	5090	4240	2090	2050	2370
MIN	701	583	1070	1250	1290	1490	1620	1350	804	1270	660	962
CAL YR 1990	TOTAL	459799	MEAN	1260	MAX	4080	MIN	532				
WTR YR 1991	TOTAL	594868	MEAN	1630	MAX	5340	MIN	583				

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04065722 MENOMINEE RIVER NEAR VULCAN, MI

LOCATION.--Lat 45°44'12", long 87°51'48", sec.34, T.39 N., R.29 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank 0.35 mi downstream from Sturgeon Falls Dam, 3.0 mi south of Vulcan, and at mile 78.7.

DRAINAGE AREA.--2,900 mi<sup>2</sup>.

PERIOD OF RECORD.--December 1987 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 820 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 9, 10. Records excellent. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft<sup>3</sup>/s, May 31, 1991, gage height, 12.82 ft; minimum, 815 ft<sup>3</sup>/s, Aug. 3, 4, 1988, gage height, 4.67 ft; minimum daily, 846 ft<sup>3</sup>/s, Aug. 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 10,700 ft<sup>3</sup>/s, May 31, gage height, 12.82 ft; minimum, 890 ft<sup>3</sup>/s, Mar. 12, gage height, 4.72 ft; minimum daily, 1,060 ft<sup>3</sup>/s, Aug. 11, 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1280	2130	2180	1670	1680	1990	4190	5230	9260	2580	2670	1920
2	1660	2220	2150	1780	1670	2170	3410	5620	8250	2930	2510	1890
3	2090	1650	1900	1790	1790	1960	3430	4990	6280	3190	1980	2110
4	1580	1560	1780	1750	1730	1970	3460	4490	5060	3440	2130	1870
5	1710	1810	1830	1650	1800	2000	3910	4540	3860	3390	2120	2050
6	1410	1950	1920	1620	1590	1980	3690	4500	3540	3240	2000	1980
7	1350	1720	1890	1690	1700	2000	3820	4830	3020	2940	1770	1960
8	1820	1580	1890	1590	1730	2010	4230	4650	3080	3230	1740	2260
9	1450	1600	1950	1620	1730	2030	6450	4510	2640	3180	1750	2260
10	1280	1250	1940	1740	1830	2000	8780	4820	2460	2690	1210	2160
11	1220	1220	1880	1600	1800	2090	8170	4650	1950	2490	1060	2470
12	1250	1240	1550	1590	1760	1830	7690	4080	2100	2600	1300	2660
13	1110	1460	1830	1670	1720	1970	7060	4060	2010	1980	1140	2570
14	1190	1260	1760	1680	1780	2140	6110	4000	1830	1910	1070	2650
15	1950	1480	1610	1680	1830	2040	6440	3140	1940	2170	1090	2150
16	2220	1480	1880	1640	1600	1950	6030	3110	2390	2540	1080	2750
17	1980	1320	1830	1680	1650	2040	5660	3490	2440	2510	1060	3310
18	2740	1160	1950	1680	1590	2090	5410	3310	2300	2310	1070	2910
19	3720	1260	1740	1720	1720	2180	4710	3470	2200	2280	1210	2400
20	4130	1290	1780	1780	1810	2340	4370	3230	2070	2260	1250	2090
21	4300	1390	1950	1670	1580	2290	3770	2810	2290	2340	1190	2020
22	3840	1540	1820	1660	1900	2720	3650	2730	2340	2310	1170	1960
23	3850	1710	1710	1730	1950	3260	3410	2470	2130	2410	1420	1800
24	4130	1650	1730	1740	2060	4640	3180	2350	2110	2090	2060	1360
25	4150	1820	1760	1810	2000	4220	2960	2210	2350	2120	2220	1760
26	4020	1540	1720	1770	1840	3640	3360	2370	1950	2030	2640	1630
27	4040	1650	1770	1770	1980	4490	4230	3070	1820	2060	2310	1470
28	3920	2040	1780	1710	2010	5860	4000	3940	1920	2080	2160	1620
29	3150	2280	1790	1650	---	7220	3950	5440	2800	2890	2090	1570
30	2830	1970	1760	1640	---	5210	4360	8440	2400	3650	2070	1600
31	2440	---	1840	1600	---	3990	---	10300	---	2800	1910	---
TOTAL	77810	48230	56870	52370	49830	88320	143890	130850	90790	80640	52450	63210
MEAN	2510	1608	1835	1689	1780	2849	4796	4221	3026	2601	1692	2107
MAX	4300	2280	2180	1810	2060	7220	8780	10300	9260	3650	2670	3310
MIN	1110	1160	1550	1590	1580	1830	2960	2210	1820	1910	1060	1360
CAL YR 1990	TOTAL	740200	MEAN	2028	MAX	6540	MIN	1010				
WTR YR 1991	TOTAL	935260	MEAN	2562	MAX	10300	MIN	1060				



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04066003 MENOMINEE RIVER BELOW PEMENE CREEK NEAR PEMBINE, WI

LOCATION.--Lat 45°34'46", long 87°47'13", in NE1/4 sec.29, T.37 N., R.28 W., Michigan Meridian, Menominee County, Hydrologic Unit 04030108, on left bank 40 ft downstream from County Trunk Z bridge, 0.9 mi downstream from Pemene Creek, 3.9 mi west of Nathan, 10.6 mi southeast of Pembine, WI, and at mile 64.3.

DRAINAGE AREA.--3,140 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1949 to current year. Published as "near Pembine, WI" prior to August 1982. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. October 1949 to Oct. 27, 1972, water-stage recorder at site 1.0 mi upstream at different datum, and Oct. 28, 1972, to August 1982, water-stage recorder at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 4-9, 13-16, 18-21, and Dec. 23 to Mar. 17. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station.

AVERAGE DISCHARGE.--42 years, 2,940 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,900 ft<sup>3</sup>/s, May 8, 1960, gage height, 13.90 ft, site and datum then in use; minimum, 694 ft<sup>3</sup>/s, Sept. 3, 1969, gage height, 1.66 ft, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 13,000 ft<sup>3</sup>/s, June 1, gage height, 13.02 ft; minimum daily, 1,140 ft<sup>3</sup>/s, Aug. 16, 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1180	2210	2260	1800	1800	2200	4630	5700	12000	2490	2930	1970
2	1440	2360	2290	1700	1800	2300	3870	5930	9980	3130	2810	1860
3	1770	2010	2070	1800	1900	2100	3610	5320	7750	3340	2260	2220
4	1600	1570	1700	1800	1800	2100	3740	4750	6100	3560	2150	2060
5	1710	1940	1900	1700	2000	2100	4070	4770	4240	3730	2290	2170
6	1510	1830	1800	1600	2000	2100	4200	4740	3920	3290	2110	2210
7	1320	2040	2000	1600	1900	2100	4040	5140	3520	3190	2020	1820
8	1480	1680	1900	1600	1800	2100	4430	4960	3380	3270	1830	2240
9	1580	1660	2100	1600	2000	2200	6450	4580	2950	3380	1810	2380
10	1310	1520	2310	1600	2000	2200	9790	5050	2750	2960	1560	2440
11	1250	1310	2010	1500	2000	2300	9380	5000	2270	2490	1180	2350
12	1260	1330	1700	1500	1900	2300	8540	4230	2290	2730	1260	2750
13	1210	1540	1800	1600	1900	2200	7890	4230	2120	2170	1310	2640
14	1190	1370	1800	1600	1900	2200	6880	4310	2070	1950	1150	2810
15	1720	1440	1800	1600	1700	2300	7420	3360	2110	2070	1160	2170
16	1990	1660	1900	1700	1700	2200	7170	3260	2670	2620	1140	2750
17	1990	1600	1950	1700	1800	2200	6550	4100	2660	2610	1150	3450
18	2600	1360	1900	1700	1800	2400	6160	3900	2670	2510	1140	3030
19	3670	1350	1900	1800	1900	2540	5350	3940	2320	2270	1180	2740
20	4430	1410	1900	1800	1900	2700	4890	3720	2200	2310	1330	2150
21	4460	1430	2100	1700	2000	2660	4170	3220	2570	2450	1300	2140
22	4120	1610	1970	1600	2000	3020	4000	2980	2700	2430	1240	2050
23	3890	1870	1700	1700	2000	3470	3760	2750	2450	2570	1400	1920
24	4270	1790	1700	1800	2100	5240	3450	2650	2200	2310	1950	1560
25	4210	1900	1800	1700	2000	5050	3230	2940	2450	2200	2270	1840
26	4140	1720	1700	1800	1900	4220	3490	2860	2300	2190	2450	1830
27	4200	1690	1800	1900	2000	5180	4410	3630	1980	2180	2620	1760
28	4020	2020	1800	1800	2100	6510	4290	4360	1950	2160	2260	1760
29	3300	2460	1900	1800	---	7990	4240	6010	2720	2840	2160	1840
30	2930	2160	1800	1700	---	6130	4450	9340	2690	4240	2170	1550
31	2590	---	1700	1800	---	4540	---	12200	---	3410	2020	---
TOTAL	78340	51840	58960	52600	53600	98850	158550	143930	103980	85050	55610	66460
MEAN	2527	1728	1902	1697	1914	3189	5285	4643	3466	2744	1794	2215
MAX	4460	2460	2310	1900	2100	7990	9790	12200	12000	4240	2930	3450
MIN	1180	1310	1700	1500	1700	2100	3230	2650	1950	1950	1140	1550

CAL YR 1990 TOTAL 755070 MEAN 2069 MAX 7700 MIN 1100  
WTR YR 1991 TOTAL 1007770 MEAN 2761 MAX 12200 MIN 1140

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04096400 ST. JOSEPH RIVER NEAR BURLINGTON, MI

LOCATION.--Lat 42°06'10", long 85°02'25", in SW1/4 SW1/4 sec.20, T.4 S., R.6 W., Calhoun County, Hydrologic Unit 04050001, on downstream side of bridge on 13 Mile Road, 2.0 mi east of Burlington, 4.0 mi downstream from Tekonsha Creek, and at mile 164.

DRAINAGE AREA.--201 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Non-recording gage. Datum of gage is 916.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 1-22, Dec. 24-28, Jan. 3-10, 18-20, Jan. 23 to Feb. 1, July 7, July 27 to Aug. 1, and Sept. 7. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 177 ft<sup>3</sup>/s, 11.96 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft<sup>3</sup>/s, June 5, 1989, gage height, 5.82 ft; minimum, 8.0 ft<sup>3</sup>/s, Aug. 9, 10, 11, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 740 ft<sup>3</sup>/s, Dec. 31, gage height, 5.23 ft, from floodmark; minimum daily, 24 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	99	139	395	580	225	250	235	315	184	50	28	42
2	98	137	364	588	223	284	227	298	203	53	27	36
3	97	135	352	560	236	310	217	282	204	51	36	32
4	100	132	349	550	249	305	213	270	191	50	36	36
5	110	196	330	530	275	301	216	254	177	49	35	42
6	120	281	320	500	292	303	219	257	159	46	33	40
7	115	280	309	460	291	302	219	256	144	43	30	35
8	110	275	299	410	287	292	216	250	136	41	42	32
9	130	274	291	390	287	282	217	244	128	55	62	38
10	160	274	284	375	280	271	217	234	122	53	72	39
11	210	270	274	367	267	260	212	219	122	51	69	47
12	250	263	267	359	253	246	204	207	122	46	61	49
13	280	250	260	349	236	236	199	198	121	45	53	46
14	300	238	249	343	230	225	204	224	113	44	50	45
15	310	225	246	338	225	217	221	207	108	42	44	44
16	320	212	250	354	220	211	235	196	114	37	40	40
17	315	198	250	380	209	206	240	191	114	33	37	36
18	300	185	253	385	227	220	244	182	106	30	36	35
19	280	175	253	375	247	228	254	180	98	27	47	33
20	260	167	249	360	271	224	329	176	89	25	55	33
21	240	161	252	349	289	219	329	170	81	26	63	32
22	220	165	264	345	306	212	323	157	78	31	63	33
23	215	167	266	320	308	213	329	152	78	33	54	36
24	200	165	250	300	305	216	352	149	76	31	48	36
25	187	161	235	290	298	216	367	149	71	28	42	36
26	176	155	220	280	285	221	369	157	67	25	37	38
27	168	189	215	265	268	228	367	165	65	25	35	38
28	162	361	215	250	253	230	372	172	61	24	32	37
29	156	493	343	240	---	234	356	176	55	25	30	37
30	150	441	621	235	---	236	334	161	50	27	28	36
31	143	---	704	230	---	238	---	170	---	29	46	---
TOTAL	5981	6764	9429	11657	7342	7636	8036	6418	3437	1175	1371	1139
MEAN	193	225	304	376	262	246	268	207	115	37.9	44.2	38.0
MAX	320	493	704	588	308	310	372	315	204	55	72	49
MIN	97	132	215	230	209	206	199	149	50	24	27	32
CFSM	.96	1.12	1.51	1.87	1.30	1.22	1.33	1.03	.57	.19	.22	.19
IN.	1.11	1.25	1.75	2.16	1.36	1.41	1.49	1.19	.64	.22	.25	.21
CAL YR 1990	TOTAL	90732	MEAN	249	MAX	903	MIN	69	CFSM	1.24	IN	16.79
WTR YR 1991	TOTAL	70385	MEAN	193	MAX	704	MIN	24	CFSM	.96	IN	13.03

STREAMS TRIBUTARY TO LAKE MICHIGAN

83

04096515 SOUTH BRANCH HOG CREEK NEAR ALLEN, MI

LOCATION.--Lat 41°56'55", long 84°49'40", in NE1/4 SE1/4 sec.13, T.6 S., R.5 W., Branch County, Hydrologic Unit 04050001, on left bank 12 ft downstream from bridge on U.S. Highway 12, 1.0 mi downstream from Little Hog Creek, and 3.1 mi west of Allen.

DRAINAGE AREA.--48.7 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1969 to current year. Prior to October 1987, published as Hog Creek near Allen.

GAGE.--Water-stage recorder. Elevation of gage is 1,010 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to May 23, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 23-27, Jan. 4, 7, 8, Jan. 21 to Feb. 2, Feb. 15-17, 26, and Aug. 26, 27. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 43.5 ft<sup>3</sup>/s, 12.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 664 ft<sup>3</sup>/s, Feb. 25, 1985, gage height, 6.0 ft, from floodmark; maximum gage height, 6.20 ft, June 1, 1989; minimum discharge, 0.48 ft<sup>3</sup>/s, Aug. 5, 1988; minimum gage height, 1.20 ft, July 16, Aug. 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 471 ft<sup>3</sup>/s, Dec. 31, gage height, 5.40 ft; minimum, 2.0 ft/s, Sept. 8, 9, gage height, 1.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	31	75	426	39	54	68	85	44	7.1	4.7	2.7
2	16	30	67	326	40	73	65	81	52	7.7	4.2	2.7
3	14	30	65	261	43	85	59	73	62	8.1	4.3	2.8
4	38	30	76	210	49	85	54	65	52	7.6	4.6	3.4
5	54	54	80	172	63	80	62	62	40	7.0	4.3	3.1
6	43	89	78	141	65	77	65	80	32	6.4	3.9	2.9
7	32	104	72	120	63	75	60	79	28	6.0	3.5	2.4
8	32	104	67	105	61	68	57	69	25	6.1	4.9	2.2
9	72	96	63	98	61	63	64	62	22	5.8	11	3.0
10	125	85	60	84	59	59	66	57	20	5.4	7.6	4.2
11	179	76	57	76	55	54	60	52	22	4.9	6.3	3.7
12	195	67	55	79	51	49	53	47	31	4.6	5.6	3.6
13	171	60	53	80	46	46	49	44	29	4.9	4.8	3.8
14	139	55	49	76	49	43	53	44	25	5.2	4.6	3.7
15	115	51	48	76	49	42	67	40	22	4.7	4.7	3.7
16	99	47	53	83	47	41	85	37	26	3.8	4.4	3.6
17	86	45	52	97	46	41	90	38	26	3.5	4.2	3.4
18	79	41	53	104	44	48	86	37	22	3.5	4.4	3.2
19	77	40	55	96	65	49	83	34	19	3.5	5.2	3.0
20	72	38	53	92	90	47	116	31	17	3.2	9.3	2.9
21	65	36	53	86	97	46	159	28	15	3.5	7.7	2.7
22	59	39	60	80	96	46	161	27	14	5.0	6.3	2.6
23	53	41	62	75	90	48	144	25	13	5.2	5.4	2.7
24	49	40	60	67	80	53	134	25	11	4.4	4.8	2.6
25	45	38	58	60	72	51	129	27	10	4.1	4.5	2.9
26	42	36	56	53	62	52	120	39	10	3.9	4.3	3.2
27	39	40	54	48	55	62	109	42	9.3	3.7	4.1	3.2
28	37	71	54	45	51	81	102	36	8.6	3.6	4.0	2.8
29	35	86	97	44	---	89	96	32	7.9	4.5	3.5	2.9
30	33	83	261	43	---	82	90	29	7.4	6.4	3.3	2.9
31	32	---	441	41	---	72	---	33	---	5.4	3.1	---
TOTAL	2144	1683	2487	3444	1688	1861	2606	1460	722.2	158.7	157.5	92.5
MEAN	69.2	56.1	80.2	111	60.3	60.0	86.9	47.1	24.1	5.12	5.08	3.08
MAX	195	104	441	426	97	89	161	85	62	8.1	11	4.2
MIN	14	30	48	41	39	41	49	25	7.4	3.2	3.1	2.2
CFSM	1.42	1.15	1.65	2.28	1.24	1.23	1.78	.97	.50	.11	.10	.06
IN.	1.64	1.29	1.90	2.63	1.29	1.42	1.99	1.12	.55	.12	.12	.07

CAL YR 1990 TOTAL 23516.7 MEAN 64.4 MAX 441 MIN 7.5 CFSM 1.32 IN 17.96  
WTR YR 1991 TOTAL 18503.9 MEAN 50.7 MAX 441 MIN 2.2 CFSM 1.04 IN 14.13

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04096900 NOTTAWA CREEK NEAR ATHENS, MI

LOCATION.--Lat 42°03'20", long 85°18'30", in NW1/4 sec.12, T.5 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on Shorts Road, 4.2 mi southwest of Athens, and 5.0 mi downstream from Pine Creek.

DRAINAGE AREA.--162 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 24-28, Jan. 1, Jan. 22 to Feb. 2, and Feb. 16. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 152 ft<sup>3</sup>/s, 12.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,190 ft<sup>3</sup>/s, June 2, 1989, gage height, 7.85 ft; minimum, 21 ft<sup>3</sup>/s, July 28, 29, 30, Aug. 4, 6, 1977, Aug. 4, 1988; minimum gage height, 0.37 ft, Oct. 16, 18, 20, 21, Nov. 8, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 690 ft<sup>3</sup>/s, Jan. 1, gage height, 4.60 ft, backwater from ice; minimum daily, 44 ft<sup>3</sup>/s, Sept. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	55	97	584	670	150	163	249	283	246	70	60	57
2	54	96	506	579	150	199	220	250	230	90	53	55
3	54	95	428	483	159	253	202	220	216	85	64	55
4	73	96	377	428	176	271	188	197	212	96	72	59
5	76	143	342	363	222	255	190	182	187	91	71	58
6	76	245	318	304	272	239	193	182	163	85	68	56
7	76	324	293	265	281	226	191	191	145	83	61	54
8	76	341	270	244	270	209	182	188	131	96	66	49
9	107	321	249	224	264	194	176	180	121	92	90	52
10	191	281	236	215	258	182	178	171	115	85	93	54
11	282	238	219	212	239	173	182	160	117	80	93	53
12	326	202	207	215	205	166	179	151	118	75	91	56
13	322	175	201	215	189	160	174	143	114	71	84	57
14	291	157	193	214	181	153	176	158	109	69	75	56
15	254	147	188	209	169	149	217	191	105	64	68	55
16	217	140	190	225	165	145	302	177	109	58	63	53
17	187	132	196	264	164	145	342	167	110	55	67	52
18	174	125	202	286	157	162	322	170	107	54	67	50
19	167	121	206	282	175	190	291	157	102	51	89	46
20	159	118	200	285	222	197	319	145	96	49	100	45
21	148	115	194	288	243	191	376	136	90	52	93	44
22	139	119	197	270	251	181	373	130	89	83	89	45
23	131	125	205	235	246	174	344	134	89	87	85	51
24	124	128	190	210	225	182	326	153	86	79	78	50
25	120	126	180	200	204	187	317	167	84	80	73	50
26	114	122	175	190	180	188	296	179	80	81	68	53
27	110	155	170	180	163	198	271	180	76	80	64	51
28	107	353	170	170	157	268	277	172	72	74	60	49
29	102	541	265	160	---	313	315	161	71	69	60	47
30	100	615	484	155	---	311	307	150	69	67	60	45
31	98	---	634	150	---	284	---	160	---	64	59	---
TOTAL	4510	5993	8469	8390	5737	6308	7675	5385	3659	2315	2284	1557
MEAN	145	200	273	271	205	203	256	174	122	74.7	73.7	51.9
MAX	326	615	634	670	281	313	376	283	246	96	100	59
MIN	54	95	170	150	150	145	174	130	69	49	53	44
CFSM	.90	1.24	1.69	1.67	1.27	1.25	1.58	1.07	.75	.46	.46	.32
IN.	1.04	1.38	1.94	1.93	1.32	1.45	1.76	1.24	.84	.53	.52	.36

CAL YR 1990 TOTAL 66392 MEAN 182 MAX 737 MIN 54 CFSM 1.12 IN 15.25  
WTR YR 1991 TOTAL 62282 MEAN 171 MAX 670 MIN 44 CFSM 1.06 IN 14.30



STREAMS TRIBUTARY TO LAKE MICHIGAN

85

04097195 GOURDNECK CANAL NEAR SCHOOLCRAFT, MI

LOCATION.--Lat 42°09'54", long 85°36'17", in NW1/4 sec.33, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050001, on right bank at downstream end of culvert on Osterhout Avenue, 3.8 mi northeast of Schoolcraft.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--October 1965 to December 1972, October 1982 to current year.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 4, 1969, to Dec. 31, 1972. Datum of gage is 854.98 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Jan. 5-14 and 21-27. Records poor. Canal diverts water from Gourdneck Creek to West Lake to sustain lake levels. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16 ft<sup>3</sup>/s, Dec. 10-12, 1966, Apr. 22-24, 1967; no flow on many days during November, December, 1970, January, February, 1971.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	3.6	6.4	6.0	2.8	2.4	2.7	1.6	1.4	1.0	.70	.60
2	1.1	3.3	5.9	5.6	2.8	3.6	2.5	1.5	1.4	1.3	.70	.60
3	1.4	3.3	5.7	5.3	2.8	4.2	2.4	1.5	1.4	1.2	.72	.63
4	1.9	3.3	5.7	4.9	2.9	3.9	2.4	1.5	1.3	1.2	.70	.64
5	1.5	5.4	5.4	4.5	3.0	3.4	2.5	1.5	1.3	1.1	.70	.58
6	1.4	5.3	5.1	4.1	3.0	2.5	2.3	1.6	1.2	1.1	.70	.58
7	1.4	5.0	4.8	3.7	3.0	1.9	1.9	1.5	1.2	1.1	.70	.58
8	1.5	4.9	4.5	3.4	3.0	1.6	1.8	1.4	1.2	1.1	.79	.58
9	2.1	4.7	4.4	3.2	3.1	1.5	1.9	1.4	1.2	.98	.74	.57
10	3.0	4.6	4.3	3.1	3.1	1.4	1.8	1.4	1.2	.93	.70	.56
11	3.1	4.4	6.3	3.1	2.9	1.4	1.7	1.4	1.3	.88	.70	.56
12	3.0	4.3	8.8	3.2	2.8	1.4	1.7	1.5	1.2	.86	.68	.60
13	3.0	4.1	9.3	3.3	2.7	1.4	1.7	1.7	1.2	.84	.68	.59
14	3.1	3.8	9.5	3.6	2.6	1.4	1.9	1.5	1.2	.85	.68	.58
15	3.4	3.7	7.9	3.9	2.6	1.3	2.3	1.4	1.2	.82	.68	.58
16	3.4	3.6	5.9	4.2	2.5	1.3	2.2	1.5	1.2	.81	.68	.58
17	3.5	3.5	5.2	4.4	2.4	1.3	1.9	1.6	1.1	.79	.68	.58
18	4.2	3.4	4.8	4.3	2.4	1.4	1.7	1.5	1.1	.79	.66	.57
19	4.1	3.3	4.4	4.3	2.7	1.3	1.7	1.4	1.1	.77	.85	.57
20	4.0	3.2	4.1	4.3	2.7	1.3	1.9	1.4	1.0	.77	.88	.56
21	3.9	3.1	4.0	4.0	2.7	1.3	1.7	1.3	1.0	.76	.73	.55
22	3.9	3.3	4.0	3.7	2.8	1.3	1.6	1.3	1.1	1.0	.68	.54
23	3.9	3.3	3.9	3.5	2.7	1.5	1.6	1.3	1.0	.84	.65	.57
24	3.9	3.1	3.7	3.4	2.6	1.6	2.0	1.3	.98	.76	.64	.58
25	4.2	3.1	3.6	3.3	2.5	1.5	1.9	1.6	.95	.72	.64	.58
26	4.7	2.9	3.5	3.2	2.3	1.5	1.8	1.6	.92	.70	.64	.58
27	4.6	4.0	3.4	3.1	2.3	2.3	1.7	1.5	.91	.70	.64	.58
28	3.6	6.9	3.4	3.1	2.2	3.1	1.8	1.4	.93	.70	.64	.58
29	3.5	7.0	4.8	3.0	---	2.8	1.8	1.4	.86	.70	.62	.56
30	3.6	6.7	6.3	2.9	---	2.9	1.7	1.3	.84	.70	.61	.56
31	3.6	---	6.2	2.9	---	2.8	---	1.4	---	.70	.60	---
TOTAL	94.6	124.1	165.2	118.5	75.9	62.5	58.5	45.2	33.89	27.47	21.41	17.37
MEAN	3.05	4.14	5.33	3.82	2.71	2.02	1.95	1.46	1.13	.89	.69	.58
MAX	4.7	7.0	9.5	6.0	3.1	4.2	2.7	1.7	1.4	1.3	.88	.64
MIN	1.1	2.9	3.4	2.9	2.2	1.3	1.6	1.3	.84	.70	.60	.54
CAL YR 1990	TOTAL 962.58		MEAN 2.64		MAX 9.5		MIN .68					
WTR YR 1991	TOTAL 844.64		MEAN 2.31		MAX 9.5		MIN .54					

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04097540 PRAIRIE RIVER NEAR NOTTAWA, MI

LOCATION.--Lat 41°53'18", long 85°24'34", in NW1/4 SW1/4 sec.6, T.7 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on left bank 10 ft upstream from bridge on State Highway 66, 3.0 mi upstream from unnamed tributary, and 3.0 mi southeast of Nottawa.

DRAINAGE AREA.--106 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 25-27, Jan. 1, 4, 5, 7, 8, 22-25, 27, 28, 31, and Feb. 1. Records good except for estimated daily discharges, which are fair. Since 1987, some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 95.8 ft<sup>3</sup>/s, 12.27 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 797 ft<sup>3</sup>/s, Feb. 26, 1985, gage height, 6.30 ft; minimum, 5.4 ft<sup>3</sup>/s, Aug. 4, 5, 1988, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 510 ft<sup>3</sup>/s, Jan. 1, gage height, 5.98 ft, backwater from ice; minimum daily, 36 ft<sup>3</sup>/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	61	102	189	500	130	132	130	159	169	67	38	41
2	58	100	172	446	129	144	125	152	176	159	36	40
3	57	99	166	376	133	156	120	145	152	207	44	41
4	68	99	169	325	138	162	117	140	134	197	48	48
5	70	120	173	295	147	162	121	138	123	160	49	49
6	70	158	171	264	151	158	121	139	113	132	49	48
7	69	181	166	235	151	153	120	136	104	111	47	46
8	71	189	158	220	150	148	119	137	96	98	55	43
9	93	183	151	206	149	143	121	136	90	85	71	43
10	143	169	144	196	147	140	121	131	86	76	74	44
11	200	158	140	194	143	136	118	124	88	69	70	43
12	238	146	137	196	137	132	116	117	94	61	64	48
13	238	136	130	197	133	129	114	113	92	59	58	52
14	219	127	125	194	137	126	117	112	86	59	55	51
15	193	123	124	190	135	122	131	106	80	56	51	50
16	172	120	124	197	128	119	143	101	77	52	49	48
17	157	117	124	207	128	119	147	105	73	46	49	46
18	152	115	125	216	128	127	144	106	71	43	48	45
19	148	112	125	215	139	129	145	100	67	39	57	43
20	144	109	123	210	154	127	165	96	63	38	66	42
21	139	108	122	204	164	124	175	90	57	38	68	40
22	132	111	124	190	167	121	185	88	54	49	65	40
23	126	112	127	180	163	123	186	98	53	52	62	43
24	122	110	127	175	157	125	189	108	51	52	58	44
25	118	108	120	170	150	125	186	112	48	51	54	45
26	115	105	120	159	143	126	181	118	46	46	52	45
27	113	115	120	150	136	130	174	116	43	43	49	44
28	111	176	117	145	132	133	178	108	39	41	47	43
29	108	201	184	139	---	133	175	99	37	40	45	42
30	105	204	322	137	---	133	166	93	40	40	44	41
31	104	---	460	135	---	131	---	101	---	40	43	---
TOTAL	3914	4013	4879	6863	3999	4168	4350	3624	2502	2306	1665	1338
MEAN	126	134	157	221	143	134	145	117	83.4	74.4	53.7	44.6
MAX	238	204	460	500	167	162	189	159	176	207	74	52
MIN	57	99	117	135	128	119	114	88	37	38	36	40
CFSM	1.19	1.26	1.48	2.09	1.35	1.26	1.37	1.10	.79	.70	.51	.42
IN.	1.37	1.41	1.71	2.41	1.40	1.46	1.53	1.27	.88	.81	.58	.47
CAL YR 1990	TOTAL	46406	MEAN	127	MAX	460	MIN	40	CFSM	1.20	IN	16.29
WTR YR 1991	TOTAL	43621	MEAN	120	MAX	500	MIN	36	CFSM	1.13	IN	15.31

STREAMS TRIBUTARY TO LAKE MICHIGAN

87

04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI

LOCATION.--Lat 41°48'03", long 85°45'22", in SW1/4 sec.6, T.8 S., R.12 W., St. Joseph County, Hydrologic Unit 04050001, on right bank 500 ft upstream from bridge on U.S. Highway 12 in Mottville, 0.4 mi downstream from Indiana Michigan Power Co. hydroelectric plant, 4 mi upstream from Pigeon River, and at mile 96.

DRAINAGE AREA.--1,866 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1923 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1930, 1932, 1938, 1940-42, 1945. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.3 ft, Indiana Michigan Power Co. datum. Prior to Oct. 1, 1951, at site 0.4 mi upstream at datum 4.2 ft higher.

REMARKS.--Estimated daily discharges: Dec. 25-27, Jan. 1, 23-28, 31, and Feb. 1. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--68 years, 1,621 ft<sup>3</sup>/s, 11.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,400 ft<sup>3</sup>/s, June 4, 1989, gage height, 10.41 ft; maximum gage height, 10.76 ft, Apr. 27, 1950, present datum; minimum daily discharge, 39 ft<sup>3</sup>/s, Oct. 19, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,990 ft<sup>3</sup>/s, Jan. 3, gage height, 7.42 ft; minimum daily, 679 ft<sup>3</sup>/s, July 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	905	1600	4580	5000	2400	2370	2590	3390	2330	946	725	758
2	1140	1620	4400	5330	2400	2510	2470	3280	2660	1610	715	736
3	1090	1660	4310	5810	2530	2760	2460	3100	2560	1720	773	767
4	1060	1630	3960	5570	2380	2820	2330	2970	2280	1590	718	876
5	1180	2100	3740	5060	2530	3100	2280	2790	2340	1690	773	887
6	1300	2310	3280	5040	2650	2930	2170	2720	2190	1650	816	848
7	1060	2560	3690	4750	2800	3020	2300	2730	2110	1530	762	823
8	1280	2950	3420	4350	2770	2860	2270	2640	1950	1450	877	794
9	1550	2920	3210	4120	2860	2710	2320	2570	1940	1480	1070	811
10	1830	2940	3270	4210	2920	2720	2310	2560	1650	1410	1130	835
11	2450	2970	3140	3810	2600	2650	2300	2520	1630	1190	1050	823
12	3080	2690	3050	3610	2580	2560	2150	2340	1680	1040	1040	985
13	3270	2600	2440	3610	2510	2380	2140	2200	1690	973	1000	1140
14	3340	2510	2800	3380	2560	2360	2180	1950	1640	886	927	1070
15	3210	2350	2840	3480	2460	2090	2450	1930	1420	823	896	873
16	3260	2260	2790	3500	2220	2190	2730	1900	1410	815	875	878
17	3020	2230	2650	3460	2260	2060	2810	2310	1510	794	846	866
18	3100	2180	2640	3470	2340	2380	2890	2170	1500	743	792	878
19	2930	1980	2640	3690	2300	2160	3030	2060	1320	720	906	865
20	2670	2030	2470	3680	2410	2350	2870	1930	1260	689	1220	860
21	2560	2010	2610	3680	2690	2150	2990	1910	1100	679	1270	855
22	2400	1970	2690	3510	2680	2160	3260	1810	980	748	1070	798
23	2270	1810	2650	3200	2920	2170	3640	1670	976	998	1030	809
24	2390	1820	2530	3050	2950	2200	3670	1590	1040	1030	1040	810
25	2270	1920	2300	2900	2670	2350	3640	1790	1030	1040	978	805
26	1890	1870	1900	2600	2790	2390	3660	1790	914	954	955	813
27	1940	2130	2100	2650	2650	2290	3660	2130	868	875	940	789
28	1910	3050	2220	2700	2510	2550	3560	1980	831	848	893	775
29	1710	3990	2950	2860	---	2880	3580	1940	832	760	839	759
30	1730	4490	4120	2630	---	2650	3490	1970	795	780	797	797
31	1850	---	4520	2350	---	2590	---	1940	---	765	757	---
TOTAL	65645	71150	95910	117060	72340	77360	84200	70580	46436	33226	28480	25383
MEAN	2118	2372	3094	3776	2584	2495	2807	2277	1548	1072	919	846
MAX	3340	4490	4580	5810	2950	3100	3670	3390	2660	1720	1270	1140
MIN	905	1600	1900	2350	2220	2060	2140	1590	795	679	715	736
CFSM	1.14	1.27	1.66	2.02	1.39	1.34	1.50	1.22	.83	.57	.49	.45
IN.	1.31	1.42	1.91	2.33	1.44	1.54	1.58	1.41	.93	.66	.57	.51

CAL YR 1990 TOTAL 819600 MEAN 2245 MAX 5770 MIN 552 CFSM 1.20 IN 16.34  
WTR YR 1991 TOTAL 787770 MEAN 2158 MAX 5810 MIN 679 CFSM 1.16 IN 15.70

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04099750 PIGEON RIVER NEAR SCOTT, IN

LOCATION.--Lat 41°44'56", long 85°34'35", in SE1/4 NW1/4 sec.14, T.38 N., R.8 E., Lagrange County, Hydrologic Unit 04050001, on right bank 20 ft downstream from bridge on County Road 750 North, 1,200 ft downstream from Page Ditch, 0.7 mi south of Indiana-Michigan State line, and 1.2 mi northwest of Scott, IN.

DRAINAGE AREA.--361 mi<sup>2</sup>, of which 53.9 mi<sup>2</sup> does not contribute directly to surface runoff.

PERIOD OF RECORD.--June 1968 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 815.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 25-28, Dec. 31 to Jan. 15, Jan. 24 to Feb. 2, and Feb. 16-18. Records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--23 years, 370 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,370 ft<sup>3</sup>/s, Mar. 21, 1982, gage height, 7.85 ft; minimum daily, 42 ft<sup>3</sup>/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,660 ft<sup>3</sup>/s, Jan. 1; minimum daily, 114 ft<sup>3</sup>/s, Aug. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	196	323	413	1610	425	499	487	727	534	266	140	152
2	190	314	399	1550	420	535	479	690	603	442	135	146
3	187	306	403	1430	443	583	465	637	536	506	140	150
4	212	303	479	1300	465	570	454	591	511	392	144	162
5	215	407	486	1210	494	576	475	572	500	349	149	177
6	209	598	462	1130	504	582	468	564	488	324	138	165
7	212	593	460	1050	519	577	447	563	471	305	114	143
8	237	557	471	980	514	561	438	533	448	284	146	123
9	384	547	460	910	511	542	450	510	421	242	215	124
10	655	560	445	860	506	529	447	503	395	223	201	146
11	823	549	432	810	493	512	444	475	371	211	175	144
12	801	524	418	770	475	492	442	426	368	204	148	164
13	739	497	404	730	468	474	442	427	339	216	134	204
14	744	469	393	700	502	454	466	432	323	219	136	188
15	763	448	400	690	491	440	519	413	318	207	136	150
16	751	426	398	748	460	433	545	400	314	195	135	131
17	706	402	392	811	435	425	536	400	306	180	139	141
18	683	365	406	794	430	445	530	384	293	159	153	143
19	664	354	406	759	517	452	569	368	279	154	176	138
20	601	352	376	755	578	437	696	337	252	172	228	136
21	549	334	404	750	577	430	809	334	246	189	215	135
22	496	346	440	706	586	424	774	333	246	188	193	135
23	446	357	442	667	605	429	779	360	249	157	182	137
24	441	346	447	620	583	440	860	384	239	129	170	134
25	430	335	450	580	564	439	916	383	233	155	167	135
26	417	327	440	550	543	446	892	405	229	149	169	139
27	397	344	410	520	519	474	858	389	220	140	152	134
28	376	448	390	495	501	505	852	370	214	139	142	130
29	337	498	632	480	---	520	824	357	203	141	151	128
30	331	446	1130	460	---	491	785	349	208	154	148	127
31	328	---	1530	440	---	482	---	388	---	147	149	---
TOTAL	14520	12675	15218	25865	14128	15198	18148	14004	10357	6938	4920	4361
MEAN	468	422	491	834	505	490	605	452	345	224	159	145
MAX	823	598	1530	1610	605	583	916	727	603	506	228	204
MIN	187	303	376	440	420	424	438	333	203	129	114	123
CFSM	1.53	1.38	1.60	2.72	1.64	1.60	1.97	1.47	1.12	.73	.52	.47
IN.	1.76	1.54	1.84	3.13	1.71	1.84	2.20	1.70	1.25	.84	.60	.53
CAL YR 1990	TOTAL 168126		MEAN 461		MAX 1530		MIN 167		CFSM 1.50		IN. 20.37	
WTR YR 1991	TOTAL 156332		MEAN 428		MAX 1610		MIN 114		CFSM 1.40		IN. 18.94	



## STREAMS TRIBUTARY TO LAKE MICHIGAN

89

## 04100222 NORTH BRANCH ELKHART RIVER AT COSPERVILLE, IN

LOCATION.--Lat 41°28'54", long 85°28'32", in NE1/4 NW1/4 sec.22, T.35 N., R.9 E., Noble County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on County Road 900 North at Cosperville, IN, 1,300 ft downstream from Boyd Ditch, 1.7 mi upstream from Hustin Ditch, and 3.1 mi downstream from Waldron Lake.

DRAINAGE AREA.--142 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 880.12 ft above National Geodetic Vertical Datum of 1929 (levels by Indiana Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 24-28, Jan. 24 to Feb. 3, and Feb. 16-18. Records good except for estimated daily discharges, which are fair. Flow regulated at times by dam at Waldron Lake.

AVERAGE DISCHARGE.--20 years, 142 ft<sup>3</sup>/s, 13.58 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 919 ft<sup>3</sup>/s, Mar. 23, 1982, gage height, 8.12 ft; minimum daily, 2.2 ft<sup>3</sup>/s, July 7, 1988, caused by regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 643 ft<sup>3</sup>/s, Jan. 3, gage height, 7.01 ft; minimum daily, 21 ft<sup>3</sup>/s, July 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	166	166	619	169	182	175	347	349	92	27	64
2	83	157	166	637	168	201	173	334	391	152	26	55
3	81	148	179	639	172	225	168	321	411	161	41	50
4	94	142	193	627	189	226	162	305	417	159	48	52
5	103	189	199	604	202	225	161	292	412	154	46	48
6	105	243	199	577	210	223	159	286	397	149	43	44
7	106	262	194	548	211	217	155	276	375	142	39	40
8	108	273	190	517	208	213	154	264	348	136	46	37
9	155	270	183	489	207	204	158	249	318	126	58	36
10	263	265	179	463	202	197	163	231	289	119	57	37
11	320	259	174	443	196	190	168	208	266	112	53	36
12	354	249	167	432	188	183	167	189	246	107	49	63
13	369	238	162	412	182	178	162	174	227	106	45	73
14	375	228	158	393	180	169	162	164	207	100	41	73
15	379	219	162	381	175	162	177	155	189	94	37	70
16	372	209	166	387	161	157	191	144	174	88	35	66
17	357	200	171	384	156	153	225	138	160	81	33	61
18	357	190	175	366	158	160	242	136	146	76	32	56
19	348	182	179	355	186	163	259	132	133	70	37	50
20	336	175	181	356	205	161	307	123	120	65	47	43
21	324	165	182	350	213	156	324	114	109	62	47	38
22	310	161	198	331	217	152	327	107	99	60	44	34
23	291	156	211	315	217	149	331	124	90	55	42	31
24	276	151	204	287	211	153	352	129	81	50	39	29
25	260	143	192	265	205	156	361	130	72	26	36	28
26	245	137	180	241	196	158	359	136	64	21	34	26
27	229	137	176	220	187	166	355	134	57	22	32	27
28	214	158	175	205	182	179	356	128	52	23	30	41
29	202	168	297	190	---	187	359	121	46	24	29	38
30	189	168	487	180	---	182	351	138	57	28	46	34
31	175	---	579	173	---	178	---	262	---	28	71	---
TOTAL	7466	5808	6424	12386	5353	5605	7163	5991	6302	2688	1290	1380
MEAN	241	194	207	400	191	181	239	193	210	86.7	41.6	46.0
MAX	379	273	579	639	217	226	361	347	417	161	71	73
MIN	81	137	158	173	156	149	154	107	46	21	26	26
CFSM	1.70	1.36	1.46	2.81	1.35	1.27	1.68	1.36	1.48	.61	.29	.32
IN.	1.96	1.52	1.68	3.24	1.40	1.47	1.88	1.57	1.65	.70	.34	.36

CAL YR 1990 TOTAL 73591 MEAN 202 MAX 579 MIN 59 CFSM 1.42 IN. 19.28  
WTR YR 1991 TOTAL 67856 MEAN 186 MAX 639 MIN 21 CFSM 1.31 IN. 17.78

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04100500 ELKHART RIVER AT GOSHEN, IN

LOCATION.--Lat 41°35'36", long 85°50'55", in NE1/4 NE1/4 sec.8, T.36 N., R.6 E., Elkhart County, Hydrologic Unit 04050001, on right bank 20 ft downstream from River Avenue bridge at Goshen, IN, 0.4 mi upstream from Rock Run, and at mile 16.1.

DRAINAGE AREA.--594 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1931 to current year.

REVISED RECORDS.--WSP 1337: 1939(M). WSP 1557: 1954. WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 769.43 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 20, 1931, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 26-28, Dec. 31 to Jan. 14, and Jan. 22 to Feb. 3. Records good except for estimated daily discharges, which are fair. Occasional low-flow regulation at Goshen Dam, 3.4 mi upstream.

AVERAGE DISCHARGE.--60 years, 532 ft<sup>3</sup>/s, 12.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,360 ft<sup>3</sup>/s, Feb. 24, 1985; maximum gage height, 11.94 ft, Mar. 14, 1982; minimum daily discharge, 7.0 ft<sup>3</sup>/s, Aug. 11, 1964, result of extreme regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,530 ft<sup>3</sup>/s, Dec. 30, gage height, 11.03 ft; minimum daily, 163 ft<sup>3</sup>/s, Aug. 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	507	794	829	3500	760	828	802	1210	2760	460	194	223
2	493	767	789	2900	770	936	778	1170	2450	454	184	211
3	486	741	811	2600	800	1160	755	1110	2050	468	221	229
4	536	732	1010	2450	852	1100	747	1060	1810	452	263	232
5	570	947	984	2200	904	978	760	1030	1650	421	249	212
6	535	1590	911	2050	942	948	744	1070	1540	402	238	198
7	524	1620	898	1900	933	941	725	1030	1470	395	231	187
8	572	1280	888	1760	918	902	710	965	1390	391	263	175
9	1100	1110	873	1650	917	880	719	913	1300	368	309	175
10	2500	1060	860	1590	914	860	740	876	1190	355	286	173
11	3220	1030	841	1490	890	835	731	843	1110	342	270	169
12	2430	996	821	1400	856	802	719	816	1050	337	257	329
13	2010	967	802	1340	840	775	717	791	976	327	245	443
14	1820	937	755	1300	847	758	770	766	907	320	226	347
15	1710	909	799	1340	819	763	1060	736	847	311	219	299
16	1660	881	879	1520	715	775	1400	723	794	296	200	275
17	1570	851	860	1890	755	789	1450	709	748	277	200	257
18	1540	818	863	1710	816	913	1560	676	684	263	195	243
19	1550	792	882	1470	969	1000	1270	650	603	254	269	231
20	1460	769	854	1380	1170	896	1510	603	546	239	317	220
21	1350	749	851	1380	1070	839	1620	567	496	238	274	211
22	1270	752	986	1240	1020	814	1370	545	464	261	251	203
23	1200	740	1040	1140	970	807	1290	547	445	249	237	198
24	1130	718	921	1050	923	825	1410	637	422	228	224	193
25	1060	694	838	1000	895	819	1500	850	396	217	212	188
26	1010	675	800	950	864	840	1350	960	370	201	205	185
27	961	693	760	890	842	921	1290	827	351	183	209	179
28	918	883	820	860	825	971	1370	705	329	179	185	173
29	881	1110	1670	830	---	932	1370	651	311	196	163	179
30	846	932	4940	800	---	851	1280	681	340	204	186	182
31	822	---	4200	770	---	814	---	1730	---	197	197	---
TOTAL	38241	27537	35035	48350	24796	27272	32517	26447	29799	9485	7179	6719
MEAN	1234	918	1130	1560	886	880	1084	853	993	306	232	224
MAX	3220	1620	4940	3500	1170	1160	1620	1730	2760	468	317	443
MIN	486	675	755	770	715	758	710	545	311	179	163	169
CFSM	2.08	1.55	1.90	2.63	1.49	1.48	1.82	1.44	1.67	.52	.39	.38
IN.	2.39	1.72	2.19	3.03	1.55	1.71	2.04	1.66	1.87	.59	.45	.42
CAL YR 1990	TOTAL 336041		MEAN 921		MAX 4940		MIN 255		CFSM 1.55		IN. 21.04	
WTR YR 1991	TOTAL 313377		MEAN 859		MAX 4940		MIN 163		CFSM 1.45		IN. 19.63	

STREAMS TRIBUTARY TO LAKE MICHIGAN

91

04101000 ST. JOSEPH RIVER AT ELKHART, IN

LOCATION.--Lat 41°41'30", long 85°58'30", in SW1/4 NE1/4 sec.5, T.37 N., R.5 E., Elkhart County, Hydrologic Unit 04050001, on left bank 200 ft downstream from Elkhart River, 200 ft upstream from Main Street bridge in Elkhart, IN, 2,000 ft downstream from Christiana Creek, 0.5 mi downstream from Elkhart Hydroelectric Plant, and at mile 76.5.

DRAINAGE AREA.--3,370 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1947 to current year. Gage heights at site 0.8 mi downstream at different datum from September 1924 to March 1926 are available in the Indiana District Office.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Elkhart Hydroelectric Plant.

AVERAGE DISCHARGE.--44 years, 3,251 ft<sup>3</sup>/s, 13.10 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 18,800 ft<sup>3</sup>/s, Feb. 27, 1985; maximum gage height, 27.91 ft, Mar. 21, 1982; minimum daily discharge, 336 ft<sup>3</sup>/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 14,400 ft<sup>3</sup>/s, Dec. 31, gage height, 25.60 ft; minimum daily, 1,400 ft<sup>3</sup>/s, Aug. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2020	3440	7100	11000	4440	4600	4810	6460	6170	2050	1400	1550
2	2340	3300	6700	11600	4740	5020	4570	6090	6400	2720	1410	1530
3	2380	3330	6660	11400	4630	5450	4420	5910	6100	3070	1460	1630
4	2580	3250	6680	10400	4710	5630	4380	5610	5640	3030	1540	1780
5	2620	4220	6320	10000	4780	5490	4410	5310	5070	2920	1520	1760
6	2680	5550	5850	10000	5030	5550	4170	5180	5050	2900	1550	1720
7	2450	5660	6000	9350	5170	5330	4240	5170	4720	2750	1550	1630
8	2530	5730	5760	8560	5260	5440	4250	5120	4510	2640	1840	1550
9	4030	5480	5530	8280	5180	4990	4170	4930	4300	2630	1950	1530
10	6080	5250	5390	8040	5290	5020	4270	4840	3960	2490	2140	1610
11	7810	5360	5540	7630	5040	4840	4230	4750	3780	2290	1990	1580
12	7600	5200	4960	7350	4750	4530	4030	4560	3750	2150	1890	2310
13	7160	4650	4790	7050	4660	4410	3980	4140	3620	2090	1810	2440
14	6910	4890	4560	6890	4830	4170	4160	3950	3430	1980	1750	2130
15	6600	4380	5130	6640	4760	4140	5240	3740	3240	1780	1690	2010
16	6430	4340	4850	7110	4210	4130	5820	3670	2950	1790	1600	1910
17	6340	4220	4910	7590	4280	4150	5990	3810	3120	1730	1660	1820
18	6180	4070	4690	7320	4500	4430	6030	3910	2990	1660	1620	1800
19	6160	4000	4960	7120	4880	4750	5910	3730	2780	1540	2130	1770
20	5650	3820	4530	7120	5290	4430	6260	3530	2640	1500	2310	1730
21	5410	3720	4770	6950	5460	4360	6380	3440	2430	1520	2370	1730
22	5060	3780	4920	6460	5440	4240	6320	3250	2260	1570	2110	1640
23	4830	3650	5240	6280	5340	4190	6670	3150	2100	1820	1950	1680
24	4800	3510	4910	5980	5450	4330	7040	3190	2170	1850	1970	1650
25	4480	3630	4060	5690	5270	4350	7150	3470	2240	1780	1850	1520
26	4260	3540	4350	5270	4990	4500	6850	3790	2040	1750	1800	1740
27	3970	3940	3910	4870	5050	4680	6800	3930	1940	1650	1800	1600
28	3900	5990	4470	5260	4730	4800	6880	3830	1840	1510	1780	1570
29	3740	6630	6790	5330	---	5280	6750	3560	1820	1600	1630	1550
30	3550	6880	11800	5240	---	5000	6530	3560	1770	1440	1610	1530
31	3590	---	13500	4590	---	4490	---	4390	---	1540	1580	---
TOTAL	144140	135410	179630	232370	138160	146720	162710	133970	104830	63740	55260	52000
MEAN	4650	4514	5795	7496	4934	4733	5424	4322	3494	2056	1783	1733
MAX	7810	6880	13500	11600	5460	5630	7150	6460	6400	3070	2370	2440
MIN	2020	3250	3910	4590	4210	4130	3980	3150	1770	1440	1400	1520
CFSM	1.38	1.34	1.72	2.22	1.46	1.40	1.61	1.28	1.04	.61	.53	.51
IN.	1.59	1.49	1.98	2.57	1.53	1.62	1.80	1.48	1.16	.70	.61	.57
CAL YR 1990	TOTAL 1599850		MEAN 4383		MAX 13500		MIN 1630		CFSM 1.30		IN. 17.66	
WTR YR 1991	TOTAL 1548940		MEAN 4244		MAX 13500		MIN 1400		CFSM 1.26		IN. 17.10	

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04101500 ST. JOSEPH RIVER AT NILES, MI  
(National stream quality accounting network station)

LOCATION.--Lat 41°49'45", long 86°15'35", in SW1/4 sec.26, T.7 S., R.17 W., Berrien County, Hydrologic Unit 04050001, on right bank 100 ft upstream from Main Street Bridge in Niles, 0.6 mi downstream from dam at French Paper Co., 1.3 mi upstream from Dowagiac River, and at mile 44.

DRAINAGE AREA.--3,666 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1933-36, 1940-43, 1945-46(M). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 633.02 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, at datum 2.00 ft higher. Oct. 1, 1930, to Feb. 11, 1931, nonrecording gage on Main Street Bridge, and Feb. 12 to June 30, 1931, nonrecording gage 50 ft upstream from present site (gage heights referred to NGVD). Oct. 1, 1943, to Apr. 12, 1970, auxiliary gage was headwater gage at hydroelectric plant at Buchanan Dam, 8 mi downstream from base gage at different datum. Since Apr. 13, 1970, auxiliary water-stage recorder at sewage-treatment plant, 1.1 mi downstream from base gage at same datum.

REMARKS.--No estimated daily discharges. Water-discharge records good. Flow regulated by powerplants upstream from station.

AVERAGE DISCHARGE.--61 years, 3,359 ft<sup>3</sup>/s, 12.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,200 ft<sup>3</sup>/s, Apr. 5, 1950, gage height, 15.10 ft, present datum; minimum daily, 420 ft<sup>3</sup>/s, Aug. 30, 1931.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 16,800 ft<sup>3</sup>/s, Dec. 31, gage height, 13.58 ft; minimum daily, 1,600 ft<sup>3</sup>/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2420	4020	8130	12500	5090	5340	5240	7210	6910	2170	1730	1760
2	2520	3670	7690	12600	5380	5660	5340	7220	7550	2750	1600	1790
3	2810	3700	7600	12300	5230	6470	5090	6580	7120	3410	1680	1960
4	3500	3820	8120	11300	5420	6430	5060	6550	6460	3400	1780	2310
5	3380	4670	7340	11300	5390	6380	5110	6130	5730	3320	1770	2020
6	3070	7030	6760	10800	5760	6330	4920	6110	5750	3310	1720	2030
7	3070	6910	6550	10500	5800	6210	4780	5970	5360	3100	1720	1920
8	2810	6490	6730	9500	5960	6010	4900	5750	5150	3200	2130	1920
9	4610	6330	6200	9120	5930	5800	4770	5510	5000	2930	2180	1830
10	8410	6050	6110	8810	5880	5630	4890	5440	4600	2940	1940	1820
11	10700	5750	6290	8530	5880	5630	4800	5300	4440	2720	2120	1900
12	9800	5990	5870	8230	5520	5300	4780	5280	4380	2490	2190	2650
13	8270	5360	5450	7780	5490	5080	4540	4600	4200	2420	2190	3050
14	8030	5310	5040	7590	5440	4920	4780	4650	4000	2420	2060	2670
15	7720	5080	5590	7460	5520	4700	6240	4290	3860	2080	1900	2360
16	7280	4780	5640	7900	5070	4770	7670	4320	3500	2130	1990	2310
17	7190	4810	5620	8930	4770	4800	7300	4510	3500	2050	1840	2200
18	7090	4680	5450	8490	5070	5110	7460	4740	3450	1990	1980	2080
19	7140	4510	5460	7880	5520	5490	7000	4360	3370	1740	2540	2090
20	6720	4240	5390	8040	6310	5220	7110	4120	3090	1770	3040	2050
21	6130	4330	5110	8090	6370	4980	7410	4020	2890	1790	2590	2030
22	5770	4290	5750	7690	6390	4860	7350	3900	2700	1820	2730	2030
23	5360	4140	5790	6980	6180	5030	7120	3900	2620	2040	2200	1930
24	5380	4030	5810	6750	6150	5030	8280	3770	2460	2260	2280	2040
25	5170	4000	4740	6340	6100	5020	8220	4180	2600	2080	2250	1920
26	4850	4070	4880	6160	5650	5390	7900	4630	2500	2070	2050	1810
27	4470	4910	4240	5490	5700	5510	7820	4530	2350	1930	2090	1990
28	4350	8260	4850	5850	5500	5630	7800	4590	2260	1870	2170	1880
29	4280	8690	7850	5970	---	5870	7750	4200	2150	1610	2020	1840
30	4020	8000	14900	5920	---	6150	7550	4110	2160	1680	1810	1810
31	3970	---	16400	5390	---	5260	---	4860	---	1790	1980	---
TOTAL	170290	157920	207350	260190	158470	170010	188980	155330	122110	73280	64270	62000
MEAN	5493	5264	6689	8393	5660	5484	6299	5011	4070	2364	2073	2067
MAX	10700	8690	16400	12600	6390	6470	8280	7220	7550	3410	3040	3050
MIN	2420	3670	4240	5390	4770	4700	4540	3770	2150	1610	1600	1760
CFSM	1.50	1.44	1.83	2.29	1.54	1.50	1.72	1.37	1.11	.65	.57	.56
IN.	1.73	1.60	2.10	2.64	1.61	1.73	1.92	1.58	1.24	.74	.65	.63
CAL YR 1990	TOTAL	1831460	MEAN	5018	MAX	16400	MIN	1830	CFSM	1.37	IN	18.58
WTR YR 1991	TOTAL	1790200	MEAN	4905	MAX	16400	MIN	1600	CFSM	1.34	IN	18.17



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1979 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: February 1979 to September 1984.

WATER TEMPERATURE: February 1979 to September 1984.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1984.

REMARKS.--Bimonthly cross-sectional samples were collected at Grant Street bridge 0.2 mi upstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1982, 1984): Maximum, 678 microsiemens, Feb. 16, 1982; minimum, 278 microsiemens, Mar. 19, 1982.

WATER TEMPERATURE (water years 1980, 1982-84): Maximum daily recorded (more than 20 percent missing record), 29.0°C, July 20, 21, 1980; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOC- CI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 08...	1500	6260	509	8.2	8.0	5.8	12.2	105	K7300	K5700
JAN 29...	1400	6080	579	8.3	0.5	3.1	15.0	107	2700	160
APR 17...	1500	7100	496	8.3	13.0	25	10.2	99	--	--
MAY 21...	1400	3930	562	8.5	20.5	4.9	9.6	108	K170	K36
JUL 30...	1330	1680	541	8.4	23.5	3.9	8.5	102	2500	360
SEP 25...	1330	1970	565	8.3	14.5	1.7	9.6	98	140	350

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)
NOV 08...	250	46	67	19	11	3.9	244	--	200	36
JAN 29...	280	64	79	21	11	2.1	268	--	220	46
APR 17...	240	51	67	18	10	2.7	232	--	190	37
MAY 21...	280	55	78	21	13	2.0	264	6	226	37
JUL 30...	250	55	65	22	18	2.2	237	2	198	44
SEP 25...	260	59	69	22	17	2.3	249	--	204	49

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
NOV 08...	21	<0.1	7.9	300	0.41	5070	0.02	0.01	1.2	1.2
JAN 29...	22	0.1	8.1	351	0.48	5760	0.05	0.05	2.2	2.3
APR 17...	21	0.1	5.3	286	0.39	5480	0.08	0.03	2.2	2.1
MAY 21...	21	0.2	4.6	335	0.46	3550	0.03	0.02	1.5	1.4
JUL 30...	33	0.2	3.4	308	0.42	1400	0.03	0.02	1.0	1.1
SEP 25...	32	0.2	6.4	331	0.45	1760	0.02	0.01	1.4	1.5

STREAMS TRIBUTARY TO LAKE MICHIGAN  
04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
NOV 08...	0.04	0.04	0.6	0.08	0.03	0.01	0.02	20	1	52
JAN 29...	0.08	0.09	0.6	0.03	<0.01	0.01	0.01	--	--	--
APR 17...	0.12	0.10	1.2	0.14	0.04	0.07	0.02	20	<1	64
MAY 21...	0.02	<0.01	0.8	0.06	0.03	<0.01	<0.01	<10	1	68
JUL 30...	0.01	<0.01	0.8	0.08	0.01	<0.01	<0.01	--	--	--
SEP 25...	0.05	0.04	0.6	0.06	0.03	0.02	0.02	10	--	56

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
NOV 08...	<0.5	<1	2	<3	<1	79	<1	5	13	<0.1
JAN 29...	--	--	--	--	--	--	--	--	--	--
APR 17...	0.7	<1	<1	<3	2	24	<1	<4	8	<0.1
MAY 21...	<0.5	<1	1	<3	1	11	<1	5	2	<0.1
JUL 30...	--	--	--	--	--	--	--	--	--	--
SEP 25...	--	--	--	<3	--	6	--	8	6	--

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 08...	<10	1	<1	<1	120	<6	10	20	338	91
JAN 29...	--	--	--	--	--	--	--	3	49	71
APR 17...	<10	1	<1	<1	120	<6	5	54	1040	97
MAY 21...	<10	<1	<1	<1	130	<6	10	--	--	--
JUL 30...	--	--	--	--	--	--	--	28	127	92
SEP 25...	<10	1	<1	<1	120	<6	--	17	90	87

STREAMS TRIBUTARY TO LAKE MICHIGAN

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04101800 DOWAGIAC RIVER AT SUMNERVILLE, MI

LOCATION.--Lat 41°54'48", long 86°12'47", in SE1/4 sec.30, T.6 S., R.16 W., Cass County, Hydrologic Unit 04050001, on right bank 30 ft upstream from bridge on Indian Lake Road, 0.3 mi west of Sumnerville.

DRAINAGE AREA.--255 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Datum of gage is 692.62 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by millpond and lake-level control dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 293 ft<sup>3</sup>/s, 15.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft<sup>3</sup>/s, Feb. 24, 1985, gage height, 9.26 ft; minimum, 86 ft<sup>3</sup>/s, Sept. 10, 1964; minimum gage height, 2.57 ft, Aug. 8, 9, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,440 ft<sup>3</sup>/s, Nov. 28, gage height, 8.71 ft; minimum, 153 ft<sup>3</sup>/s, July 21, gage height, 3.23 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	245	317	713	626	325	401	413	482	393	207	164	174
2	238	311	604	553	328	614	392	476	432	427	159	169
3	239	307	571	507	340	700	379	440	402	351	209	174
4	595	309	592	461	388	582	381	423	363	324	203	207
5	567	598	562	441	462	508	452	461	334	300	192	192
6	437	861	531	433	463	486	420	555	315	276	184	185
7	355	701	513	423	435	462	394	507	298	257	175	178
8	340	562	491	411	414	426	381	463	287	252	226	170
9	684	495	477	408	410	415	395	439	276	235	304	167
10	1170	452	475	403	396	413	407	417	267	223	259	171
11	1270	420	463	407	367	411	382	395	301	209	238	169
12	992	398	448	413	342	394	364	381	335	200	223	302
13	742	381	440	405	338	381	353	368	295	200	210	329
14	607	369	417	402	348	364	399	352	280	195	199	274
15	572	359	423	400	336	355	855	339	270	189	186	267
16	518	351	437	451	331	349	978	332	282	179	177	247
17	470	340	428	509	351	353	694	410	265	170	177	231
18	489	333	453	476	358	435	584	390	250	164	173	220
19	494	329	438	444	446	420	531	358	236	162	181	213
20	459	322	412	458	505	391	554	340	226	158	238	211
21	431	320	410	467	527	377	518	325	218	171	216	206
22	412	350	443	423	530	365	485	320	211	266	211	206
23	392	350	431	396	461	371	467	328	212	300	204	216
24	380	334	411	377	418	382	690	339	205	255	194	211
25	370	322	388	362	389	371	667	373	202	237	186	212
26	357	314	377	352	366	384	570	532	194	223	179	212
27	348	584	355	341	358	542	527	478	189	210	170	206
28	337	1340	363	339	359	626	525	416	181	200	167	201
29	330	1330	687	334	---	522	509	376	174	192	166	199
30	326	936	1040	334	---	456	494	355	172	188	182	196
31	322	---	800	330	---	426	---	373	---	173	187	---
TOTAL	15488	14695	15593	13086	11091	13682	15160	12543	8065	7093	6139	6315
MEAN	500	490	503	422	396	441	505	405	269	229	198	211
MAX	1270	1340	1040	626	530	700	978	555	432	427	304	329
MIN	238	307	355	330	325	349	353	320	172	158	159	167
CFSM	1.96	1.92	1.97	1.66	1.55	1.73	1.98	1.59	1.06	.90	.78	.83
IN.	2.26	2.14	2.27	1.91	1.62	2.00	2.21	1.83	1.18	1.03	.90	.92

CAL YR 1990 TOTAL 135121 MEAN 370 MAX 1340 MIN 151 CFSM 1.45 IN 19.71  
WTR YR 1991 TOTAL 138950 MEAN 381 MAX 1340 MIN 158 CFSM 1.49 IN 20.27

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04102500 PAW PAW RIVER AT RIVERSIDE, MI

LOCATION.--Lat 42°11'10", long 86°22'06", in SW1/4 SE1/4 sec.23, T.3 S., R.18 W., Berrien County, Hydrologic Unit 04050001, on left bank 40 ft upstream from bridge on Coloma Road, 0.8 mi east of Riverside.

DRAINAGE AREA.--390 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 1337: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 588.80 ft above National Geodetic Vertical Datum of 1929. May 10, 1966, to July 11, 1967, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 3-12, 22-30, and Feb. 16. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 457 ft<sup>3</sup>/s, 15.91 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,580 ft<sup>3</sup>/s, Oct. 4, 1986, gage height, 10.90 ft; minimum, 99 ft<sup>3</sup>/s, July 5, 1964, gage height, 2.66 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,330 ft<sup>3</sup>/s, Dec. 1, gage height, 9.86 ft; minimum, 263 ft<sup>3</sup>/s, Aug. 2, Sept. 8, gage height, 4.31 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	345	458	2260	1150	480	539	1140	762	622	294	270	284
2	338	452	1980	1200	475	608	970	719	603	429	265	286
3	334	448	1490	1300	475	1000	842	694	592	491	266	285
4	400	442	1230	1050	499	1030	759	670	554	463	266	282
5	495	504	1070	900	548	1030	714	656	506	450	276	284
6	513	803	985	830	597	1200	696	657	467	448	284	287
7	508	1030	919	790	618	1120	670	684	436	413	275	283
8	511	911	871	730	633	984	647	678	408	386	280	266
9	564	1010	836	690	650	876	714	685	394	365	321	266
10	764	1190	808	650	656	794	897	706	383	364	344	270
11	1150	1040	779	620	635	743	902	694	411	347	365	273
12	1100	889	751	600	600	705	839	636	452	313	346	332
13	1110	782	726	585	573	665	826	584	453	299	319	356
14	1470	700	705	575	553	633	867	545	448	304	309	347
15	1390	645	692	575	528	608	991	516	431	306	283	355
16	1140	600	686	600	500	581	1360	490	400	300	277	338
17	953	563	696	667	492	560	1270	489	379	288	283	317
18	871	538	700	722	497	571	1260	497	377	282	272	313
19	822	521	703	705	524	593	1300	500	358	274	272	297
20	765	505	701	721	597	592	1160	495	341	266	300	290
21	709	495	701	777	668	584	1010	492	330	276	337	287
22	671	491	711	760	710	587	899	477	324	303	370	280
23	636	491	726	710	732	591	821	464	321	308	375	283
24	607	486	709	675	736	590	799	485	312	322	342	285
25	589	478	680	640	709	583	831	487	307	333	304	294
26	564	471	660	610	656	583	834	562	317	317	289	292
27	540	572	650	590	600	635	821	671	307	289	281	291
28	515	1330	700	560	560	861	813	644	298	279	276	293
29	495	1740	771	540	---	1070	830	604	302	276	273	297
30	481	1650	994	520	---	1070	812	563	282	268	276	286
31	468	---	1200	503	---	1270	---	579	---	270	298	---
TOTAL	21818	22235	28090	22545	16501	23856	27294	18385	12115	10323	9294	8899
MEAN	704	741	906	727	589	770	910	593	404	333	300	297
MAX	1470	1740	2260	1300	736	1270	1360	762	622	491	375	356
MIN	334	442	650	503	475	539	647	464	282	266	265	266
CFSM	1.81	1.90	2.32	1.86	1.51	1.97	2.33	1.52	1.04	.85	.77	.76
IN.	2.08	2.12	2.68	2.15	1.57	2.28	2.60	1.75	1.16	.98	.89	.85
CAL YR 1990	TOTAL	212823	MEAN	583	MAX	2260	MIN	249	CFSM	1.50	IN	20.30
WTR YR 1991	TOTAL	221355	MEAN	606	MAX	2260	MIN	265	CFSM	1.55	IN	21.11



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04102700 SOUTH BRANCH BLACK RIVER NEAR BANGOR, MI

LOCATION.--Lat 42°21'15", long 86°11'15", in NW1/4 sec.28, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, on left bank 50 ft upstream from bridge on 66th Street, 4.9 mi northwest of Bangor.

DRAINAGE AREA.--83.6 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1966 to current year. Prior to October 1981, published as Black River near Bangor.

REVISED RECORDS.--WDR MI-81: 1973-75(M), 1979(M).

GAGE.--Water-stage recorder. Elevation of gage is 610 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 24-29, Dec. 31 to Jan. 9, Jan. 22 to Feb. 1, and Feb. 16-17. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 107 ft<sup>3</sup>/s, 17.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft<sup>3</sup>/s, Sept. 30, 1986, gage height, 13.63 ft, from rating curve extended above 1,200 ft<sup>3</sup>/s; minimum, 20 ft<sup>3</sup>/s, Sept. 28, 1966, Aug. 18, 19, 1984; minimum gage height, 1.79 ft, Aug. 18, 19, 1984.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	1300	645	9.55	Mar. 3	1600	577	9.04
Nov. 6	1600	903	10.58	Mar. 28	2300	422	7.84
Nov. 28	1200	*1,590	*12.92	Apr. 10	1000	475	8.33
Dec. 30	1500	622	9.28	Apr. 16	0400	1,080	11.25

Minimum discharge, 27 ft<sup>3</sup>/s, Aug. 1, 2, Sept. 7; minimum gage height, 2.01 ft, Aug. 1, Sept. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48	70	583	350	81	111	164	121	64	36	28	30
2	51	69	434	250	79	242	142	116	61	58	28	29
3	66	68	336	170	83	531	127	101	58	56	32	29
4	97	68	292	150	102	480	117	86	53	48	32	34
5	122	240	242	135	142	344	134	94	49	44	31	31
6	99	790	201	125	153	260	142	167	46	41	30	29
7	83	711	187	115	141	227	127	168	45	41	30	28
8	72	507	175	110	129	186	115	133	44	43	35	28
9	117	367	162	105	125	160	221	115	43	41	49	28
10	327	275	154	105	122	154	456	102	42	39	41	30
11	597	209	146	104	110	158	362	92	48	37	36	30
12	490	163	137	105	96	145	252	85	54	36	34	36
13	353	142	133	106	91	129	191	80	49	35	32	39
14	253	128	125	105	90	117	171	75	45	35	32	37
15	197	118	121	106	86	108	432	71	43	34	31	40
16	169	111	150	134	87	101	945	66	43	32	30	37
17	140	104	158	222	88	98	621	77	41	31	29	35
18	163	98	176	211	88	125	420	87	40	31	30	33
19	209	94	181	177	121	141	294	78	39	30	35	33
20	188	91	156	205	185	128	225	71	38	30	45	34
21	149	93	141	217	222	116	185	65	36	32	38	33
22	125	112	154	160	247	114	160	62	37	38	35	32
23	111	118	161	140	225	126	142	63	39	37	33	33
24	101	111	140	130	160	138	164	62	37	34	32	32
25	94	103	130	120	129	139	191	68	36	33	31	32
26	88	95	120	110	112	135	162	93	35	31	30	36
27	83	274	115	100	103	236	141	87	34	31	29	46
28	79	1370	110	95	100	397	145	76	34	30	29	41
29	75	1020	260	90	---	394	134	67	33	30	29	37
30	73	740	584	84	---	296	132	62	33	31	29	35
31	72	---	470	82	---	205	---	65	---	30	30	---
TOTAL	4891	8459	6634	4418	3497	6241	7214	2755	1299	1135	1015	1007
MEAN	158	282	214	143	125	201	240	88.9	43.3	36.6	32.7	33.6
MAX	597	1370	584	350	247	531	945	168	64	58	49	46
MIN	48	68	110	82	79	98	115	62	33	30	28	28
CFSM	1.89	3.37	2.56	1.71	1.50	2.40	2.87	1.06	.52	.44	.39	.40
IN.	2.18	3.76	2.95	1.97	1.56	2.78	3.21	1.23	.58	.51	.45	.45

CAL YR 1990 TOTAL 50203 MEAN 138 MAX 1370 MIN 32 CFSM 1.65 IN 22.34  
WTR YR 1991 TOTAL 48565 MEAN 133 MAX 1370 MIN 28 CFSM 1.59 IN 21.61

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04103010 KALAMAZOO RIVER NEAR MARENGO, MI

LOCATION.--Lat 42°15'42", long 84°51'21", in SW1/4 SE1/4 sec.26, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, on right bank at upstream side of bridge on B Drive North, 0.8 mi south of Marengo, and 5.0 mi west of Albion.

DRAINAGE AREA.--267 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 910 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-17, Dec. 25-28, Jan. 1, 4-8, 22-28, and Feb. 1, 16, 17. Records good except for estimated daily discharges, which are fair. Some diversion by pumping for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--5 years, 252 ft<sup>3</sup>/s, 12.82 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft<sup>3</sup>/s, June 3, 1989, gage height, 10.18 ft; minimum, 88 ft<sup>3</sup>/s, Aug. 19, 1987, gage height, 5.90 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 842 ft<sup>3</sup>/s, Dec. 31, gage height, 9.13 ft; maximum gage height, 9.39 ft, Jan. 1, backwater from ice; minimum discharge, 129 ft<sup>3</sup>/s, July 29, Aug. 30, gage height, 6.38 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	180	211	422	790	290	306	338	330	253	158	159	143
2	180	210	362	717	302	373	322	321	285	180	150	140
3	185	206	349	631	300	420	312	307	302	171	150	138
4	210	209	367	510	325	410	304	294	274	166	147	159
5	205	350	366	440	375	385	318	296	252	167	144	159
6	200	440	355	410	403	373	318	332	236	161	140	155
7	200	458	333	390	392	359	311	339	223	165	135	147
8	250	430	316	370	375	344	305	331	213	201	170	140
9	300	395	307	374	367	331	312	321	206	177	214	139
10	350	351	309	356	359	319	316	303	202	174	193	151
11	400	311	307	358	339	312	312	289	220	168	181	159
12	460	287	305	369	316	302	300	276	212	161	166	162
13	500	269	301	371	303	295	286	276	205	188	155	161
14	460	262	293	370	304	289	292	294	198	166	148	156
15	420	258	290	366	296	285	359	276	198	160	151	153
16	360	252	293	402	275	282	388	265	225	155	148	148
17	330	246	301	448	280	283	386	269	221	149	142	144
18	324	240	310	455	293	331	364	257	214	147	141	142
19	302	236	311	438	332	333	347	251	202	145	166	140
20	296	233	305	433	392	330	440	243	191	141	189	139
21	283	232	311	433	416	323	490	237	184	140	189	137
22	268	246	329	380	421	316	490	231	181	150	186	138
23	255	249	340	350	401	319	457	225	184	161	175	148
24	245	244	330	340	371	322	452	230	179	150	162	142
25	237	241	290	330	345	324	431	230	175	144	151	145
26	232	235	300	320	326	326	410	248	171	138	145	152
27	228	298	275	310	312	366	387	256	167	134	140	147
28	220	552	290	310	302	364	390	248	163	132	136	145
29	218	548	477	307	---	368	368	240	159	146	134	143
30	216	499	757	301	---	370	352	232	156	173	131	142
31	214	---	831	297	---	354	---	245	---	169	140	---
TOTAL	8728	9198	11032	12676	9512	10414	10857	8492	6251	4937	4878	4414
MEAN	282	307	356	409	340	336	362	274	208	159	157	147
MAX	500	552	831	790	421	420	490	339	302	201	214	162
MIN	180	206	275	297	275	282	286	225	156	132	131	137
CFSM	1.06	1.15	1.33	1.53	1.27	1.26	1.36	1.03	.78	.60	.59	.55
IN.	1.22	1.28	1.54	1.77	1.33	1.45	1.51	1.18	.87	.69	.68	.61

CAL YR 1990 TOTAL 112336 MEAN 308 MAX 831 MIN 171 CFSM 1.15 IN 15.65  
WTR YR 1991 TOTAL 101389 MEAN 278 MAX 831 MIN 131 CFSM 1.04 IN 14.13

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04105000 BATTLE CREEK AT BATTLE CREEK, MI

LOCATION.--Lat 42°19'55", long 85°09'15", in NW1/4 sec.5, T.2 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, on right bank 350 ft upstream from Emmett Street Bridge in Battle Creek, 3.0 mi upstream from mouth.

DRAINAGE AREA.--241 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to July 1933, January 1934 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1944. WSP 1507: 1956.

GAGE.--Water-stage recorder. Datum of gage is 823.24 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to May 14, 1951, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Occasional slight regulation prior to November 1943. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--58 years (water years 1931, 1935-91), 206 ft<sup>3</sup>/s, 11.61 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,640 ft<sup>3</sup>/s, Apr. 7, 1947, gage height, 4.48 ft, from floodmark; minimum, 22 ft<sup>3</sup>/s, Aug. 14, 1934; minimum gage height, about -0.5 ft in July 1936 and on Aug. 31, 1939, due to opening of gates at dam forming control.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,570 ft<sup>3</sup>/s, Nov. 30, gage height, 2.70 ft; minimum, 54 ft<sup>3</sup>/s, July 27, gage height, 0.60 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	88	145	1450	908	203	249	884	451	182	72	86	73
2	79	142	1180	1020	196	300	728	423	173	84	74	70
3	80	140	976	819	200	379	599	397	166	89	80	72
4	114	143	828	630	229	484	509	371	160	83	74	78
5	146	201	703	519	290	614	460	350	156	81	75	88
6	153	309	604	424	362	577	434	339	147	83	77	83
7	152	516	524	382	427	507	418	330	137	79	65	73
8	142	952	463	358	465	454	409	326	132	110	82	65
9	164	950	416	327	457	422	397	319	126	107	110	68
10	245	805	388	298	422	392	392	306	121	103	117	73
11	333	678	368	287	384	356	433	288	127	96	106	71
12	521	564	357	265	306	323	523	269	141	95	93	76
13	750	467	355	259	355	299	500	271	140	96	72	78
14	722	398	346	264	300	277	445	272	129	92	66	77
15	602	349	332	270	211	261	435	254	123	93	79	74
16	512	311	320	283	205	249	516	238	119	81	66	74
17	429	280	309	306	238	242	714	228	113	77	66	73
18	371	257	309	326	241	258	795	220	107	69	70	67
19	334	239	318	353	259	284	710	223	99	69	93	68
20	304	222	323	380	290	315	667	222	93	66	148	64
21	279	197	329	355	339	346	686	205	89	66	168	67
22	261	213	327	328	396	349	809	188	90	79	176	67
23	244	218	328	338	407	362	796	177	98	85	166	71
24	224	215	305	314	400	379	738	186	92	86	131	77
25	202	213	263	286	374	395	699	190	96	79	105	75
26	187	208	273	267	324	407	693	234	91	65	82	74
27	174	243	252	248	289	454	652	315	85	60	88	75
28	163	403	260	241	261	623	584	337	73	64	78	72
29	156	910	317	229	---	1240	522	307	75	67	77	70
30	151	1520	412	221	---	1330	477	256	79	84	78	70
31	148	---	558	214	---	1070	---	210	---	89	75	---
TOTAL	8430	12408	14493	11719	8830	14197	17624	8702	3559	2549	2923	2183
MEAN	272	414	468	378	315	458	587	281	119	82.2	94.3	72.8
MAX	750	1520	1450	1020	465	1330	884	451	182	110	176	88
MIN	79	140	252	214	196	242	392	177	73	60	65	64
CFSM	1.13	1.72	1.94	1.57	1.31	1.90	2.44	1.17	.49	.34	.39	.30
IN.	1.30	1.92	2.24	1.81	1.36	2.19	2.72	1.34	.55	.39	.45	.34

CAL YR 1990 TOTAL 105609 MEAN 289 MAX 1670 MIN 67 CFSM 1.20 IN 16.30  
WTR YR 1991 TOTAL 107617 MEAN 295 MAX 1520 MIN 60 CFSM 1.22 IN 16.61

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04105500 KALAMAZOO RIVER NEAR BATTLE CREEK, MI

LOCATION.--Lat 42°19'26", long 85°11'51", in SW1/4 sec.1, T.2 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, on left bank 20 ft upstream from bridge on Kendall Street in Battle Creek.

DRAINAGE AREA.--824 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1937 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1938-39. WSP 1387: 1938, 1945-46, 1948.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1957, water-stage recorder at site 4.7 mi downstream at different datum. Oct. 1, 1957, to June 15, 1959, nonrecording gage at bridge 1,800 ft upstream at different datum. June 16, 1959, to Oct. 13, 1960, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records fair. Diurnal fluctuation below 1,500 ft<sup>3</sup>/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--54 years, 679 ft<sup>3</sup>/s, 11.19 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,290 ft<sup>3</sup>/s, Apr. 7, 1947, gage height, 9.13 ft, site and datum then in use; minimum, 50 ft<sup>3</sup>/s, Sept. 22, 1939, site then in use; minimum daily, 86 ft<sup>3</sup>/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,860 ft<sup>3</sup>/s, Nov. 30, gage height, 5.82 ft; minimum, 278 ft<sup>3</sup>/s, Aug. 8, gage height, 3.04 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	475	590	2640	2300	782	880	1800	1360	790	447	466	405
2	474	589	2220	2450	825	1100	1620	1250	824	544	456	407
3	506	612	1900	2120	819	1290	1410	1210	860	510	533	407
4	654	677	1720	1760	892	1370	1290	1110	790	512	447	460
5	638	1010	1580	1540	1080	1470	1250	1080	746	472	425	458
6	637	1380	1450	1350	1230	1440	1220	1110	726	473	425	453
7	630	1560	1330	1240	1290	1310	1200	1140	703	490	369	447
8	653	1850	1220	1140	1300	1250	1170	1120	661	584	443	416
9	850	1850	1110	1050	1300	1160	1180	1070	662	532	654	420
10	1340	1660	1080	1020	1240	1100	1200	1050	646	508	637	474
11	1550	1460	1060	996	1150	1030	1210	946	753	494	514	440
12	1680	1290	1030	983	1010	968	1270	954	767	489	487	479
13	1810	1080	1020	979	1010	926	1210	1020	705	537	443	489
14	1810	1010	995	1000	946	861	1200	960	682	523	405	462
15	1650	916	965	997	837	852	1390	900	679	490	410	437
16	1410	873	933	1060	779	830	1570	847	665	460	413	414
17	1220	822	948	1170	885	832	1690	850	677	455	425	395
18	1100	790	969	1220	872	984	1720	781	655	438	455	381
19	1020	766	1000	1240	951	1030	1630	776	629	432	561	380
20	938	734	978	1270	1040	1040	1720	761	586	413	696	377
21	898	711	984	1250	1150	1060	1800	741	570	413	628	363
22	836	742	998	1120	1230	1050	1880	719	585	507	611	370
23	805	750	1030	1120	1260	1080	1880	745	582	514	602	405
24	761	747	994	1040	1180	1110	1840	739	585	475	539	404
25	723	739	932	940	1080	1140	1740	790	542	439	476	408
26	677	726	864	890	990	1140	1660	855	470	423	436	408
27	659	979	707	858	921	1420	1580	879	439	402	448	414
28	632	1690	884	903	863	1630	1560	950	432	394	416	388
29	625	2200	1350	890	---	2190	1510	909	422	423	390	387
30	617	2800	1770	849	---	2340	1430	888	422	453	445	390
31	603	---	2030	793	---	2050	---	859	---	509	411	---
TOTAL	28881	33603	38691	37538	28912	37933	44830	29369	19255	14755	15066	12538
MEAN	932	1120	1248	1211	1033	1224	1494	947	642	476	486	418
MAX	1810	2800	2640	2450	1300	2340	1880	1360	860	584	696	489
MIN	474	589	707	793	779	830	1170	719	422	394	369	363
CFSM	1.13	1.36	1.52	1.47	1.25	1.49	1.81	1.15	.78	.58	.59	.51
IN.	1.30	1.52	1.75	1.69	1.31	1.71	2.02	1.33	.87	.67	.68	.57

CAL YR 1990 TOTAL 350684 MEAN 961 MAX 3500 MIN 374 CFSM 1.17 IN 15.83  
WTR YR 1991 TOTAL 341371 MEAN 935 MAX 2800 MIN 363 CFSM 1.14 IN 15.41



STREAMS TRIBUTARY TO LAKE MICHIGAN

101

04105700 AUGUSTA CREEK NEAR AUGUSTA, MI

LOCATION.--Lat 42°21'12", long 85°21'14", in SW1/4 sec.27, T.1 S., R.9 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 15 ft downstream from bridge on EF Road, 1.3 mi north of Augusta.

DRAINAGE AREA.--38.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1965, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: June 6, 7, and Aug. 10. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 44.7 ft<sup>3</sup>/s, 15.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 560 ft<sup>3</sup>/s, June 27, 1978, gage height, 3.41 ft; minimum, 8.9 ft<sup>3</sup>/s, Jan. 26, 1978, result of freezeup; minimum gage height, 0.65 ft, Jan. 19, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 153 ft<sup>3</sup>/s, Nov. 28, gage height, 2.52 ft; minimum, 27 ft<sup>3</sup>/s, Sept. 7, gage height, 0.91 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	34	96	73	42	50	79	67	55	36	34	30
2	32	34	79	69	47	77	73	66	57	61	32	29
3	35	33	72	61	47	85	68	62	58	53	40	29
4	69	36	71	47	53	78	68	60	56	58	38	33
5	66	80	67	56	61	70	77	60	51	52	35	32
6	57	101	65	54	61	69	75	63	42	45	38	30
7	49	100	62	51	58	67	71	61	37	43	36	28
8	54	90	60	48	57	61	67	59	35	47	42	28
9	80	84	59	53	58	59	77	57	34	45	52	30
10	110	72	59	52	58	58	90	56	35	41	45	35
11	125	65	58	51	54	56	85	55	49	38	38	35
12	118	55	58	52	48	54	76	54	56	38	33	38
13	95	46	58	53	48	52	69	53	52	44	32	40
14	78	43	57	53	48	51	72	53	46	44	37	39
15	74	42	56	53	43	52	91	50	43	41	35	39
16	66	44	59	60	48	51	97	49	45	38	32	37
17	57	44	60	65	48	51	89	65	42	36	33	35
18	54	42	65	62	48	64	78	61	39	34	40	35
19	53	42	63	59	57	63	75	57	38	33	56	35
20	50	43	57	61	59	60	86	52	36	31	72	34
21	46	47	59	57	59	58	84	49	34	35	65	34
22	46	52	63	49	61	63	77	47	37	62	57	34
23	52	50	62	54	57	78	73	47	42	59	49	38
24	52	48	57	48	54	81	89	46	39	49	42	37
25	49	46	51	46	51	76	86	65	36	43	38	37
26	47	45	51	46	47	71	79	70	34	39	35	40
27	44	79	45	44	46	100	73	65	33	35	34	39
28	43	142	50	44	46	135	71	60	32	33	32	37
29	41	146	64	45	---	130	70	59	31	36	32	36
30	35	123	90	45	---	109	68	57	30	39	32	35
31	35	---	87	44	---	89	---	59	---	36	32	---
TOTAL	1846	1908	1960	1655	1464	2218	2333	1784	1254	1324	1248	1038
MEAN	59.5	63.6	63.2	53.4	52.3	71.5	77.8	57.5	41.8	42.7	40.3	34.6
MAX	125	146	96	73	61	135	97	70	58	62	72	40
MIN	32	33	45	44	42	50	67	46	30	31	32	28
CFSM	1.53	1.64	1.63	1.37	1.34	1.84	2.00	1.48	1.08	1.10	1.04	.89
IN.	1.77	1.82	1.87	1.58	1.40	2.12	2.23	1.71	1.20	1.27	1.19	.99
CAL YR 1990	TOTAL	18694	MEAN	51.2	MAX	146	MIN	26	CFSM	1.32	IN	17.88
WTR YR 1991	TOTAL	20032	MEAN	54.9	MAX	146	MIN	28	CFSM	1.41	IN	19.16

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04106000 KALAMAZOO RIVER AT COMSTOCK, MI

LOCATION.--Lat 42°17'08", long 85°30'50", in NE1/4 sec.19, T.2 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on River Street in Comstock, 0.2 mi downstream from Comstock Creek.

DRAINAGE AREA.--1,010 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--April to August 1931, October 1932 to December 1979, October 1984 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1933-36. WSP 1387: 1933, 1934(M), 1935, 1936(M), 1938(M), 1940(M), 1941.

GAGE.--Water-stage recorder. Datum of gage is 756.12 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1987, at datum 3.00 ft higher. Prior to November 1945, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant 1.2 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--54 years (water years 1933-79, 1985-91), 878 ft<sup>3</sup>/s, 11.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,910 ft<sup>3</sup>/s, Apr. 8, 1947, gage height, 7.94 ft, datum then in use; minimum, 119 ft<sup>3</sup>/s, May 29, 1958; minimum gage height, 0.09 ft, May 29, 1958, May 23, 1987, datum then in use; minimum daily discharge, 185 ft<sup>3</sup>/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,460 ft<sup>3</sup>/s, Dec. 2, gage height, 7.72 ft; minimum daily, 314 ft<sup>3</sup>/s, Sept. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	586	883	2960	2170	1070	1170	2470	1660	1090	586	654	667
2	598	823	3370	2430	1060	1290	2130	1570	1040	821	572	431
3	616	732	2830	2840	1100	1590	1910	1480	1020	889	646	485
4	882	885	2330	2430	1130	1740	1700	1430	1040	723	673	647
5	997	1140	2170	2140	1270	1740	1610	1350	1010	651	591	572
6	974	1830	2000	2040	1420	1750	1620	1320	969	628	585	637
7	852	1990	1890	1810	1540	1740	1550	1330	933	717	591	666
8	847	1930	1770	1460	1580	1650	1480	1370	945	645	651	495
9	1000	2040	1600	1470	1580	1550	1470	1370	815	788	791	552
10	1710	2130	1450	1420	1580	1500	1520	1340	703	753	948	563
11	1980	2080	1450	1360	1540	1440	1520	1250	750	572	877	558
12	1960	1950	1420	1370	1440	1310	1510	1170	879	641	625	629
13	1980	1660	1340	1360	1310	1240	1500	1140	949	651	534	565
14	2020	1400	1370	1320	1280	1220	1510	1260	829	643	627	314
15	2050	1310	1380	1340	1260	1160	1600	1270	784	804	571	916
16	1980	1300	1370	1380	1080	1110	1820	1180	780	616	523	680
17	1740	1230	1350	1480	1060	1100	1870	1160	831	543	545	580
18	1550	1130	1350	1520	1150	1140	1940	1170	780	592	628	506
19	1520	1100	1370	1540	1190	1280	1990	1080	742	563	717	576
20	1270	1070	1350	1600	1270	1360	2010	1040	708	543	814	527
21	1280	1070	1370	1670	1390	1340	2080	1000	632	576	994	511
22	1310	1070	1370	1450	1480	1340	2090	982	613	714	924	619
23	1190	1040	1390	1280	1560	1360	2200	973	822	786	970	586
24	1100	1030	1390	1390	1550	1470	2260	978	684	610	861	507
25	1080	1040	1270	1290	1480	1490	2230	1010	611	578	661	565
26	1060	1040	1010	1170	1380	1480	2150	1100	706	641	633	617
27	1030	1260	985	1140	1270	1640	1980	1200	641	606	632	628
28	1010	2140	988	1130	1210	2200	1900	1200	555	505	629	506
29	996	2430	1330	1250	---	2110	1840	1190	617	577	624	519
30	988	2570	2270	1290	---	2320	1760	1130	577	579	500	581
31	890	---	2400	1210	---	2520	---	1110	---	633	625	---
TOTAL	39046	43303	51893	48750	37230	47350	55220	37813	24055	20174	21216	17205
MEAN	1260	1443	1674	1573	1330	1527	1841	1220	802	651	684	574
MAX	2050	2570	3370	2840	1580	2520	2470	1660	1090	889	994	916
MIN	586	732	985	1130	1060	1100	1470	973	555	505	500	314
CFSM	1.25	1.43	1.66	1.56	1.32	1.51	1.82	1.21	.79	.65	.68	.57
IN.	1.44	1.59	1.91	1.80	1.37	1.74	2.03	1.39	.89	.74	.78	.63

CAL YR 1990 TOTAL 450301 MEAN 1234 MAX 3970 MIN 359 CFSM 1.22 IN 16.59  
WTR YR 1991 TOTAL 443255 MEAN 1214 MAX 3370 MIN 314 CFSM 1.20 IN 16.33

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04106180 PORTAGE CREEK AT PORTAGE, MI

LOCATION.--Lat 42°12'21", long 85°35'23", in SE1/4 sec.16, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 750 ft upstream from bridge on Westnedge Avenue in Portage.

DRAINAGE AREA.--16.5 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--9 years, 19.0 ft<sup>3</sup>/s, 15.64 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 118 ft<sup>3</sup>/s, May 31, 1989, gage height, 3.87 ft; minimum daily, 10 ft<sup>3</sup>/s, Sept. 15, 1988; minimum gage height, 1.79 ft, June 8, 9, 10, 16, 17, 18, 19, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 80 ft<sup>3</sup>/s, Nov. 28, gage height, 3.54 ft; minimum daily, 16 ft<sup>3</sup>/s, Oct. 1,2, Aug. 7, 16-18, 28, Sept. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	20	25	23	20	21	22	23	20	27	17	17
2	16	20	23	22	20	37	21	22	21	35	17	17
3	20	20	24	21	20	31	21	21	20	25	18	18
4	30	22	25	21	21	24	21	21	19	26	17	18
5	20	50	24	21	23	22	23	23	19	21	17	17
6	18	48	23	21	22	22	21	24	18	19	17	17
7	17	32	22	21	21	22	20	22	18	19	16	17
8	18	25	22	21	21	21	20	21	18	19	22	16
9	41	22	22	21	22	21	24	21	18	18	21	17
10	58	21	22	20	22	21	23	20	18	18	18	17
11	39	20	22	21	21	20	21	20	21	18	17	17
12	25	20	22	21	20	20	21	21	20	18	17	19
13	21	19	23	21	20	20	20	21	18	18	17	18
14	20	19	21	20	20	20	25	20	18	18	17	18
15	20	19	22	20	20	19	42	19	18	17	17	17
16	19	19	23	23	20	19	33	20	18	17	16	17
17	19	19	22	23	20	20	25	22	18	17	16	17
18	24	19	23	22	20	22	22	20	18	17	16	17
19	22	19	22	21	22	21	23	19	18	17	23	17
20	21	19	21	22	21	20	27	19	17	17	23	17
21	20	19	22	21	22	20	23	19	17	17	19	17
22	20	20	23	20	22	20	22	19	18	25	18	17
23	19	20	22	20	21	29	23	19	18	20	17	18
24	19	19	21	20	20	26	37	19	17	18	17	17
25	19	19	21	20	20	23	27	24	17	17	17	17
26	19	19	20	20	19	22	23	24	17	17	17	18
27	20	40	20	20	20	38	23	21	17	17	17	17
28	20	69	20	20	20	38	24	20	17	17	16	17
29	20	39	41	20	---	28	23	19	17	17	17	17
30	20	29	40	20	---	24	22	19	17	17	18	17
31	20	---	28	20	---	22	---	20	---	17	17	---
TOTAL	700	765	731	647	580	733	722	642	545	600	549	517
MEAN	22.6	25.5	23.6	20.9	20.7	23.6	24.1	20.7	18.2	19.4	17.7	17.2
MAX	58	69	41	23	23	38	42	24	21	35	23	19
MIN	16	19	20	20	19	19	20	19	17	17	16	16
CFSM	1.37	1.55	1.43	1.27	1.26	1.43	1.46	1.26	1.10	1.18	1.07	1.04
IN.	1.58	1.72	1.65	1.46	1.31	1.65	1.63	1.45	1.23	1.35	1.24	1.17
CAL YR 1990	TOTAL	7005	MEAN	19.2	MAX	69	MIN	14	CFSM	1.16	IN	15.79
WTR YR 1991	TOTAL	7731	MEAN	21.2	MAX	69	MIN	16	CFSM	1.29	IN	17.43

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04106300 PORTAGE CREEK NEAR KALAMAZOO, MI

LOCATION.--Lat 42°14'46", long 85°34'33", in SE1/4 sec.34, T.2 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 5 ft upstream from bridge on Lovers Lane, 3.0 mi south of Kalamazoo.

DRAINAGE AREA.--22.4 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 814.88 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow includes water which is pumped from ground-water sources by industry and discharged into stream 2.0 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 41.0 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 407 ft<sup>3</sup>/s, May 30, 1989, gage height, 3.09 ft; maximum gage height, 4.49 ft, June 26, 1978; minimum discharge, 8.0 ft<sup>3</sup>/s, Jan. 19, 1965, gage height, 0.88 ft, result of bridge construction upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 212 ft<sup>3</sup>/s, July 2, gage height, 2.30 ft; minimum daily, 29 ft<sup>3</sup>/s, Oct. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	41	51	45	39	51	57	63	54	69	48	44
2	29	41	46	47	40	88	55	59	61	125	48	43
3	38	41	51	45	42	66	50	57	55	61	54	48
4	87	45	51	44	46	57	58	57	50	67	47	49
5	44	128	49	45	50	54	62	66	50	53	46	47
6	36	94	49	43	48	52	56	65	46	50	45	46
7	33	63	46	42	45	46	54	59	46	49	45	46
8	39	55	44	41	46	49	55	59	46	49	71	45
9	101	53	44	42	49	49	71	60	46	48	59	49
10	131	51	47	41	46	49	60	62	47	49	49	48
11	80	47	46	42	42	49	55	60	60	50	47	46
12	57	47	47	43	41	49	54	59	49	49	46	57
13	48	45	47	42	41	48	54	59	46	49	47	49
14	45	44	43	44	41	48	67	57	46	49	47	49
15	50	44	47	44	39	49	108	56	46	47	48	50
16	45	45	46	52	37	47	78	60	36	48	47	50
17	44	40	45	50	39	50	63	67	35	48	46	51
18	57	39	47	46	40	59	59	57	47	47	45	53
19	48	42	44	46	43	52	62	54	43	47	70	52
20	43	43	43	46	45	50	68	53	49	46	58	47
21	40	44	46	43	52	51	59	52	43	48	52	46
22	40	46	44	41	54	52	58	52	49	78	50	44
23	41	43	41	41	50	79	63	53	48	58	49	50
24	43	41	39	40	48	64	96	52	44	51	45	45
25	41	41	37	41	48	53	69	66	46	48	44	45
26	42	42	39	40	47	56	62	59	46	49	46	47
27	41	102	39	40	47	98	59	52	46	47	46	44
28	39	148	40	41	48	90	66	50	45	46	46	44
29	41	78	95	41	---	66	63	49	45	52	48	43
30	43	60	74	40	---	59	59	50	44	50	49	45
31	39	---	53	40	---	54	---	58	---	48	46	---
TOTAL	1534	1693	1480	1338	1253	1784	1900	1782	1414	1675	1534	1422
MEAN	49.5	56.4	47.7	43.2	44.8	57.5	63.3	57.5	47.1	54.0	49.5	47.4
MAX	131	148	95	52	54	98	108	67	61	125	71	57
MIN	29	39	37	40	37	46	50	49	35	46	44	43
CAL YR 1990	TOTAL	16645	MEAN	45.6	MAX	148	MIN	24				
WTR YR 1991	TOTAL	18809	MEAN	51.5	MAX	148	MIN	29				



## STREAMS TRIBUTARY TO LAKE MICHIGAN

105

04106320 WEST FORK PORTAGE CREEK NEAR OSHTMO, MI

LOCATION.--Lat 42°14'07", long 85°38'54", in SE1/4 sec.1, T.3 S., R.12 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank at upstream side of culvert on 12th Street, 2.1 mi southeast of Oshtemo.

DRAINAGE AREA.--13.0 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.86 ft, Kalamazoo County Road Commission datum.

REMARKS.--Estimated daily discharges: Sept. 8-30. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--19 years, 6.42 ft<sup>3</sup>/s, 6.71 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26 ft<sup>3</sup>/s, Aug. 31, 1975, gage height, 2.15 ft; minimum, 0.38 ft<sup>3</sup>/s, July 14, 15, 1988, gage height, 0.89 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 16 ft<sup>3</sup>/s, Nov. 28; maximum gage height, 1.74 ft, Oct. 10; minimum daily discharge, 3.5 ft<sup>3</sup>/s, May 21, 22, June 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.5	4.5	9.7	9.0	5.0	5.5	8.3	5.9	4.3	4.1	4.2	5.0
2	4.4	4.5	8.0	7.9	5.0	7.6	8.0	5.7	4.5	6.0	4.1	4.8
3	4.7	4.3	7.5	7.5	5.1	8.8	7.6	5.2	4.4	6.1	4.7	4.7
4	7.9	4.5	7.6	7.4	5.3	8.5	7.4	5.0	4.0	7.1	4.5	4.6
5	8.6	8.1	7.4	6.7	5.6	7.9	8.0	5.1	3.9	6.6	4.4	4.5
6	8.4	11	7.1	6.0	5.7	7.6	7.6	5.7	3.7	6.1	4.3	4.3
7	7.4	10	6.7	5.8	5.6	7.2	7.0	6.0	3.7	5.8	4.2	4.2
8	6.8	8.6	6.5	5.6	5.5	6.5	6.5	5.9	3.7	5.5	5.1	4.2
9	8.6	7.4	6.6	5.5	5.5	6.3	7.0	5.7	3.7	5.1	6.0	4.3
10	13	6.6	6.8	5.4	5.5	6.1	7.4	5.2	4.0	4.8	5.9	4.4
11	14	5.8	6.8	5.5	5.3	6.1	7.2	4.9	4.7	4.6	5.5	4.8
12	12	5.3	6.7	5.7	5.2	6.2	6.7	4.7	4.9	4.4	5.0	5.3
13	11	5.0	6.8	5.7	5.2	6.2	6.2	4.6	4.9	4.5	4.7	5.2
14	9.1	5.0	6.3	5.7	5.3	6.1	6.6	4.4	4.8	4.4	4.5	5.2
15	8.3	5.0	6.3	5.5	5.2	6.1	9.3	4.1	4.8	4.2	4.3	5.1
16	7.4	4.9	6.4	5.9	5.2	5.8	10	4.1	4.7	4.2	4.2	5.0
17	6.8	4.8	6.5	6.3	5.2	5.8	9.2	4.3	4.4	4.1	4.2	4.9
18	7.0	4.6	6.8	6.2	5.2	6.5	8.1	4.1	4.3	4.0	4.1	4.8
19	6.7	4.5	6.5	6.1	5.6	6.7	7.4	3.9	4.1	4.1	4.6	4.6
20	6.4	4.4	6.3	6.0	5.8	6.6	7.5	3.8	4.0	3.9	5.8	4.4
21	5.9	4.3	6.2	5.9	5.9	6.4	7.1	3.5	3.9	3.9	6.3	4.4
22	5.8	4.7	6.4	5.7	6.0	6.0	6.6	3.5	3.9	5.0	6.2	4.7
23	5.5	4.7	6.3	5.6	5.7	7.0	6.4	3.6	3.8	5.3	5.9	4.6
24	5.3	4.7	6.3	5.5	5.6	7.6	8.1	3.7	3.8	5.2	5.5	4.5
25	5.0	4.6	6.3	5.5	5.4	7.2	8.0	4.0	3.9	5.1	5.2	4.7
26	4.8	4.3	6.3	5.5	5.3	6.9	7.4	4.4	4.0	4.9	5.0	4.4
27	4.7	8.0	6.3	5.4	5.3	8.8	6.8	4.5	3.9	4.8	4.8	4.3
28	4.5	15	5.5	5.0	5.2	11	6.6	4.3	3.8	4.6	4.6	4.2
29	4.4	14	7.4	4.9	---	10	6.4	4.1	3.6	4.5	4.8	4.1
30	4.3	12	9.7	4.9	---	9.3	6.2	3.9	3.5	4.4	5.5	4.0
31	4.3	---	9.6	5.0	---	8.7	---	4.3	---	4.3	5.4	---
TOTAL	217.5	195.1	215.6	184.3	151.4	223.0	222.6	142.1	123.6	151.6	153.5	138.2
MEAN	7.02	6.50	6.95	5.95	5.41	7.19	7.42	4.58	4.12	4.89	4.95	4.61
MAX	14	15	9.7	9.0	6.0	11	10	6.0	4.9	7.1	6.3	5.3
MIN	4.3	4.3	5.5	4.9	5.0	5.5	6.2	3.5	3.5	3.9	4.1	4.0
CFSM	.54	.50	.54	.46	.42	.55	.57	.35	.32	.38	.38	.36
IN.	.62	.56	.62	.53	.43	.64	.64	.41	.35	.43	.44	.40

CAL YR 1990 TOTAL 1991.0 MEAN 5.45 MAX 15 MIN 2.3 CFSM .42 IN 5.70  
WTR YR 1991 TOTAL 2118.5 MEAN 5.80 MAX 15 MIN 3.5 CFSM .45 IN 6.06

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04106400 WEST FORK PORTAGE CREEK AT KALAMAZOO, MI

LOCATION.--Lat 42°14'40", long 85°36'50", in NE1/4 sec.5, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 30 ft upstream from culvert on Oakland Drive, 2.5 mi upstream from mouth, and 3.7 mi southwest of main business district of Kalamazoo.

DRAINAGE AREA.--18.7 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1959 to current year.

GAGE.--Water-stage recorder and V-notch sharp-crested weir. Datum of gage is 858.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Jan. 23 to Feb. 22, Apr. 16-25, and June 28 to Aug. 8. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 9.70 ft<sup>3</sup>/s, 7.04 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 41 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 3.32 ft; minimum, 0.91 ft<sup>3</sup>/s, June 19, 20, 1988; minimum gage height, 0.88 ft, July 30, 1963, caused by construction.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 31 ft<sup>3</sup>/s, Nov. 28, gage height, 3.03 ft; minimum, 5.8 ft<sup>3</sup>/s, Oct. 1, 2, 3, gage height, 2.38 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.0	6.5	15	14	8.6	9.0	14	13	9.5	9.5	8.0	9.6
2	5.8	6.5	13	12	9.0	15	13	12	10	11	8.6	9.1
3	6.8	6.5	12	11	9.3	15	13	11	10	13	8.8	8.9
4	16	6.9	13	11	9.7	14	12	11	9.4	12	8.6	8.9
5	13	16	12	11	10	12	14	11	8.8	12	8.2	8.5
6	11	20	11	10	10	12	13	13	8.6	11	8.0	8.1
7	10	16	9.9	9.3	9.8	12	12	12	8.4	11	8.0	7.8
8	10	14	9.6	8.9	9.4	11	11	11	8.3	10	11	7.6
9	17	12	9.3	8.6	9.5	11	14	11	8.1	9.7	15	7.3
10	26	10	9.5	8.2	9.4	11	14	11	7.7	9.0	13	7.5
11	24	9.3	9.4	7.8	9.1	10	12	10	9.2	8.6	11	7.5
12	19	8.5	9.5	8.6	8.8	10	11	10	10	8.6	10	8.5
13	17	7.8	9.6	8.2	8.6	10	10	9.7	9.7	8.6	9.7	9.5
14	14	7.3	9.0	8.1	8.8	10	12	9.6	9.4	8.3	9.4	9.3
15	13	7.2	9.2	8.1	8.9	10	19	9.3	9.2	8.0	9.0	9.5
16	11	7.3	9.6	9.6	8.8	10	20	9.6	9.2	7.9	8.6	9.3
17	10	7.3	9.4	11	8.6	11	18	12	8.6	7.8	8.1	9.1
18	11	7.3	9.8	10	8.8	13	16	11	8.2	7.8	8.1	8.7
19	10	7.3	9.4	9.8	9.5	12	15	9.6	8.1	7.8	9.9	8.5
20	9.5	7.1	9.0	9.8	9.5	12	15	9.1	8.1	7.6	13	8.2
21	8.9	7.2	9.2	9.7	9.6	11	14	8.6	7.9	8.5	12	8.0
22	8.4	8.0	9.6	9.5	9.7	11	13	8.6	7.7	9.8	11	7.8
23	7.9	8.2	9.6	9.3	9.3	15	14	8.8	7.8	10	11	8.5
24	7.6	7.9	9.2	9.0	9.1	15	17	8.9	7.8	9.9	10	8.3
25	7.3	7.7	8.7	9.0	8.8	14	16	9.6	7.5	9.5	9.7	7.9
26	7.4	7.3	8.6	9.0	8.6	13	16	11	7.5	9.3	9.5	8.3
27	7.2	15	8.9	9.0	8.7	20	15	11	7.5	9.0	9.1	7.9
28	6.8	28	8.9	8.7	8.6	23	14	10	7.2	8.8	8.8	7.6
29	6.8	21	15	8.5	---	18	14	9.7	6.9	8.5	9.1	7.3
30	6.8	17	18	8.3	---	16	13	9.3	7.2	8.3	10	7.2
31	6.5	---	16	8.5	---	15	---	9.8	---	8.1	10	---
TOTAL	341.7	318.1	329.9	293.5	256.5	401.0	424	321.2	253.5	288.9	304.2	250.2
MEAN	11.0	10.6	10.6	9.47	9.16	12.9	14.1	10.4	8.45	9.32	9.81	8.34
MAX	26	28	18	14	10	23	20	13	10	13	15	9.6
MIN	5.8	6.5	8.6	7.8	8.6	9.0	10	8.6	6.9	7.6	8.0	7.2
CFSM	.59	.57	.57	.51	.49	.69	.75	.56	.45	.50	.53	.45
IN.	.68	.63	.66	.58	.51	.80	.84	.64	.50	.57	.61	.50

CAL YR 1990 TOTAL 3242.3 MEAN 8.88 MAX 28 MIN 4.0 CFSM .48 IN 6.45  
WTR YR 1991 TOTAL 3782.7 MEAN 10.4 MAX 28 MIN 5.8 CFSM .56 IN 7.52

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 42°35'36", long 85°59'03", in NE1/4 sec.5, T.2 N., R.14 W., Allegan County, Hydrologic Unit 04050003, on left bank 40 ft upstream from bridge on State Highway 89, 2.1 mi downstream from Swan Creek, 4.0 mi downstream from Calkins Dam, and 6.1 mi east of Fennville.

DRAINAGE AREA.--1,600 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1929 to September 1936, October 1937 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Allegan" April 1929 to September 1932; as "at Calkins Bridge, near Allegan" October 1932 to September 1936, and October 1937 to September 1938; as "at Calkins Dam, near Allegan" October 1938 to September 1950.

REVISED RECORDS.--WSP 1387: 1929(M), 1930, 1933, 1934-36(M), 1938(M), 1939-40, 1942.

GAGE.--Water-stage recorder. Datum of gage is 586.51 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). April 1929 to September 1936 at bridge and October 1937 to September 1950 in powerplant, 4.0 mi upstream at NGVD (levels by City of Allegan).

REMARKS.--Estimated daily discharge: Dec. 26. Water-discharge records good. Flow regulated by powerplants upstream from station and since June 1936 by Calkins Dam and powerplant, 4.0 mi upstream from station.

AVERAGE DISCHARGE.--61 years, 1,464 ft<sup>3</sup>/s, 12.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,500 ft<sup>3</sup>/s, Apr. 11, 1947, gage height, 606.76 ft, site and datum then in use; minimum daily, 50 ft<sup>3</sup>/s, Aug. 19, 1976, caused by shutting off flow at Calkins Dam.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,880 ft<sup>3</sup>/s, Nov. 29, gage height, 12.62 ft; minimum daily, 725 ft<sup>3</sup>/s, June 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1160	1410	3920	3440	1850	2010	3120	2580	1970	1210	928	770
2	884	1310	3850	3550	1860	2130	3310	2440	1890	1340	1100	908
3	1030	1440	4310	3040	1750	3110	3140	2510	1640	1460	1110	1010
4	1200	1510	4420	3080	1710	3350	2710	2310	1710	1640	1020	937
5	1730	2030	4110	3530	1980	2940	2470	2260	1630	1380	1050	896
6	1730	3540	3230	3230	2260	2660	2540	2310	1510	1010	1030	896
7	1580	4000	3240	3350	2350	2530	2390	2140	1460	998	975	884
8	1650	3420	2960	2780	2300	2760	2400	2050	1430	1200	1000	905
9	2010	3270	2820	2300	2290	2560	2670	2190	1410	1370	1230	985
10	2150	2890	2590	2270	2340	2540	3250	2140	1370	920	1450	1010
11	3430	2970	2460	2270	2340	2450	3080	2090	1490	1160	962	986
12	4300	2970	2330	2260	2330	2250	2460	2020	1570	968	1440	949
13	3540	2870	2330	2210	2300	2140	2480	1830	1530	892	1190	1010
14	2950	2610	2320	2160	2080	2010	2520	1800	1440	1020	826	1210
15	2750	2360	2320	2110	1870	1920	3140	1790	1440	1100	783	950
16	2820	1950	2330	2210	1880	1890	4130	1830	1320	1190	1150	1080
17	2850	1990	2310	2320	1920	1850	4050	1880	1270	1090	996	1050
18	2630	2070	2360	2420	1850	1860	3160	2020	1310	969	947	988
19	2760	1840	2340	2550	1830	1890	3080	1830	1190	776	979	929
20	2430	1710	2360	2400	1990	2070	3090	1750	1190	1010	1530	775
21	2090	1910	2270	2570	2170	2080	3180	1460	1220	1010	1630	798
22	1890	1990	2250	2460	2140	2020	2980	1650	1180	1170	1300	882
23	1850	1820	2300	2520	2200	2150	2980	1680	1160	1340	1330	933
24	1950	1870	2300	2110	2320	2270	3260	1750	1160	1230	1270	1140
25	1660	1760	2290	1950	2290	2480	3340	1700	1160	1040	1310	915
26	1630	1730	2200	2040	2230	2370	3470	1910	1150	961	1020	788
27	1680	2160	1890	2040	2020	2620	3070	1880	1020	949	875	1050
28	1600	4630	1720	1900	2040	3130	2980	1820	1300	950	978	1090
29	1480	5620	2260	1730	---	3780	2880	1770	927	975	1020	875
30	1500	5290	3270	1870	---	3580	2690	1740	725	866	1230	930
31	1470	---	3940	2170	---	3240	---	1830	---	875	1240	---
TOTAL	64384	76940	85600	76840	58490	76640	90020	60960	40772	34069	34899	28529
MEAN	2077	2565	2761	2479	2089	2472	3001	1966	1359	1099	1126	951
MAX	4300	5620	4420	3550	2350	3780	4130	2580	1970	1640	1630	1210
MIN	884	1310	1720	1730	1710	1850	2390	1460	725	776	783	770
CFSM	1.30	1.60	1.73	1.55	1.31	1.55	1.88	1.23	.85	.69	.70	.59
IN.	1.50	1.79	1.99	1.79	1.36	1.78	2.09	1.42	.95	.79	.81	.66

CAL YR 1990 TOTAL 727473 MEAN 1993 MAX 5620 MIN 714 CFSM 1.25 IN 16.91  
WTR YR 1991 TOTAL 728143 MEAN 1995 MAX 5620 MIN 725 CFSM 1.25 IN 16.93

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04108500 KALAMAZOO RIVER NEAR FENNIVILLE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 09...	1100	3360	500	8.2	6.0	7.5	11.4	94	--	K690
JAN 30...	1400	1870	620	8.3	0.5	4.0	13.6	97	140	29
APR 18...	1300	3110	443	8.3	12.0	21	10.0	95	K72	200
MAY 22...	1130	1640	554	8.5	22.0	4.9	12.1	141	K34	K1200
JUL 31...	1330	908	548	8.4	23.5	3.8	8.4	101	K13	4000
SEP 26...	1130	788	617	8.6	14.0	4.2	11.2	112	K20	360

DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD HCO3 (MG/L AS) (00453)	CAR-BONATE WATER DIS IT FIELD CO3 (MG/L AS) (00452)	ALKA-LINITY WAT DIS TOT IT FIELD CACO3 (MG/L AS) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
NOV 09...	230	38	64	18	16	2.6	239	--	196	35
JAN 30...	280	56	77	22	21	2.5	276	--	226	42
APR 18...	210	32	57	16	13	2.1	215	--	176	29
MAY 22...	260	39	69	21	21	2.1	254	7	220	34
JUL 31...	230	44	55	22	29	2.2	220	2	184	45
SEP 26...	260	44	68	23	29	2.6	249	10	220	51

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
NOV 09...	27	<0.1	8.4	301	0.41	2730	0.03	0.02	2.1	2.1
JAN 30...	33	0.2	9.5	367	0.50	1850	0.02	0.01	1.6	1.5
APR 18...	21	0.2	6.1	282	0.38	2370	0.03	0.02	0.93	0.92
MAY 22...	31	0.2	5.7	309	0.42	1370	0.03	<0.01	0.64	<0.05
JUL 31...	42	0.2	0.8	303	0.41	743	0.03	0.02	0.32	0.34
SEP 26...	42	0.2	0.94	351	0.48	747	0.02	0.02	0.68	0.69



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
NOV 09...	0.03	0.03	0.7	0.13	0.05	0.04	0.04	20	1	54
JAN 30...	0.09	0.08	0.6	0.03	<0.01	0.01	<0.01	--	--	--
APR 18...	0.06	0.05	0.9	0.16	0.02	0.04	0.01	10	<1	49
MAY 22...	0.03	<0.01	1	0.06	0.01	<0.01	<0.01	10	1	67
JUL 31...	0.14	0.14	1.1	0.12	0.02	<0.01	<0.01	--	--	--
SEP 26...	0.04	0.03	0.9	0.08	<0.01	<0.01	<0.01	<10	--	62

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
NOV 09...	<0.5	<1	2	<3	1	98	1	5	20	<0.1
JAN 30...	--	--	--	--	--	--	--	--	--	--
APR 18...	0.6	<1	<1	<3	2	26	<1	<4	25	<0.1
MAY 22...	<0.5	<1	1	<3	2	8	<1	5	1	<0.1
JUL 31...	--	--	--	--	--	--	--	--	--	--
SEP 26...	--	--	--	<3	--	6	--	9	3	--

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 09...	<10	1	<1	<1	110	<6	13	16	145	82
JAN 30...	--	--	--	--	--	--	--	3	15	76
APR 18...	<10	2	<1	<1	110	<6	<3	37	311	97
MAY 22...	<10	<1	<1	<1	130	<6	<3	25	111	84
JUL 31...	--	--	--	--	--	--	--	18	44	98
SEP 26...	<10	2	<1	<1	130	<6	--	19	40	90

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04108600 RABBIT RIVER NEAR HOPKINS, MI

LOCATION.--Lat 42°38'32", long 85°43'19", in SE1/4 sec.16, T.3 N., R.12 W., Allegan County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on 18th Street, 2.5 mi northeast of Hopkins.

DRAINAGE AREA.--71.4 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 3-15, Jan. 22 to Feb. 3, and Feb. 11-17. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 58.9 ft<sup>3</sup>/s, 11.20 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft<sup>3</sup>/s, May 31, 1989, gage height, 9.57 ft, from floodmark; minimum not determined; minimum daily, 9.2 ft<sup>3</sup>/s, Aug. 27, 28, 1970, Sept. 18, 1971, Aug. 7, 1987; minimum gage height, 1.68 ft, Aug. 8, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	2200	498	7.70	Dec. 29	2200	498	7.70
Nov. 6	0100	776	8.28	Apr. 9	2000	428	7.51
Nov. 28	0700	*1,140	*8.82	Apr. 15	1800	565	7.86

Minimum daily discharge, 22 ft<sup>3</sup>/s, Sept. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	44	206	166	49	59	91	82	55	27	33	23
2	25	43	152	132	54	186	82	78	52	38	30	23
3	25	43	126	97	61	240	76	72	58	32	32	23
4	58	43	119	89	87	162	72	68	63	29	31	28
5	53	300	109	78	119	111	83	67	45	28	29	27
6	42	599	100	72	110	106	80	83	41	27	28	25
7	35	339	96	67	97	103	73	76	39	28	27	24
8	33	231	92	64	90	84	68	70	38	41	32	23
9	88	151	89	62	95	81	247	74	36	34	63	23
10	305	114	88	59	92	81	323	72	35	30	47	33
11	349	96	82	58	68	76	223	64	93	29	37	32
12	235	89	78	58	60	71	140	60	100	28	33	27
13	143	78	77	59	55	68	110	57	65	30	30	29
14	97	71	71	60	53	64	117	53	51	30	29	27
15	135	67	69	66	52	60	346	51	50	29	28	28
16	104	63	80	89	52	58	395	49	46	27	27	26
17	83	58	78	126	53	58	262	53	41	26	27	26
18	120	55	98	106	56	83	172	50	38	26	34	25
19	140	53	88	97	98	85	131	48	36	25	30	25
20	100	51	77	136	108	74	125	46	34	24	30	24
21	79	63	75	112	101	70	115	44	33	55	29	24
22	68	138	95	90	105	67	104	42	32	79	28	23
23	61	120	85	82	83	69	95	45	34	72	27	25
24	58	93	71	74	73	109	130	58	32	51	26	25
25	55	75	68	68	64	96	140	67	30	39	25	24
26	52	64	66	62	55	92	114	91	29	34	25	26
27	50	190	65	58	55	158	98	86	29	32	24	25
28	48	996	64	55	55	224	94	65	28	30	24	23
29	46	503	246	52	---	182	90	56	27	33	24	23
30	45	295	371	49	---	121	89	52	26	49	24	22
31	45	---	246	47	---	98	---	56	---	38	25	---
TOTAL	2802	5125	3427	2490	2100	3196	4285	1935	1316	1100	938	761
MEAN	90.4	171	111	80.3	75.0	103	143	62.4	43.9	35.5	30.3	25.4
MAX	349	996	371	166	119	240	395	91	100	79	63	33
MIN	25	43	64	47	49	58	68	42	26	24	24	22
CFSM	1.27	2.40	1.56	1.13	1.05	1.44	2.00	.87	.62	.50	.42	.36
IN.	1.46	2.67	1.79	1.30	1.09	1.67	2.23	1.01	.69	.57	.49	.40

CAL YR 1990	TOTAL	28742	MEAN	78.7	MAX	996	MIN	22	CFSM	1.10	IN	14.97
WTR YR 1991	TOTAL	29475	MEAN	80.8	MAX	996	MIN	22	CFSM	1.13	IN	15.36

STREAMS TRIBUTARY TO LAKE MICHIGAN

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04108800 MACATAWA RIVER NEAR ZEELAND, MI

LOCATION.--Lat 42°46'40", long 86°01'06", in NW1/4 sec.31, T.5 N., R.14 W., Ottawa County, Hydrologic Unit 04050002, on left bank 20 ft upstream from bridge on State Road, 0.2 mi downstream from South Branch, and 2.5 mi south of Zeeland.

DRAINAGE AREA.--65.8 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1960 to current year. Prior to October 1978, published as Black River near Zeeland.

GAGE.--Water-stage recorder. Datum of gage is 585.7 ft above National Geodetic Vertical Datum of 1929 (levels by Gove Associates, Inc.).

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 4-15, Jan. 22 to Feb. 3, and Feb. 11-18, 25-28. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 69.4 ft<sup>3</sup>/s, 14.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,220 ft<sup>3</sup>/s, May 11, 1981, gage height, 15.81 ft; minimum, 0.83 ft<sup>3</sup>/s, Aug. 3, 1988; minimum gage height, 1.61 ft, Sept. 3, 1983.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 6	0400	*3,080	*13.03	Mar. 28	0700	1,190	10.63
Nov. 28	1000	3,030	12.98	Apr. 9	2000	1,400	11.09
Dec. 29	2200	2,380	12.33	Apr. 15	2100	1,600	11.45

Minimum discharge, 2.5 ft<sup>3</sup>/s, July 20, Sept. 8, gage height, 1.74 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.2	19	200	238	25	46	62	39	44	5.6	7.7	2.9
2	5.2	18	79	80	23	517	47	33	45	14	6.3	3.3
3	5.6	17	62	54	40	506	40	29	34	7.8	9.5	4.7
4	33	18	67	46	151	166	38	26	19	5.7	6.4	6.1
5	16	782	62	39	224	74	47	58	14	4.6	5.8	3.7
6	9.9	2340	84	37	134	90	41	188	12	4.1	5.0	3.2
7	9.0	926	100	36	100	79	35	63	11	5.2	4.6	3.1
8	14	442	134	35	76	42	75	43	9.9	7.3	23	2.8
9	105	226	142	32	86	49	859	78	9.0	4.9	31	3.0
10	481	121	248	30	73	76	749	48	8.6	4.4	11	8.0
11	640	83	100	31	35	62	228	34	9.8	3.6	7.5	4.3
12	310	93	72	31	32	43	79	29	10	4.1	6.3	4.9
13	139	64	70	31	28	35	58	25	7.9	5.3	8.1	4.7
14	70	52	46	31	27	32	138	23	7.0	4.7	6.6	4.5
15	345	48	51	34	24	29	837	19	8.0	4.3	5.1	4.7
16	155	43	201	112	22	27	939	18	7.3	6.7	4.9	4.0
17	66	37	100	271	21	28	312	19	6.4	6.2	5.8	3.5
18	319	35	210	149	22	103	95	18	5.5	6.0	5.5	3.6
19	286	33	104	137	182	74	61	16	5.2	5.0	5.8	3.6
20	107	31	60	393	224	43	52	14	4.9	3.0	5.2	3.7
21	58	59	68	209	237	37	44	13	4.5	32	4.6	3.4
22	46	184	210	110	202	62	40	13	4.9	106	3.9	3.4
23	38	95	111	85	69	106	37	14	6.0	64	3.6	3.7
24	33	64	65	70	44	285	108	15	5.1	14	3.4	3.4
25	30	44	62	57	33	102	55	19	4.4	9.1	3.3	3.7
26	27	36	55	43	31	214	40	154	4.1	7.0	3.4	4.3
27	25	378	51	36	29	500	59	53	3.8	5.7	3.2	3.7
28	23	2270	46	31	28	955	188	28	3.8	5.2	3.3	3.5
29	21	1020	1010	29	---	349	70	20	3.6	37	3.2	3.7
30	21	424	1430	26	---	102	58	18	3.5	25	3.3	3.7
31	20	---	511	24	---	64	---	28	---	11	3.2	---
TOTAL	3462.9	10002	5811	2567	2222	4897	5491	1195	322.2	428.5	209.5	118.8
MEAN	112	333	187	82.8	79.4	158	183	38.5	10.7	13.8	6.76	3.96
MAX	640	2340	1430	393	237	955	939	188	45	106	31	8.0
MIN	5.2	17	46	24	21	27	35	13	3.5	3.0	3.2	2.8
CFSM	1.70	5.06	2.84	1.26	1.21	2.40	2.78	.59	.16	.21	.10	.06
IN.	1.96	5.65	3.29	1.45	1.26	2.77	3.10	.68	.18	.24	.12	.07

CAL YR 1990	TOTAL	41479.1	MEAN	114	MAX	2340	MIN	3.7	CFSM	1.73	IN	23.45
WTR YR 1991	TOTAL	36726.9	MEAN	101	MAX	2340	MIN	2.8	CFSM	1.54	IN	20.76

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04109000 GRAND RIVER AT JACKSON, MI

LOCATION.--Lat 42°17'05", long 84°24'30", in sec.22, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, on left bank on grounds of sewage-treatment plant, 1 mi north of Jackson, 2.2 mi upstream from Portage River, and at mile 216.

DRAINAGE AREA.--174 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1935 to current year.

REVISED RECORDS.--WSP 974: 1937(M). WSP 1387: 1936. WSP 1727: 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft, Fargo Engineering Co. datum. Prior to Sept. 24, 1935, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 25 to Feb. 2 and July 22 to Aug. 13. Records good except for estimated daily discharges, which are poor. Slight regulation by mills upstream from station. Flow includes about 20 ft<sup>3</sup>/s as sewage effluent, which originates from ground-water sources, from the City of Jackson. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--56 years, 125 ft<sup>3</sup>/s, 9.76 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,070 ft<sup>3</sup>/s, June 25, 1937, gage height, 13.50 ft; maximum gage height, 15.44 ft, June 25, 1968; minimum discharge, 9.2 ft<sup>3</sup>/s, Aug. 22, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 636 ft<sup>3</sup>/s, Aug. 30, gage height, 12.59 ft; minimum daily, 45 ft<sup>3</sup>/s, Sept. 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	113	122	192	249	145	222	197	254	100	56	75	78
2	99	122	182	267	145	216	192	223	162	66	66	69
3	98	121	211	322	151	217	187	206	128	60	62	109
4	183	124	209	320	158	211	187	194	150	63	60	95
5	132	246	203	333	176	209	186	198	152	77	58	77
6	121	222	201	318	187	213	176	203	149	61	56	71
7	118	216	197	303	193	215	170	195	146	102	56	64
8	120	215	190	326	196	207	185	187	139	88	75	61
9	242	220	184	334	199	202	192	185	131	73	110	74
10	346	220	181	307	200	199	189	177	135	68	95	79
11	284	218	177	294	197	196	180	139	154	65	85	97
12	286	222	173	282	185	192	169	127	139	69	78	96
13	286	219	172	270	184	186	163	124	129	73	72	96
14	291	214	164	265	177	179	170	159	107	62	67	94
15	299	211	161	259	167	170	199	171	120	60	93	91
16	297	200	157	291	172	192	186	173	112	60	76	88
17	292	184	165	277	199	203	186	169	107	59	106	66
18	317	169	163	266	198	219	186	162	104	58	106	60
19	309	163	162	272	228	211	207	158	99	57	147	60
20	303	156	199	275	226	208	280	156	94	53	129	57
21	286	151	235	267	232	215	258	150	90	54	84	55
22	273	151	226	249	241	184	258	143	89	60	78	51
23	260	146	222	250	246	174	262	134	85	70	76	57
24	247	140	196	222	246	168	278	137	83	65	73	54
25	201	138	184	205	246	169	333	132	79	60	72	54
26	162	141	192	190	242	176	344	155	64	56	73	54
27	150	218	154	170	236	179	331	143	63	55	71	49
28	140	272	124	160	227	196	320	138	61	54	69	47
29	134	239	337	155	---	205	311	109	59	70	69	45
30	130	204	297	150	---	198	295	99	55	95	142	47
31	125	---	253	145	---	196	---	117	---	85	102	---
TOTAL	6644	5584	6063	7993	5599	6127	6777	5017	3285	2054	2581	2095
MEAN	214	186	196	258	200	198	226	162	110	66.3	83.3	69.8
MAX	346	272	337	334	246	222	344	254	162	102	147	109
MIN	98	121	124	145	145	168	163	99	55	53	56	45
CFSM	1.23	1.07	1.13	1.48	1.15	1.14	1.30	.93	.63	.38	.48	.40
IN.	1.42	1.19	1.30	1.71	1.20	1.31	1.45	1.07	.70	.44	.55	.45
CAL YR 1990	TOTAL	68805	MEAN	189	MAX	551	MIN	61	CFSM	1.09	IN	14.71
WTR YR 1991	TOTAL	59819	MEAN	164	MAX	346	MIN	45	CFSM	.94	IN	12.79



STREAMS TRIBUTARY TO LAKE MICHIGAN

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04111500 DEER CREEK NEAR DANSVILLE, MI

LOCATION.--Lat 42°36'30", long 84°19'15", in SE1/4 NE1/4 sec.33, T.3 N., R.1 E., Ingham County, Hydrologic Unit 04050004, on right bank 15 ft upstream from bridge on Clark Road, 3.5 mi north of Dansville, and 7.2 mi upstream from mouth.

DRAINAGE AREA.--16.3 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1954 to current year.

REVISED RECORDS.--WSP 1727: 1954(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 889.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 4-28, Jan. 3-15, Jan. 21 to Feb. 3, and Feb. 11-17. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 11.0 ft<sup>3</sup>/s, 9.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 962 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 12.18 ft, from floodmark, from rating curve extended above 610 ft<sup>3</sup>/s; minimum, 0.04 ft<sup>3</sup>/s, Sept. 8, 9, 12, 1978, gage height, 2.58 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 5	2400	126	4.99	Dec. 30	0100	160	5.54
Nov. 28	1000	*181	*5.88				

Minimum daily discharge, 0.25 ft<sup>3</sup>/s, July 27, 28; minimum gage height, 2.69 ft, Sept. 16, 17, 18, 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	3.5	32	37	6.7	11	18	16	3.3	.97	.38	.66
2	1.2	3.5	24	27	7.2	44	15	14	7.9	1.1	.34	.68
3	1.1	3.3	21	19	9.5	52	13	13	8.3	.89	.44	.62
4	1.7	3.4	26	15	21	29	13	12	6.0	1.3	.43	.68
5	1.6	45	22	13	34	28	19	12	4.7	.87	.37	.65
6	1.3	103	18	12	27	42	18	18	4.0	.72	.33	.56
7	1.2	53	17	11	22	34	15	14	3.5	.87	.29	.50
8	1.2	31	16	10	20	22	13	13	3.2	1.6	.67	.49
9	6.2	23	20	9.5	21	20	22	12	2.8	.91	1.3	.49
10	44	19	27	9.0	20	18	59	11	2.6	.76	.65	.51
11	40	15	20	9.0	12	15	29	9.8	6.1	.70	.49	.48
12	19	13	17	9.0	9.0	14	21	9.3	6.3	.67	.44	.45
13	13	12	15	9.0	8.0	13	18	8.9	4.4	.80	.39	.47
14	11	11	13	9.5	7.5	12	18	9.3	3.6	.69	.38	.51
15	9.5	10	12	10	7.0	11	62	7.9	3.5	.54	.34	.49
16	8.8	9.4	14	16	7.5	11	61	7.0	3.7	.48	.35	.41
17	7.6	8.8	16	25	8.0	11	33	8.2	3.2	.45	.43	.37
18	8.1	8.1	20	22	8.7	19	23	7.3	2.8	.44	.55	.38
19	8.0	7.9	16	20	28	19	20	6.6	2.5	.38	2.3	.38
20	7.1	7.3	18	35	37	16	77	5.9	2.2	.33	7.0	.40
21	6.4	7.2	25	23	34	15	58	5.3	1.9	.42	3.2	.40
22	5.8	8.1	37	17	40	15	39	4.9	2.1	.60	1.8	.41
23	5.4	8.6	25	12	24	15	28	4.4	2.3	.47	1.6	.50
24	4.9	7.9	16	11	18	16	35	4.5	1.7	.31	1.4	.52
25	4.4	7.3	13	9.8	15	14	30	4.6	1.5	.28	1.3	.52
26	4.2	6.5	11	9.2	13	13	24	8.4	1.3	.26	1.1	.55
27	4.1	21	10	8.5	12	25	20	7.2	1.2	.25	.89	.50
28	3.9	150	11	7.8	10	63	23	5.4	1.1	.25	.71	.47
29	3.6	81	79	7.2	---	36	21	4.6	1.0	.53	.67	.48
30	3.6	47	124	6.8	---	24	20	4.2	.98	1.2	.67	.47
31	3.6	---	62	6.7	---	20	---	3.7	---	.56	.72	---
TOTAL	242.7	734.8	797	446.0	487.1	697	865	272.4	99.68	20.60	31.93	15.00
MEAN	7.83	24.5	25.7	14.4	17.4	22.5	28.8	8.79	3.32	.66	1.03	.50
MAX	44	150	124	37	40	63	77	18	8.3	1.6	7.0	.68
MIN	1.1	3.3	10	6.7	6.7	11	13	3.7	.98	.25	.29	.37
CFSM	.48	1.50	1.58	.88	1.07	1.38	1.77	.54	.20	.04	.06	.03
IN.	.55	1.68	1.82	1.02	1.11	1.59	1.97	.62	.23	.05	.07	.03

CAL YR 1990	TOTAL	5668.51	MEAN	15.5	MAX	168	MIN	.45	CFSM	.95	IN	12.94
WTR YR 1991	TOTAL	4709.21	MEAN	12.9	MAX	150	MIN	.25	CFSM	.79	IN	10.75

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04112000 SLOAN CREEK NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'33", long 84°21'50", in SE1/4 NE1/4 sec.1, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 30 ft downstream from culvert on Meridian Road, 2.1 mi upstream from mouth, and 4.2 mi west of Williamston.

DRAINAGE AREA.--9.34 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1954 to current year.

GAGE.--Water-stage recorder and concrete control with V-notch sharp-crested weir. Datum of gage is 862.12 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Oct. 1-3, Jan. 3-14, Jan. 21 to Feb. 4, Feb. 13-18, June 30, July 25, Aug. 31 to Sept. 9, and Sept. 12-30. Records good except for discharges less than 1.0 ft<sup>3</sup>/s and estimated daily discharges, which are poor. At times, low flow is affected by pumpage for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 5.73 ft<sup>3</sup>/s, 8.33 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft<sup>3</sup>/s, Apr. 18, 1975, gage height, 9.99 ft, from rating curve extended above 660 ft<sup>3</sup>/s on basis of computation of peak flow through culvert and over road embankment; minimum, 0.01 ft<sup>3</sup>/s, Sept. 11, 1954, Jan. 18, 1957, Aug. 3, 1988; minimum gage height, 1.10 ft, Sept. 11, 1954, Jan. 18, 1957.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 28	0600	*152	*4.17	No other peak greater than base discharge.			
Minimum daily discharge, 0.07 ft <sup>3</sup> /s, Sept. 16-18, 30; minimum gage height, 1.27 ft, Sept. 30.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.25	1.2	20	22	2.1	4.6	12	6.4	1.9	.40	.16	.12
2	.25	1.1	13	14	2.2	28	8.6	5.3	6.5	.47	.15	.12
3	.25	1.1	12	8.5	3.5	28	7.4	4.6	11	.42	.19	.13
4	.72	1.1	13	6.5	11	15	6.8	4.2	5.1	.58	.19	.13
5	.77	35	9.9	5.7	23	15	11	4.3	3.4	.44	.16	.12
6	.65	59	8.4	5.0	16	28	9.6	5.2	2.5	.43	.14	.11
7	.62	31	7.5	4.7	12	21	7.7	4.7	1.9	.52	.16	.10
8	.68	20	6.9	4.3	10	11	6.6	4.1	1.7	2.6	.55	.09
9	2.6	14	7.9	4.0	11	8.9	10	3.9	1.4	1.2	.88	.09
10	28	8.9	12	3.8	10	7.9	20	3.6	1.2	.69	.46	.09
11	22	6.9	9.2	3.7	6.9	7.1	10	3.3	4.9	.52	.33	.09
12	9.5	5.7	7.9	3.7	5.3	6.3	7.5	3.1	6.0	.42	.29	.09
13	5.9	4.9	7.2	3.6	4.6	5.7	6.5	2.9	3.3	.46	.27	.09
14	4.4	4.5	5.7	3.6	3.4	5.0	6.3	2.7	2.4	.40	.28	.09
15	4.2	4.3	5.5	3.7	3.1	4.5	38	2.4	3.5	.30	.27	.08
16	3.6	4.1	6.4	6.1	2.9	4.2	30	2.2	2.6	.24	.26	.07
17	3.1	3.4	6.6	11	2.9	4.0	17	2.4	2.0	.22	.36	.07
18	3.2	3.1	9.0	9.8	3.1	8.6	11	2.2	1.6	.20	.26	.07
19	3.2	2.9	7.2	9.3	18	8.7	8.8	1.9	1.3	.18	.27	.08
20	2.8	2.6	6.0	23	24	6.9	41	1.8	1.1	.17	.25	.08
21	2.6	2.6	8.3	11	25	6.2	27	1.7	.91	.21	.20	.08
22	2.4	2.7	17	6.5	27	5.4	19	1.5	1.4	.33	.20	.09
23	2.1	2.7	11	5.0	14	5.4	13	1.4	1.5	.22	.20	.09
24	2.0	2.6	8.2	4.2	9.1	5.4	19	2.2	1.0	.18	.19	.10
25	1.8	2.4	6.6	3.7	6.9	4.8	15	11	.88	.17	.21	.10
26	1.6	2.1	5.4	3.4	5.7	4.6	11	17	.75	.16	.15	.09
27	1.5	17	4.6	3.1	4.9	49	8.9	8.8	.62	.15	.13	.09
28	1.4	97	4.7	2.8	4.3	68	16	4.8	.50	.16	.12	.09
29	1.3	44	53	2.6	---	36	11	3.5	.45	.31	.13	.08
30	1.2	28	64	2.4	---	24	7.8	2.8	.39	.31	.12	.07
31	1.2	---	34	2.2	---	16	---	2.3	---	.21	.13	---
TOTAL	115.79	415.9	398.1	202.9	271.9	453.2	423.5	128.2	73.70	13.27	7.66	2.79
MEAN	3.74	13.9	12.8	6.55	9.71	14.6	14.1	4.14	2.46	.43	.25	.093
MAX	28	97	64	23	27	68	41	17	11	2.6	.88	.13
MIN	.25	1.1	4.6	2.2	2.1	4.0	6.3	1.4	.39	.15	.12	.07
CFSM	.40	1.49	1.37	.70	1.04	1.56	1.51	.44	.26	.05	.03	.01
IN.	.46	1.66	1.59	.81	1.08	1.80	1.69	.51	.29	.05	.03	.01
CAL YR 1990	TOTAL	2627.88	MEAN	7.20	MAX	97	MIN	.10	CFSM	.77	IN	10.47
WTR YR 1991	TOTAL	2506.91	MEAN	6.87	MAX	97	MIN	.07	CFSM	.74	IN	9.98

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04112500 RED CEDAR RIVER AT EAST LANSING, MI

LOCATION.--Lat 42°43'40", long 84°28'40", in SW1/4 sec.18, T.4 N., R.1 W., Ingham County, Hydrologic Unit 04050004, in left downstream bridge abutment of Farm Lane Bridge on Michigan State University Campus in East Lansing, 4.0 mi upstream from Sycamore Creek, and 5.6 mi upstream from mouth.

DRAINAGE AREA.--355 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1902 to December 1903, March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Red Cedar River at Agricultural College, August 1902 to December 1903 and as Cedar River at East Lansing, March 1931 to September 1965. Gage-height records collected in this vicinity 1911-19, and 1920-28 (flood seasons only), are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1936(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 824.39 ft above National Geodetic Vertical Datum of 1929. August 1902 to December 1903 nonrecording gage at site 0.8 mi downstream at different datum. March 1931 to November 1940 water-stage recorder at site 250 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Jan. 1, 3-7, 21-27. Records good except for estimated daily discharges, which are fair. Prior to April 1975, occasional regulation at low flow by mill at Williamston, 16 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--61 years, 210 ft<sup>3</sup>/s, 8.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,940 ft<sup>3</sup>/s, Apr. 20, 1975, gage height, 11.95 ft; minimum, 3 ft<sup>3</sup>/s, July 31, 1931.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 24, 1904, reached a stage of 13.4 ft, discharge, 8,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,150 ft<sup>3</sup>/s, Nov. 29, gage height, 5.74 ft; maximum gage height, 5.84 ft, Jan. 1, backwater from ice; minimum daily discharge, 24 ft<sup>3</sup>/s, Sept. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48	98	849	1000	149	237	490	433	122	52	47	31
2	46	95	660	892	156	381	423	365	122	66	40	29
3	51	92	539	700	167	600	359	312	201	71	50	32
4	75	98	493	550	229	628	322	267	204	91	39	33
5	56	284	458	450	404	568	349	255	180	80	38	28
6	55	737	419	400	501	594	356	287	162	69	35	29
7	53	837	381	350	450	684	327	308	139	84	33	27
8	53	761	347	299	411	651	290	287	116	106	102	24
9	123	634	322	306	402	542	346	267	102	97	135	26
10	312	522	341	270	402	469	488	248	90	74	95	34
11	485	435	345	228	360	411	553	230	131	63	72	31
12	459	368	329	199	273	356	495	217	172	55	56	29
13	394	316	314	235	279	313	441	219	159	55	48	30
14	324	268	281	247	235	277	404	207	125	56	42	32
15	293	231	259	236	161	253	506	200	114	52	39	31
16	258	209	269	253	147	235	727	190	117	48	35	30
17	231	193	276	336	215	229	716	186	109	42	47	28
18	217	181	297	396	207	242	601	179	95	40	58	26
19	198	170	309	392	275	286	504	171	82	37	71	26
20	188	162	283	440	516	320	613	158	74	37	62	25
21	176	159	274	440	588	316	799	145	69	38	76	26
22	162	165	332	370	644	290	871	132	104	43	63	25
23	149	170	362	340	633	282	823	123	101	46	52	29
24	142	168	332	310	552	292	790	125	90	41	45	26
25	134	161	209	280	460	291	778	162	76	37	41	26
26	125	152	226	240	385	278	719	195	68	33	39	27
27	115	229	217	220	311	388	634	239	63	32	35	27
28	109	854	243	205	262	822	613	205	58	30	32	26
29	105	1120	427	189	---	884	572	174	54	60	31	26
30	103	1050	979	177	---	730	511	150	52	63	36	25
31	101	---	1090	166	---	579	---	137	---	60	34	---
TOTAL	5340	10919	12462	11116	9774	13428	16420	6773	3351	1758	1628	844
MEAN	172	364	402	359	349	433	547	218	112	56.7	52.5	28.1
MAX	485	1120	1090	1000	644	884	871	433	204	106	135	34
MIN	46	92	209	166	147	229	290	123	52	30	31	24
CFSM	.49	1.03	1.13	1.01	.98	1.22	1.54	.61	.32	.16	.15	.08
IN.	.56	1.14	1.31	1.16	1.02	1.41	1.72	.71	.35	.18	.17	.09

CAL YR 1990 TOTAL 106387 MEAN 291 MAX 1690 MIN 26 CFSM .82 IN 11.15  
WTR YR 1991 TOTAL 93813 MEAN 257 MAX 1120 MIN 24 CFSM .72 IN 9.83

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04113000 GRAND RIVER AT LANSING, MI

LOCATION.--Lat 42°45'02", long 84°33'19", in NW1/4 sec.9, T.4 N., R.2 W., Ingham County, Hydrologic Unit 04050004, on right bank 30 ft upstream from bridge on North Grand River Avenue in Lansing, 2.0 mi downstream from Red Cedar River, and at mile 152.

DRAINAGE AREA.--1,230 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1901 to September 1906, October 1934 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at North Lansing" 1901-6. Gage-height records collected in this vicinity 1907-10 (flood seasons only), 1911-19, 1920-28 (flood seasons only), and since 1931 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1174: 1949. WSP 1387: 1901, 1903-4, 1935, 1937, 1942.

GAGE.--Water-stage recorder. Datum of gage is 805.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to August 1906, nonrecording gage at same site at different datum. November 1934 to June 1949 water-stage recorder at site 1.8 mi downstream at datum 2.42 ft lower.

REMARKS.--No estimated daily discharges. Records good. Large diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--62 years, 851 ft<sup>3</sup>/s, 9.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,500 ft<sup>3</sup>/s, Mar. 26, 1904, gage height, 18.60 ft, datum then in use, from rating curve extended above 15,000 ft<sup>3</sup>/s; minimum, 2.8 ft<sup>3</sup>/s, Sept. 9, 1963, gage height, 0.85 ft; minimum daily, 20 ft<sup>3</sup>/s, Aug. 25, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 26, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,930 ft<sup>3</sup>/s, Nov. 28, gage height, 8.55 ft; minimum daily, 136 ft<sup>3</sup>/s, Sept. 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	361	737	2870	2880	938	1330	1940	1940	570	168	286	221
2	350	687	2390	3200	980	1800	1730	1700	629	361	278	270
3	414	611	1910	2630	1050	2260	1620	1610	710	216	276	285
4	651	681	1860	1990	1170	2320	1540	1530	926	319	231	289
5	203	1640	1790	1780	1610	2130	1580	1420	908	294	317	247
6	478	2430	1630	1850	1890	2140	1630	1510	860	308	245	229
7	443	2590	1630	1720	1800	2250	1530	1450	829	335	206	283
8	454	2330	1460	1420	1730	2080	1420	1440	577	398	406	243
9	893	2030	1440	1650	1760	1910	1890	1410	629	405	495	234
10	1620	1950	1410	1440	1720	1810	1910	1280	570	308	423	267
11	1920	1590	1430	1390	1660	1650	1950	1240	891	346	450	193
12	1830	1490	1400	1230	1380	1550	1800	1170	609	302	340	171
13	1930	1360	1320	1410	1410	1450	1640	1080	758	233	266	273
14	1790	1220	1260	1450	1360	1420	1570	1050	584	231	177	270
15	1630	1150	1200	1390	977	1320	1960	1030	539	332	214	284
16	1410	1120	1250	1480	785	1260	2640	838	553	285	229	178
17	1330	1050	1220	1640	1100	1240	2270	928	464	285	320	215
18	1340	1000	1230	1680	1310	1410	2020	904	440	254	414	274
19	1100	958	1270	1880	1490	1470	2040	879	496	154	519	221
20	1190	965	1310	1920	1780	1500	2290	751	348	205	635	170
21	1180	891	1140	1900	1820	1430	2800	687	404	214	510	231
22	1060	932	1370	1460	2070	1530	2810	736	506	243	524	146
23	1080	917	1400	1550	2190	1510	2880	612	406	308	386	167
24	988	887	1320	1540	1960	1550	2730	659	436	207	380	136
25	943	855	999	1250	1790	1460	2730	713	299	157	264	188
26	932	821	988	1230	1600	1450	2470	856	369	182	332	218
27	891	1210	811	1230	1450	1870	2400	964	279	219	262	213
28	820	3280	1030	1200	1450	3150	2390	870	301	190	207	161
29	792	3350	1730	1160	---	3100	2200	795	256	299	226	215
30	778	3220	3150	1190	---	2680	2090	739	276	311	285	186
31	703	---	3210	1020	---	2150	---	700	---	260	235	---
TOTAL	31504	43952	48428	50760	42230	56180	62470	33491	16422	8329	10338	6678
MEAN	1016	1465	1562	1637	1508	1812	2082	1080	547	269	333	223
MAX	1930	3350	3210	3200	2190	3150	2880	1940	926	405	635	289
MIN	203	611	811	1020	785	1240	1420	612	256	154	177	136
CFSM	.83	1.19	1.27	1.33	1.23	1.47	1.69	.88	.45	.22	.27	.18
IN.	.95	1.33	1.46	1.54	1.28	1.70	1.89	1.01	.50	.25	.31	.20

CAL YR 1990 TOTAL 430993 MEAN 1181 MAX 5230 MIN 162 CFSM .96 IN 13.03  
WTR YR 1991 TOTAL 410782 MEAN 1125 MAX 3350 MIN 136 CFSM .92 IN 12.42



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04114000 GRAND RIVER AT PORTLAND, MI

LOCATION.--Lat 42°51'23", long 84°54'44", in NW1/4 sec.4, T.5 N., R.5 W., Ionia County, Hydrologic Unit 04050004, on left bank at downstream side of bridge on Kent Street, 1.0 mi south of Portland, 1.9 mi upstream from Looking Glass River, and at mile 115.

DRAINAGE AREA.--1,385 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1952 to March 1982, June 1988 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 705.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 6, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 26-30 and Jan. 25-30. Records good except for estimated daily discharges, which are fair. Slight diurnal fluctuation caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--32 years (water years 1953-81, 1989-91), 943 ft<sup>3</sup>/s, 9.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft<sup>3</sup>/s, Apr. 21, 1975, gage height, 12.98 ft; minimum, 38 ft<sup>3</sup>/s, Oct. 10, 1963; minimum daily, 58 ft<sup>3</sup>/s, Oct. 9, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,000 ft<sup>3</sup>/s, Nov. 29, gage height, 9.38 ft; maximum gage height, 10.66 ft, Jan. 28, backwater from ice; minimum daily discharge, 203 ft<sup>3</sup>/s, Sept. 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	519	833	3950	4100	1180	1460	2390	2240	758	342	325	322
2	430	886	3460	3420	996	2030	2060	2070	668	276	340	254
3	431	809	2720	3440	1100	3090	1850	1770	750	438	384	325
4	791	759	2420	2940	1230	2860	1720	1660	824	317	361	353
5	804	1510	2250	2460	1600	2650	1810	1580	976	399	286	355
6	380	3630	2130	2090	2080	2440	1750	1640	939	387	381	318
7	596	3540	2000	2110	2090	2550	1730	1600	906	376	301	280
8	555	3240	1920	2020	1980	2380	1650	1550	861	492	328	343
9	929	2900	1810	1630	1890	2210	1790	1520	647	489	817	300
10	2090	2430	1790	1700	1960	2040	2820	1460	696	485	643	334
11	3050	2200	1790	1640	1820	1880	2310	1360	791	383	543	351
12	2590	1910	1760	1560	1700	1700	2170	1290	1180	428	533	276
13	2360	1730	1720	1460	1440	1650	1960	1220	753	401	428	223
14	2300	1580	1580	1600	1470	1510	1770	1200	847	312	354	333
15	2190	1480	1540	1630	1350	1490	2180	1090	708	295	245	368
16	1910	1360	1520	1600	1090	1360	3110	1100	682	387	261	334
17	1710	1290	1510	1810	938	1330	2920	942	640	357	312	268
18	1620	1260	1620	1950	1210	1430	2640	1100	570	352	467	246
19	1570	1190	1600	1930	1470	1580	2160	943	547	322	649	337
20	1340	1120	1490	2160	1820	1610	2500	950	586	227	649	299
21	1430	1150	1560	2280	2010	1570	2790	826	467	243	737	208
22	1370	1110	1640	2240	2170	1540	3050	796	510	329	601	289
23	1250	1130	1760	1760	2200	1590	3050	819	683	395	613	214
24	1240	1100	1670	1710	2240	1720	3280	705	510	400	466	229
25	1170	1060	1680	1650	1920	1670	3180	809	534	294	460	203
26	1090	1010	1200	1400	1810	1540	2930	889	416	209	346	228
27	1100	1500	1150	1350	1630	1870	2700	938	450	224	412	244
28	1050	4040	1150	1350	1510	3520	2670	1040	372	261	350	265
29	953	4870	1300	1300	---	3940	2600	896	418	264	265	240
30	948	4440	2500	1300	---	3330	2380	872	337	404	302	244
31	926	---	4190	1240	---	2920	---	840	---	396	328	---
TOTAL	40692	57067	60380	60830	45904	64460	71920	37715	20026	10884	13487	8583
MEAN	1313	1902	1948	1962	1639	2079	2397	1217	668	351	435	286
MAX	3050	4870	4190	4100	2240	3940	3280	2240	1180	492	817	368
MIN	380	759	1150	1240	938	1330	1650	705	337	209	245	203
CFSM	.95	1.37	1.41	1.42	1.18	1.50	1.73	.88	.48	.25	.31	.21
IN.	1.09	1.53	1.62	1.63	1.23	1.73	1.93	1.01	.54	.29	.36	.23

CAL YR 1990 TOTAL 521685 MEAN 1429 MAX 6150 MIN 234 CFSM 1.03 IN 14.01  
WTR YR 1991 TOTAL 491948 MEAN 1348 MAX 4870 MIN 203 CFSM .97 IN 13.21

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04114500 LOOKING GLASS RIVER NEAR EAGLE, MI

LOCATION.--Lat 42°49'45", long 84°46'40", in sec.10, T.5 N., R.4 W., Clinton County, Hydrologic Unit 04050004, on right bank at upstream side of former bridge site on Hinman Road, 1.5 mi northeast of Eagle, and 10 mi upstream from mouth.

DRAINAGE AREA.--281 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1387: 1946-47.

GAGE.--Water-stage recorder. Datum of gage is 747.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 2, 1962, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 31 to Feb. 4, Feb. 16-18, and Feb. 23 to Mar. 1. Records good except for estimated daily discharges, which are fair. Small intermittent diversion at times into Lake Geneva when discharge is above 50 ft<sup>3</sup>/s. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 180 ft<sup>3</sup>/s, 8.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,860 ft<sup>3</sup>/s, Apr. 5, 1947, gage height, 7.70 ft, from graph based on gage readings, from rating curve extended above 1,900 ft<sup>3</sup>/s; maximum gage height, 9.9 ft, Mar. 7, 1956, from floodmark, backwater from ice; minimum discharge, 10 ft<sup>3</sup>/s, July 28, 1965, gage height, 1.01 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,620 ft<sup>3</sup>/s, Nov. 28, gage height, 5.93 ft; minimum daily, 34 ft<sup>3</sup>/s, Sept. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	45	104	522	465	210	325	400	571	149	70	53	39
2	43	99	505	400	210	654	407	546	147	70	54	39
3	47	101	528	365	210	813	411	519	150	73	63	39
4	91	99	573	335	240	623	406	496	141	73	60	40
5	92	518	588	310	297	564	433	475	143	71	57	39
6	68	836	588	300	299	616	420	474	151	68	57	39
7	61	573	575	280	289	625	385	439	158	68	51	37
8	60	443	551	265	294	575	363	399	158	83	66	37
9	143	403	526	255	336	560	567	375	150	79	96	37
10	480	407	517	250	347	539	636	353	136	69	93	46
11	455	430	485	240	345	517	536	331	211	67	72	42
12	324	455	451	235	368	489	461	312	206	69	66	40
13	259	469	424	235	352	457	441	292	152	78	61	39
14	244	471	391	235	336	423	455	279	138	74	57	39
15	274	460	375	235	275	389	747	256	154	68	58	40
16	276	432	376	240	215	358	755	237	161	63	51	39
17	277	404	362	245	220	331	633	298	139	61	50	38
18	281	372	368	250	230	343	548	226	127	62	59	39
19	274	340	351	260	285	330	525	197	118	58	77	37
20	258	308	329	260	324	308	641	179	109	54	108	35
21	239	283	331	245	318	299	610	166	110	52	88	34
22	219	268	374	235	353	294	565	154	104	62	73	35
23	198	251	356	230	315	303	530	144	113	58	70	37
24	182	232	335	225	300	320	617	137	104	54	60	37
25	167	217	336	220	290	313	598	131	97	50	55	41
26	152	204	305	220	280	302	568	158	95	48	51	38
27	140	478	281	215	280	416	548	149	89	46	48	37
28	130	1350	299	215	290	714	662	140	84	44	46	36
29	120	807	494	215	---	521	664	140	78	50	47	37
30	113	603	634	210	---	428	610	144	76	57	42	37
31	108	---	545	210	---	397	---	155	---	54	41	---
TOTAL	5820	12417	13675	8100	8108	14146	16142	8872	3948	1953	1930	1149
MEAN	188	414	441	261	290	456	538	286	132	63.0	62.3	38.3
MAX	480	1350	634	465	368	813	755	571	211	83	108	46
MIN	43	99	281	210	210	294	363	131	76	44	41	34
CFSM	.67	1.47	1.57	.93	1.03	1.62	1.92	1.02	.47	.22	.22	.14
IN.	.77	1.64	1.81	1.07	1.07	1.87	2.14	1.17	.52	.26	.26	.15
CAL YR 1990	TOTAL	96947	MEAN	266	MAX	1350	MIN	35	CFSM	.95	IN	12.83
WTR YR 1991	TOTAL	96260	MEAN	264	MAX	1350	MIN	34	CFSM	.94	IN	12.74

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04115000 MAPLE RIVER AT MAPLE RAPIDS, MI

LOCATION.--Lat 43°06'35", long 84°41'35", in sec.5, T.8 N., R.3 W., Clinton County, Hydrologic Unit 04050005, on right bank at downstream side of bridge on Maple Road in Maple Rapids, 50 ft upstream from Pine Creek, and 0.8 mi upstream from Hayworth Creek. Records include flow of Pine Creek.

DRAINAGE AREA.--434 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1707: 1956.

GAGE.--Water-stage recorder. Datum of gage is 642.58 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 4, 1968, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 1-15, 25, 26, Feb. 16, 25-27, and Mar. 3 to Apr. 2. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 273 ft<sup>3</sup>/s, 8.54 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,770 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 12.33 ft, from floodmark, caused by dam failure on Rainbow Lake (Pine Creek); minimum, 4.4 ft<sup>3</sup>/s, Aug. 13, 1965, gage height, 1.62 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in March 1904 reached a stage of 13.8 ft, from information by local resident.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,930 ft<sup>3</sup>/s, Nov. 30, gage height, 9.07 ft; minimum daily, 17 ft<sup>3</sup>/s, Sept. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	47	287	1910	990	200	373	1100	1580	303	87	60	30
2	47	269	1750	980	183	466	920	1330	320	82	55	28
3	48	265	1560	880	180	660	819	1140	358	77	60	27
4	130	250	1320	790	241	840	736	982	362	71	63	29
5	210	344	1130	700	359	1000	679	869	352	65	62	29
6	233	963	1000	640	456	940	636	797	326	63	57	28
7	235	1550	898	580	533	920	602	721	295	68	51	26
8	220	1780	824	530	559	890	577	674	262	89	50	26
9	226	1740	765	480	572	860	727	625	233	96	53	24
10	314	1580	760	440	568	800	1280	578	205	93	53	23
11	651	1380	759	400	543	720	1570	547	190	80	50	22
12	931	1200	743	380	499	650	1500	528	184	71	47	18
13	1210	1040	721	360	446	600	1300	499	173	85	43	17
14	1310	920	693	340	406	560	1140	461	158	98	40	21
15	1260	821	652	325	368	520	1210	420	170	95	38	26
16	1190	738	612	318	325	490	1800	385	234	84	36	28
17	1090	670	581	321	286	450	1830	379	269	73	37	30
18	1030	607	581	328	263	455	1600	372	280	66	43	28
19	965	569	604	338	274	460	1340	350	266	59	48	28
20	882	520	602	362	351	470	1220	322	244	53	51	27
21	798	476	582	397	414	480	1140	294	220	51	57	26
22	719	447	593	424	516	480	1060	266	211	72	56	25
23	647	425	630	408	569	480	982	242	236	129	52	26
24	582	414	629	389	574	500	985	224	232	123	46	28
25	530	399	588	360	530	530	1020	214	216	99	41	27
26	481	389	539	330	480	520	1020	251	196	76	38	28
27	432	449	493	299	440	510	965	314	173	62	37	29
28	395	972	452	272	404	800	969	370	145	53	36	29
29	365	1730	507	250	---	1300	1520	377	119	52	34	29
30	337	1910	776	230	---	1500	1730	355	102	60	32	25
31	312	---	934	215	---	1400	---	331	---	63	33	---
TOTAL	17827	25104	25188	14056	11539	21624	33977	16797	7034	2395	1459	787
MEAN	575	837	813	453	412	698	1133	542	234	77.3	47.1	26.2
MAX	1310	1910	1910	990	574	1500	1830	1580	362	129	63	30
MIN	47	250	452	215	180	373	577	214	102	51	32	17
CFSM	1.33	1.93	1.87	1.04	.95	1.61	2.61	1.25	.54	.18	.11	.06
IN.	1.53	2.15	2.16	1.20	.99	1.85	2.91	1.44	.60	.21	.13	.07
CAL YR 1990	TOTAL	154725	MEAN	424	MAX	3340	MIN	24	CFSM	.98	IN	13.26
WTR YR 1991	TOTAL	177787	MEAN	487	MAX	1910	MIN	17	CFSM	1.12	IN	15.24

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04115265 FISH CREEK NEAR CRYSTAL, MI

LOCATION.--Lat 43°14'59", long 84°58'52", in NW1/4 NE1/4 sec.23, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, on left bank 10 ft downstream from bridge on Sidney Road, 3.5 mi southwest of Crystal.

DRAINAGE AREA.--50.5 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 795 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 31, Jan. 1, 4, 8, 12, 22, Jan. 25 to Feb. 1, and Feb. 16. Records good. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 204 ft<sup>3</sup>/s, Mar. 15, 1989, gage height, 5.42 ft; maximum gage height, 5.53 ft, Mar. 12, 1990; minimum discharge, 7.0 ft<sup>3</sup>/s, July 10, 14, 1988, gage height, 2.27 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 151 ft<sup>3</sup>/s, Nov. 28, gage height, 4.85 ft; minimum daily, 15 ft<sup>3</sup>/s, Oct. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	27	51	40	25	30	49	53	36	27	24	18
2	15	27	44	36	26	92	45	48	41	30	27	18
3	16	27	42	33	28	112	43	46	40	29	30	20
4	32	29	43	29	34	59	42	44	33	26	27	22
5	26	78	41	31	46	50	48	45	31	25	24	20
6	22	143	40	31	43	57	48	64	30	23	21	19
7	20	93	38	30	39	53	48	54	29	23	19	18
8	22	55	38	28	37	43	62	48	28	26	24	18
9	52	44	38	30	39	43	132	57	27	24	31	18
10	94	41	44	30	36	44	134	58	26	22	25	24
11	121	38	40	29	31	42	88	47	33	21	22	22
12	59	36	39	30	29	40	68	46	31	28	21	21
13	41	34	43	31	28	38	60	53	28	47	20	21
14	37	33	35	31	28	36	65	42	27	33	19	21
15	60	34	35	32	27	37	106	38	58	27	18	26
16	44	33	38	33	27	37	129	36	55	25	19	30
17	49	32	39	34	27	39	84	39	38	24	20	25
18	50	30	46	33	29	55	67	38	32	22	22	23
19	43	30	40	33	46	54	60	36	30	20	41	23
20	36	29	35	35	55	47	61	34	27	20	47	22
21	33	35	36	32	51	46	57	33	26	22	27	22
22	32	48	44	30	55	46	54	32	55	38	24	21
23	31	39	38	32	39	55	50	40	55	88	23	22
24	30	35	32	28	35	72	54	40	36	33	22	22
25	29	33	32	27	31	55	51	46	31	27	21	22
26	28	30	30	27	29	46	48	64	29	24	20	23
27	28	51	29	27	27	66	47	59	27	22	20	22
28	28	137	30	26	28	114	62	42	27	21	19	24
29	27	110	65	25	---	86	72	36	26	31	19	24
30	27	63	90	25	---	61	64	34	25	40	19	23
31	27	---	47	26	---	52	---	35	---	28	19	---
TOTAL	1174	1474	1282	944	975	1707	1998	1387	1017	896	734	654
MEAN	37.9	49.1	41.4	30.5	34.8	55.1	66.6	44.7	33.9	28.9	23.7	21.8
MAX	121	143	90	40	55	114	134	64	58	88	47	30
MIN	15	27	29	25	25	30	42	32	25	20	18	18
CFSM	.75	.97	.82	.60	.69	1.09	1.32	.89	.67	.57	.47	.43
IN.	.86	1.09	.94	.70	.72	1.26	1.47	1.02	.75	.66	.54	.48
CAL YR 1990	TOTAL	12123	MEAN	33.2	MAX	181	MIN	12	CFSM	.66	IN	8.93
WTR YR 1991	TOTAL	14242	MEAN	39.0	MAX	143	MIN	15	CFSM	.77	IN	10.49



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04116000 GRAND RIVER AT IONIA, MI

LOCATION.--Lat 42°58'20", long 85°04'13", in NW1/4 sec.30, T.7 N., R.6 W., Ionia County, Hydrologic Unit 04050006, on left bank 15 ft downstream from bridge on State Highway 66 in Ionia, 2.7 mi downstream from Prairie Creek, and at mile 87.

DRAINAGE AREA.--2,840 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March to June 1931, July and September 1931 (fragmentary), July 1951 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 615.38 ft above National Geodetic Vertical Datum of 1929. Mar. 19 to Sept. 24, 1931, nonrecording gage at site 1.5 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Diurnal fluctuation below about 5,000 ft<sup>3</sup>/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--40 years (water years 1952-91), 1,997 ft<sup>3</sup>/s, 9.55 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,500 ft<sup>3</sup>/s, Apr. 1, 1960, gage height, 23.43 ft; minimum, 40 ft<sup>3</sup>/s, May 13, 1968, gage height, 5.61 ft; minimum daily, 109 ft<sup>3</sup>/s, July 16, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 12,100 ft<sup>3</sup>/s, Nov. 30, gage height, 20.09 ft; minimum, 395 ft<sup>3</sup>/s, Sept. 3, 25, gage height, 7.26 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	723	1850	10600	7290	2980	3040	5910	5580	1740	823	838	482
2	742	1660	9070	6790	2790	3830	5140	5460	1730	808	716	602
3	715	1770	7840	6220	2250	6220	4540	4990	1730	791	785	451
4	1070	1540	6780	5740	2430	6760	4140	4630	1860	789	770	493
5	1750	2570	6000	4660	3220	6360	4000	4260	1980	763	740	634
6	1290	6600	5460	4470	3620	6050	3950	4110	1950	747	568	627
7	985	8540	4970	4370	3940	6030	3790	3940	1860	828	716	504
8	1020	8770	4580	3680	3790	5890	3640	3620	1800	918	724	519
9	1420	8120	4350	3730	3750	5500	4390	3600	1550	1060	932	515
10	3240	7140	4190	3460	3780	5050	6680	3440	1470	1120	1300	665
11	5560	6210	4220	3390	3710	4620	7630	3250	1680	784	938	636
12	5810	5480	4110	3070	3260	4210	7100	3110	1930	785	798	516
13	5610	4770	3980	2760	3160	3970	6300	2870	1960	833	810	497
14	5330	4360	3790	3120	3000	3670	5650	2640	1390	863	675	486
15	5060	4000	3590	3090	2870	3390	5920	2670	1490	841	654	520
16	4910	3710	3480	3010	2380	3290	7820	2350	1680	803	532	723
17	4410	3300	3440	2990	2090	3060	8620	2480	1650	767	524	543
18	4160	3170	3520	3170	2400	3060	8020	2470	1490	741	789	509
19	4040	2970	3570	3240	2660	3240	7070	2170	1320	717	945	522
20	3770	2730	3530	3550	3390	3370	6500	2290	1280	561	1180	533
21	3350	2630	3440	3810	3660	3300	6470	1880	1300	542	1040	531
22	3350	2800	3730	3370	4050	3180	6310	1790	1240	578	1030	473
23	3000	2660	3720	3020	4150	3300	6000	1790	1310	879	875	512
24	2900	2610	3700	2930	3970	3600	6340	1730	1330	700	824	501
25	2710	2420	3350	3100	3910	3690	6860	1680	1240	941	802	464
26	2320	2430	2980	2750	3520	3500	6440	2190	1170	773	672	503
27	2440	3140	2660	2410	3250	3770	5880	2020	1120	568	650	489
28	2290	7060	2730	2850	3010	6080	5510	1870	985	501	528	470
29	2030	10900	3760	2500	---	7580	5540	2060	903	573	613	472
30	2240	11800	6370	2520	---	7580	5550	1860	853	809	624	492
31	1580	---	7310	2490	---	6770	---	1930	---	642	480	---
TOTAL	89825	137710	144820	113550	90990	142960	177710	90730	44991	23848	24072	15884
MEAN	2898	4590	4672	3663	3250	4612	5924	2927	1500	769	777	529
MAX	5810	11800	10600	7290	4150	7580	8620	5580	1980	1120	1300	723
MIN	715	1540	2660	2410	2090	3040	3640	1680	853	501	480	451
CFSM	1.02	1.62	1.65	1.29	1.14	1.62	2.09	1.03	.53	.27	.27	.19
IN.	1.18	1.80	1.90	1.49	1.19	1.87	2.33	1.19	.59	.31	.32	.21
CAL YR 1990	TOTAL	1053028	MEAN	2885	MAX	13500	MIN	485	CFSM	1.02	IN	13.79
WTR YR 1991	TOTAL	1097090	MEAN	3006	MAX	11800	MIN	451	CFSM	1.06	IN	14.37

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04118000 THORNAPPLE RIVER NEAR CALEDONIA, MI

LOCATION.--Lat 42°48'40", long 85°29'00", in NW1/4 sec.22, T.5 N., R.10 W., Kent County, Hydrologic Unit 04050007, on right bank 200 ft downstream from LaBarge powerplant, 200 ft upstream from 84th Street, 2.3 mi northeast of Caledonia, and 3.3 mi downstream from Coldwater River.

DRAINAGE AREA.--773 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to September 1938, October 1951 to March 1982, October 1983 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1931-36. WSP 1307: 1931-37.

GAGE.--Water-stage recorder. Datum of gage is 676.31 ft, Consumers Power Co. datum. Oct. 1, 1930, to Sept. 30, 1938, nonrecording gage at same site and at National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 4. Records good except for estimated daily discharges, which are fair. Prior to Dec. 1, 1958, and since Oct. 1, 1983, large diurnal fluctuation at low and medium flow, and occasional regulation during high flow, caused by powerplant upstream from station; occasional fluctuation during the interim period. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--46 years (water years 1931-38, 1952-81, 1984-91), 610 ft<sup>3</sup>/s, 10.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft<sup>3</sup>/s, Feb. 27, 1985, gage height, 11.43 ft; minimum, 1.0 ft<sup>3</sup>/s, May 28, 1968, gage height, 1.40 ft, result of regulation during bridge construction.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1947, reached a stage of 14.4 ft, from information by powerplant operator.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,680 ft<sup>3</sup>/s, Dec. 1, gage height, 9.44 ft; minimum daily, 238 ft<sup>3</sup>/s, Sept. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	296	525	4580	2500	627	706	2620	1420	553	348	356	356
2	317	526	4310	2400	641	1150	2310	1200	545	372	324	302
3	351	507	3780	2100	650	2030	2110	1160	521	340	361	238
4	455	533	3350	1850	673	2190	1700	1040	484	324	358	354
5	602	1150	2690	1690	940	2230	1590	971	500	304	298	288
6	676	2500	2150	1520	1270	2240	1410	981	463	334	335	331
7	729	2960	1850	1260	1410	2220	1270	967	439	323	277	259
8	704	3140	1660	1010	1460	1990	1220	933	413	407	380	311
9	695	3240	1460	1010	1460	1790	1720	909	393	365	570	262
10	1520	3110	1360	919	1410	1590	2210	851	405	373	469	373
11	2270	2910	1290	878	1230	1400	2200	799	462	358	477	346
12	2450	2480	1230	829	1090	1190	2160	768	652	345	391	295
13	2880	2030	1200	837	981	1060	2060	719	625	349	379	373
14	2950	1760	1120	824	889	940	2130	701	595	359	334	391
15	2790	1500	1060	828	800	872	2530	664	583	361	340	301
16	2500	1210	1060	858	698	816	2770	644	515	288	281	360
17	2130	1070	1030	924	691	782	2620	655	493	379	346	315
18	2110	940	1040	948	677	826	2460	649	479	254	410	353
19	1510	859	1130	1000	741	908	2290	644	413	335	464	290
20	1330	792	1070	1090	869	944	2340	638	449	248	487	322
21	1230	766	1050	1100	993	968	2210	617	357	396	488	281
22	1090	836	1100	917	1140	948	2060	506	412	521	458	279
23	961	834	1080	975	1160	933	1970	538	349	679	394	311
24	855	804	1020	903	1110	1110	2370	586	452	545	370	292
25	788	771	900	816	1010	1180	2570	589	358	487	361	328
26	691	734	791	780	894	1190	2270	726	372	404	334	331
27	641	1210	833	762	798	1460	2150	775	352	375	290	326
28	676	3330	1120	747	738	2270	1900	762	301	368	319	277
29	632	4140	2010	738	---	2710	1820	711	343	311	290	322
30	618	4380	2250	702	---	2870	1640	620	325	417	349	331
31	511	---	2350	647	---	2830	---	599	---	385	263	---
TOTAL	37958	51547	52924	34362	27050	46343	62680	24342	13603	11654	11553	9498
MEAN	1224	1718	1707	1108	966	1495	2089	785	453	376	373	317
MAX	2950	4380	4580	2500	1460	2870	2770	1420	652	679	570	391
MIN	296	507	791	647	627	706	1220	506	301	248	263	238
CFSM	1.58	2.22	2.21	1.43	1.25	1.93	2.70	1.02	.59	.49	.48	.41
IN.	1.83	2.48	2.55	1.65	1.30	2.23	3.02	1.17	.65	.56	.56	.46

CAL YR 1990 TOTAL 348799 MEAN 956 MAX 4580 MIN 236 CFSM 1.24 IN 16.79  
WTR YR 1991 TOTAL 383514 MEAN 1051 MAX 4580 MIN 238 CFSM 1.36 IN 18.46

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04118500 ROGUE RIVER NEAR ROCKFORD, MI

LOCATION.--Lat 43°04'56", long 85°35'27", in NE1/4 sec.15, T.8 N., R.11 W., Kent County, Hydrologic Unit 04050006, on left bank at downstream side of bridge on Packer Drive, 2.2 mi upstream from mouth, and 3.0 mi southwest of Rockford.

DRAINAGE AREA.--234 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1952 to September 1982, October 1987 to current year.

GAGE.--Water-stage recorder. Datum of gage is 624.80 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.). Prior to Aug. 30, 1952, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 3-14, Jan. 20 to Feb. 2, and Feb. 10-12, 15, 16. Records good except for estimated daily discharges, which are fair. Some diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--34 years, 238 ft<sup>3</sup>/s, 13.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,540 ft<sup>3</sup>/s, Mar. 6, 1976, gage height, 9.29 ft; minimum, 28 ft<sup>3</sup>/s, Jan. 22, 1967, gage height, 3.41 ft; minimum daily, 49 ft<sup>3</sup>/s, Aug. 27, 1955.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sept. 12, 1986, reached a stage of 11.35 ft, from floodmark, and discharge of about 6,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,580 ft<sup>3</sup>/s, Mar. 29, gage height, 7.96 ft; minimum daily, 136 ft<sup>3</sup>/s, Sept. 8, 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	151	200	810	719	220	285	615	437	362	211	194	142
2	145	196	622	550	225	604	518	403	369	258	177	137
3	155	192	518	430	239	725	460	367	356	305	192	141
4	208	198	467	365	266	717	424	336	330	301	189	152
5	194	554	424	330	319	685	426	342	307	272	181	148
6	188	872	397	300	376	604	413	421	272	228	169	143
7	194	1210	375	290	411	465	400	431	248	224	163	139
8	193	1040	365	280	387	406	436	411	229	266	235	136
9	311	800	361	270	388	395	715	427	217	247	300	136
10	581	627	361	265	360	374	1080	403	212	236	315	171
11	655	532	352	260	300	358	1100	378	263	211	292	166
12	700	468	343	260	270	340	783	347	248	252	233	170
13	593	421	342	260	272	324	601	319	222	290	195	164
14	515	387	320	265	289	308	561	296	212	306	175	165
15	461	367	320	282	240	296	920	277	430	317	166	173
16	390	350	339	315	215	287	1340	264	542	268	158	210
17	424	331	341	335	219	284	1330	259	600	221	164	187
18	445	316	374	335	257	322	935	249	505	196	186	180
19	423	304	378	332	324	333	675	241	368	184	226	171
20	404	291	370	325	361	340	558	232	283	174	291	165
21	361	315	365	300	436	338	488	225	238	169	303	160
22	335	344	378	260	470	341	444	224	317	224	323	157
23	307	354	361	240	416	347	421	289	360	257	274	157
24	283	356	293	235	404	432	399	382	404	233	215	156
25	262	344	282	230	351	460	371	406	412	202	187	163
26	245	327	238	225	296	509	353	630	345	179	174	171
27	231	485	276	225	268	738	346	750	277	169	166	168
28	218	940	313	220	266	1180	397	795	236	163	161	163
29	210	1410	557	220	---	1530	470	631	209	212	151	158
30	199	1210	650	215	---	1130	467	464	196	232	147	155
31	200	---	672	215	---	769	---	389	---	219	145	---
TOTAL	10181	15741	12564	9353	8845	16226	18446	12025	9569	7226	6447	4804
MEAN	328	525	405	302	316	523	615	388	319	233	208	160
MAX	700	1410	810	719	470	1530	1340	795	600	317	323	210
MIN	145	192	238	215	215	284	346	224	196	163	145	136
CFSM	1.40	2.24	1.73	1.29	1.35	2.24	2.63	1.66	1.36	1.00	.89	.68
IN.	1.62	2.50	2.00	1.49	1.41	2.58	2.93	1.91	1.52	1.15	1.02	.76
CAL YR 1990	TOTAL	116373	MEAN	319	MAX	1450	MIN	127	CFSM	1.36	IN	18.50
WTR YR 1991	TOTAL	131427	MEAN	360	MAX	1530	MIN	136	CFSM	1.54	IN	20.89



STREAMS TRIBUTARY TO LAKE MICHIGAN

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04119000 GRAND RIVER AT GRAND RAPIDS, MI

LOCATION.--Lat 42°57'52", long 85°40'35", in NE1/4 sec.25, T.7 N., R.12 W., Kent County, Hydrologic Unit 04050006, on right bank 500 ft upstream from bridge on Fulton Street, 1.7 mi upstream from Plaster Creek, and at mile 41.

DRAINAGE AREA.--4,900 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1901 to December 1905, January 1906 to August 1918 (gage heights only), October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records collected in this vicinity since 1907 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 924: 1938(M). WSP 1387: 1901-5, 1940.

GAGE.--Water-stage recorder. Datum of gage is 585.70 ft above National Geodetic Vertical Datum of 1929 (levels by City of Grand Rapids). March 1901 to August 1918, nonrecording gage at Fulton Street Bridge and Oct. 1, 1930, to Oct. 26, 1953, water-stage recorder at sewage pumping station 1 mi downstream at datum 2.99 ft higher.

REMARKS.--Estimated daily discharges: Dec. 31 to Feb. 4. Records good except for estimated daily discharges, which are fair. Moderate diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--65 years, 3,687 ft<sup>3</sup>/s, 10.22 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,000 ft<sup>3</sup>/s, Mar. 28, 1904, gage height, 19.5 ft, from graph based on gage readings, site then in use; maximum gage height, 19.64 ft, Mar. 1, 1985; minimum daily discharge, 381 ft<sup>3</sup>/s, Aug. 9, 17, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 28, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 17,400 ft<sup>3</sup>/s, Dec. 2, gage height, 15.40 ft; maximum gage height, 17.59 ft, Jan. 15, backwater from ice; minimum discharge, 1,320 ft<sup>3</sup>/s, Sept. 8, gage height, 3.06 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1970	3630	16500	11000	4100	5380	12300	8910	4370	2230	2050	1510
2	1790	3740	17400	11500	4100	6580	11500	8910	4070	2310	2130	1570
3	1850	3560	16700	11500	4200	8440	10200	8800	4010	2380	2340	1570
4	2280	3530	15200	10500	5000	9690	8880	8170	3960	2180	2230	1470
5	2680	5150	13400	9200	5910	10300	7930	7570	3970	2240	2110	1560
6	3400	9440	11800	8000	6950	10600	7380	7050	4040	2160	1870	1630
7	2990	11200	10200	7400	7150	10400	7070	6830	3880	2170	1890	1590
8	2850	12200	9070	7000	7110	10100	6970	6710	3710	2280	2160	1400
9	3390	13100	8280	6500	6940	9780	8880	6580	3390	2480	2850	1570
10	5740	13300	7630	6000	6830	9260	10900	6440	3140	2530	2950	2190
11	8640	12800	7350	5600	6700	8500	11400	6160	3340	2660	2930	1980
12	9800	11900	7170	5400	6330	7740	11900	5860	3680	2220	2570	1770
13	9970	10600	7070	5200	5830	7100	12000	5590	3910	2500	2180	1650
14	10200	9210	6820	5100	5690	6640	11600	5260	3740	2450	2070	1680
15	10100	8070	6670	5000	5420	6180	12300	4940	3710	2470	1890	1650
16	9720	7290	6530	5200	5000	5910	13400	4840	3720	2360	1920	1740
17	9290	6580	6400	5500	4740	5670	13500	4720	3920	2330	1660	1780
18	8930	6060	6430	5800	4650	5700	13700	4640	3850	2270	2040	1720
19	8400	5700	6490	6000	5120	5800	13700	4540	3520	2060	2450	1710
20	7650	5430	6460	6200	5520	5910	13000	4320	3050	1900	2600	1610
21	6870	5290	6380	6200	6200	6010	12100	4260	2960	1880	2820	1780
22	6320	5600	6500	6000	6680	5970	11200	3920	2920	2040	2780	1500
23	6080	5710	6660	5800	7000	5920	10600	3920	2990	2360	2470	1500
24	5560	5490	6410	5400	6950	6450	10200	4210	2980	2570	2210	1550
25	5350	5310	6220	5100	6750	6820	10500	4600	3160	2260	2040	1560
26	5040	5030	5690	4900	6420	6870	10900	5460	3120	2360	2050	1580
27	4670	5770	5230	4700	5980	7480	10600	5500	2910	2130	1810	1620
28	4590	10600	6360	4500	5570	9440	10200	5110	2640	1870	1760	1600
29	4470	13100	8280	4300	---	10800	9390	4890	2400	1980	1580	1560
30	4250	14600	10500	4200	---	11800	9040	4960	2270	2110	1710	1590
31	4150	---	10800	4100	---	12400	---	4490	---	2290	1680	---
TOTAL	178990	238990	272600	198800	164840	245640	323240	178160	103330	70030	67800	49190
MEAN	5774	7966	8794	6413	5887	7924	10770	5747	3444	2259	2187	1640
MAX	10200	14600	17400	11500	7150	12400	13700	8910	4370	2660	2950	2190
MIN	1790	3530	5230	4100	4100	5380	6970	3920	2270	1870	1580	1400
CFSM	1.18	1.63	1.80	1.31	1.20	1.62	2.20	1.17	.70	.46	.45	.34
IN.	1.36	1.81	2.07	1.51	1.25	1.86	2.45	1.35	.78	.53	.51	.37

CAL YR 1990 TOTAL 1971440 MEAN 5401 MAX 20600 MIN 1330 CFSM 1.10 IN 14.97  
WTR YR 1991 TOTAL 2091610 MEAN 5730 MAX 17400 MIN 1400 CFSM 1.17 IN 15.88



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04119300 GRAND RIVER AT EASTMANVILLE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 43°00'53", long 85°57'21", in NE1/4 NW1/4 sec.10, T.7 N., R.14 W., Ottawa County, Hydrologic Unit 04050006, at bridge on 68th Avenue in Eastmanville, 1.1 mi downstream from Deer Creek, and at mile 19.3.

DRAINAGE AREA.--5,230 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--Water years 1979 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: February 1979 to September 1983.

WATER TEMPERATURE: February 1979 to September 1983.

INSTRUMENTATION.--Water-quality monitor from Oct. 7, 1980 to Sept. 30, 1983.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1979-82): Maximum daily recorded (more than 20 percent missing record), 1,100 microsiemens, Mar. 2, 1979; minimum measured, 324 microsiemens, Mar. 24, 1982.

WATER TEMPERATURE (water years 1980-81, 1983): Maximum, 28.5°C, July 21, 1983; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED SATUR- ATION (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 16...	1530	7560	556	8.3	6.0	11	11.3	93	K89	K94
FEB 07...	1345	7640	589	8.3	0.5	9.4	13.5	95	K320	890
APR 19...	1530	15600	440	8.2	11.5	33	9.5	89	K140	400
MAY 23...	1300	4000	635	8.4	21.0	15	8.8	100	360	200
AUG 01...	1315	2390	594	8.8	23.0	7.0	13.0	155	K210	600
SEP 27...	1140	1850	663	8.4	12.5	5.0	10.7	103	K140	200

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	ALKA- LITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)
NOV 16...	260	58	72	20	14	4.1	249	--	204	44
FEB 07...	270	51	74	21	17	2.7	268	--	220	45
APR 19...	200	36	57	15	11	3.0	205	--	168	28
MAY 23...	300	65	82	23	25	2.9	276	5	234	44
AUG 01...	250	58	67	21	26	3.1	210	14	196	52
SEP 27...	280	67	74	23	30	3.4	249	5	212	61

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
NOV 16...	28	0.2	8.6	351	0.48	7160	0.02	0.02	2.4	2.0
FEB 07...	34	0.2	7.0	345	0.47	7120	0.02	0.02	1.7	1.8
APR 19...	22	0.1	5.0	247	0.34	10400	0.04	0.03	1.5	1.6
MAY 23...	42	0.2	3.8	378	0.51	4080	0.06	0.06	1.0	1.0
AUG 01...	48	0.2	4.3	337	0.46	2170	0.04	0.04	0.6	0.63
SEP 27...	50	0.2	6.4	389	0.53	1940	0.07	0.07	1.2	1.2

STREAMS TRIBUTARY TO LAKE MICHIGAN  
04119300 GRAND RIVER AT EASTMANVILLE, MI

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WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
NOV 16...	0.13	0.14	0.7	0.04	0.09	0.04	0.04	30	<1	45
FEB 07...	0.29	0.30	0.7	0.08	0.04	0.04	0.02	--	--	--
APR 19...	0.13	0.11	1.1	0.14	0.04	0.07	0.03	20	<1	33
MAY 23...	0.17	0.18	1.1	0.10	0.02	0.01	<0.01	10	1	61
AUG 01...	<0.01	<0.01	1.1	0.11	0.01	<0.01	<0.01	--	--	--
SEP 27...	0.11	0.10	0.9	0.06	<0.01	0.01	<0.01	10	--	47

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
NOV 16...	<0.5	<1	<1	<3	3	86	1	6	15	<0.1
FEB 07...	--	--	--	--	--	--	--	--	--	--
APR 19...	<0.5	<1	1	3	2	23	<1	<4	3	<0.1
MAY 23...	<0.5	<1	<1	3	2	13	<1	7	3	<0.1
AUG 01...	--	--	--	--	--	--	--	--	--	--
SEP 27...	--	--	--	<3	--	7	--	9	4	--

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 16...	<10	2	<1	<1	190	<6	6	18	367	90
FEB 07...	--	--	--	--	--	--	--	21	433	90
APR 19...	<10	2	<1	<1	140	<6	<3	52	2190	94
MAY 23...	<10	3	<1	<1	280	<6	30	35	378	97
AUG 01...	--	--	--	--	--	--	--	32	206	98
SEP 27...	10	3	<1	<1	310	<6	--	21	105	88

LOCATION.--Lat 44°24'16", long 84°47'28", in NW1/4 NW1/4 sec.10, T.23 N., R.4 W., Roscommon County, Hydrologic Unit 04060102, on right bank of Muskegon River at upstream side of bridge on Old U.S. Highway 27, 0.4 mi downstream from Houghton Lake, and 5.2 mi north of Houghton Lake Heights.

PERIOD OF RECORD.--June 1942 to current year, except winter period of 1942-43.

GAGE.--Water-stage recorder. Datum of gage is 1,130.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1960, nonrecording gage at datum 6.21 ft higher.

REMARKS.--Backus Creek and "The Cut" from Higgins Lake, join about 1 mi upstream from Houghton Lake and become the major inlet. There are also many small tributaries which feed the lake. The outlet is Muskegon River. Houghton Lake is the largest inland lake in Michigan. Established legal level; summer, 1,138.1 ft, minimum winter, 1,137.6 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 10.18 ft, Apr. 23, 1985; minimum observed, 6.95 ft, Sept. 3, 5, Nov. 8, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.61 ft, May 28; minimum, 8.03 ft, Sept. 26.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.38	8.48	8.65	8.53	8.29	8.09	8.65	9.35	9.47	8.84	8.62	8.46
2	8.38	8.48	8.62	8.52	8.28	8.14	8.73	9.30	9.46	8.82	8.63	8.42
3	8.48	8.45	8.71	8.51	8.27	8.15	8.76	9.33	9.42	8.81	8.71	8.39
4	8.35	8.43	8.59	8.50	8.26	8.15	8.77	9.37	9.40	8.81	8.67	8.37
5	8.38	8.45	8.68	8.49	8.25	8.15	8.77	9.38	9.37	8.77	8.70	8.38
6	8.37	8.51	8.66	8.49	8.24	8.16	8.80	9.38	9.35	8.79	8.71	8.36
7	8.33	8.55	8.67	8.48	8.23	8.15	8.81	9.31	9.34	8.74	8.70	8.36
8	8.33	8.58	8.66	8.47	8.23	8.15	8.91	9.32	9.32	8.68	8.68	8.36
9	8.34	8.61	8.65	8.45	8.22	8.15	9.03	9.33	9.30	8.70	8.64	8.41
10	8.49	8.54	8.63	8.44	8.21	8.15	8.93	9.31	9.27	8.67	8.61	8.36
11	8.51	8.49	8.64	8.43	8.20	8.15	9.07	9.30	9.25	8.68	8.61	8.39
12	8.50	8.46	8.62	8.46	8.20	8.15	9.17	9.28	9.19	8.70	8.62	8.43
13	8.50	8.52	8.53	8.46	8.18	8.14	9.16	9.28	9.23	8.65	8.59	8.39
14	8.54	8.55	8.60	8.46	8.17	8.13	9.24	9.29	9.20	8.64	8.58	8.42
15	8.51	8.54	8.60	8.45	8.17	8.13	9.17	9.29	9.17	8.65	8.57	8.39
16	8.56	8.49	8.60	8.44	8.17	8.13	9.24	9.28	9.12	8.63	8.58	8.40
17	8.60	8.52	8.60	8.44	8.15	8.13	9.30	9.28	9.15	8.59	8.61	8.38
18	8.49	8.58	8.60	8.43	8.15	8.12	9.36	9.30	9.12	8.60	8.60	8.34
19	8.52	8.54	8.60	8.43	8.16	8.13	9.36	9.26	9.08	8.59	8.60	8.31
20	8.64	8.54	8.59	8.41	8.15	8.15	9.33	9.21	9.06	8.58	8.61	8.31
21	8.57	8.62	8.58	8.40	8.14	8.18	9.35	9.19	9.04	8.67	8.61	8.34
22	8.55	8.55	8.59	8.39	8.13	8.22	9.33	9.17	9.01	8.73	8.56	8.37
23	8.55	8.52	8.58	8.38	8.12	8.31	9.37	9.17	8.98	8.66	8.58	8.23
24	8.50	8.52	8.58	8.37	8.12	8.35	9.35	9.16	8.94	8.66	8.60	8.29
25	8.47	8.44	8.57	8.37	8.12	8.38	9.37	9.17	8.90	8.63	8.58	8.31
26	8.52	8.58	8.57	8.36	8.11	8.42	9.37	9.32	8.89	8.64	8.54	8.15
27	8.49	8.58	8.55	8.35	8.10	8.51	9.39	9.32	8.87	8.64	8.52	8.22
28	8.39	8.61	8.53	8.33	8.10	8.49	9.43	9.36	8.81	8.64	8.51	8.24
29	8.51	8.59	8.55	8.32	---	8.58	9.45	9.44	8.80	8.64	8.50	8.21
30	8.49	8.69	8.54	8.31	---	8.67	9.46	9.45	8.78	8.63	8.47	8.20
31	8.48	---	8.54	8.30	---	8.75	---	9.44	---	8.66	8.44	---
MEAN	8.47	8.53	8.60	8.42	8.18	8.25	9.15	9.30	9.14	8.68	8.60	8.34
MAX	8.64	8.69	8.71	8.53	8.29	8.75	9.46	9.45	9.47	8.84	8.71	8.46
MIN	8.33	8.43	8.53	8.30	8.10	8.09	8.65	9.16	8.78	8.58	8.44	8.15
CAL YR 1990	MEAN 8.43		MAX 9.08		MIN 7.63							
WTR YR 1991	MEAN 8.64		MAX 9.47		MIN 8.09							

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04121300 CLAM RIVER AT VOGEL CENTER, MI

LOCATION.--Lat 44°12'02", long 85°03'10", in SW1/4 NW1/4 sec.21, T.21 N., R.6 W., Missaukee County, Hydrologic Unit 04060102, on left bank 10 ft downstream from bridge on 8 Mile Road, 0.5 mi north of Vogel Center, and 3.5 mi southeast of Falmouth.

DRAINAGE AREA.--243 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 31, Jan. 4, 7, 10, 11, 24-29, and Feb. 17, 18. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 132 ft<sup>3</sup>/s, 7.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,710 ft<sup>3</sup>/s, Mar. 29, 1989, gage height, 7.31 ft; minimum, 29 ft<sup>3</sup>/s, Nov. 3, 1969, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 29	2100	380	4.27	Apr. 10	1700	*527	*4.77
Mar. 24	1500	462	4.56	Apr. 17	0700	502	4.69
Mar. 29	1000	468	4.58				

Minimum discharge, 68 ft<sup>3</sup>/s, Aug. 29, gage height, 2.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	133	154	268	156	131	123	255	264	151	81	135	75
2	136	153	220	149	127	240	235	239	151	84	101	77
3	135	151	197	147	129	250	225	227	169	93	179	84
4	143	157	171	143	138	239	220	219	181	116	226	96
5	145	172	177	139	149	223	222	214	162	116	193	97
6	145	184	184	134	157	224	229	225	149	101	132	83
7	134	196	176	135	157	224	229	232	143	91	106	76
8	138	202	175	137	161	201	269	226	138	86	97	74
9	145	199	173	133	169	196	390	221	135	79	94	74
10	202	192	176	130	169	175	508	217	134	77	89	94
11	288	187	180	129	151	165	483	211	137	75	84	96
12	343	181	176	128	148	159	387	199	134	77	80	85
13	298	171	178	132	145	155	311	191	126	89	77	86
14	229	164	166	134	134	152	284	183	115	90	77	88
15	208	174	167	139	99	154	330	166	116	81	76	96
16	201	214	160	142	118	166	436	137	121	77	79	107
17	196	231	161	143	128	182	490	134	112	75	92	106
18	197	209	163	143	129	192	408	134	102	74	105	100
19	197	187	164	144	131	213	322	129	97	72	122	101
20	195	173	157	148	132	256	280	128	95	72	120	111
21	189	170	165	139	131	292	259	125	92	88	103	114
22	180	177	180	122	130	340	244	122	93	106	91	115
23	173	181	173	129	120	407	234	123	95	113	84	117
24	167	176	146	130	124	457	227	129	93	99	79	115
25	163	170	131	129	125	431	222	134	90	84	82	114
26	161	162	133	128	117	357	221	224	85	78	78	119
27	158	170	147	128	117	338	213	322	83	76	73	120
28	158	258	145	129	122	414	276	287	82	75	72	116
29	157	351	153	130	---	460	313	185	80	82	71	111
30	155	352	164	132	---	383	297	153	81	129	73	120
31	152	---	155	131	---	295	---	149	---	170	73	---
TOTAL	5621	5818	5281	4212	3788	8063	9019	5849	3542	2806	3143	2967
MEAN	181	194	170	136	135	260	301	189	118	90.5	101	98.9
MAX	343	352	268	156	169	460	508	322	181	170	226	120
MIN	133	151	131	122	99	123	213	122	80	72	71	74
CFSM	.75	.80	.70	.56	.56	1.07	1.24	.78	.49	.37	.42	.41
IN.	.86	.89	.81	.64	.58	1.23	1.38	.90	.54	.43	.48	.45

CAL YR 1990	TOTAL	60071	MEAN	165	MAX	910	MIN	78	CFSM	.68	IN	9.20
WTR YR 1991	TOTAL	60109	MEAN	165	MAX	508	MIN	71	CFSM	.68	IN	9.20



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04121500 MUSKEGON RIVER AT EVART, MI

LOCATION.--Lat 43°53'57", long 85°15'19", in NW1/4 NE1/4 sec.3, T.17 N., R.8 W., Osceola County, Hydrologic Unit 04060102, on right bank 500 ft downstream from bridge on U.S. Highway 10 in Evart, 0.4 mi upstream from Twin Creek, and at mile 123.9.

DRAINAGE AREA.--1,450 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1437: 1934, 1947(M).

GAGE.--Water-stage recorder. Datum of gage is 977.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 7, 1956, nonrecording gages at sites 400 ft and 500 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 29, 30, Jan. 1, Jan. 5 to Feb. 1, Feb. 10-16, 23, 25-27, and Mar. 3-7. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--59 years, 1,476 ft<sup>3</sup>/s, 9.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,040 ft<sup>3</sup>/s, Mar. 31, 1989, gage height, 14.99 ft; minimum observed, 164 ft<sup>3</sup>/s, Dec. 20, 1947, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,650 ft<sup>3</sup>/s, Apr. 17, gage height, 11.58 ft; minimum, 535 ft<sup>3</sup>/s, Sept. 9, gage height, 6.93 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	899	1250	2590	1250	970	954	3670	2670	2240	774	848	570
2	910	1230	2370	1190	984	1580	3240	2370	2150	788	810	553
3	916	1230	2190	1170	991	2150	2930	2160	2160	805	800	550
4	949	1250	2100	1150	1010	2100	2700	2010	2090	825	923	558
5	961	1440	1990	1100	1050	2000	2530	1900	1910	811	1050	563
6	959	1890	1940	1100	1140	1950	2390	1910	1760	791	1060	563
7	984	1950	1850	1100	1240	1920	2240	1890	1610	757	959	562
8	1050	1960	1780	1050	1290	1900	2300	1830	1470	728	870	548
9	1160	1930	1720	1050	1360	1800	3080	1780	1370	689	838	540
10	1650	1910	1700	1050	1300	1700	3690	1730	1290	657	792	569
11	2230	1880	1670	1000	1200	1640	4090	1680	1230	630	744	613
12	2310	1820	1640	1050	1100	1570	4190	1650	1190	621	706	621
13	2330	1740	1650	1050	1000	1470	3970	1600	1140	722	675	615
14	2180	1670	1610	1050	950	1400	3560	1550	1100	717	647	608
15	2160	1680	1550	1100	930	1390	3850	1500	1130	683	627	662
16	2100	1760	1510	1100	900	1420	4450	1440	1250	643	609	729
17	2050	1780	1490	1150	866	1470	4580	1400	1250	608	660	721
18	2040	1760	1540	1150	939	1550	4480	1400	1190	586	766	701
19	2010	1690	1560	1180	983	1700	4130	1350	1120	567	957	677
20	1930	1640	1500	1150	1010	1870	3630	1300	1070	553	1040	649
21	1870	1660	1470	1100	1020	2030	3220	1250	1020	588	987	638
22	1790	1820	1590	1050	1120	2220	2930	1220	985	764	913	630
23	1720	1800	1500	1000	1050	2430	2680	1200	956	797	831	629
24	1660	1780	1300	980	1010	2710	2460	1210	922	808	759	630
25	1590	1710	1150	980	1000	2840	2270	1230	900	797	706	630
26	1520	1640	1100	970	990	2990	2100	2070	879	759	672	649
27	1480	1690	932	960	950	3350	2020	2590	854	712	654	653
28	1430	2400	883	960	934	4340	2720	2600	829	679	626	644
29	1380	2610	1150	960	---	4440	2890	2500	808	684	606	635
30	1320	2670	1250	950	---	4460	2890	2340	786	735	605	635
31	1280	---	1330	960	---	4150	---	2320	---	835	597	---
TOTAL	48818	53240	49605	33060	29287	69494	95880	55650	38659	22113	24337	18545
MEAN	1575	1775	1600	1066	1046	2242	3196	1795	1289	713	785	618
MAX	2330	2670	2590	1250	1360	4460	4580	2670	2240	835	1060	729
MIN	899	1230	883	950	866	954	2020	1200	786	553	597	540
CFSM	*1.09	1.22	1.10	.74	.72	1.55	2.20	1.24	.89	.49	.54	.43
IN.	1.25	1.37	1.27	.85	.75	1.78	2.46	1.43	.99	.57	.62	.48
CAL YR 1990	TOTAL	478616	MEAN	1311	MAX	4590	MIN	600	CFSM	.90	IN	12.28
WTR YR 1991	TOTAL	538688	MEAN	1476	MAX	4580	MIN	540	CFSM	1.02	IN	13.82

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04121900 LITTLE MUSKEGON RIVER NEAR MORLEY, MI

LOCATION.--Lat 43°30'09", long 85°20'33", in SW1/4 SW1/4 sec.24, T.13 N., R.9 W., Mecosta County, Hydrologic Unit 04060102, on right bank at upstream side of highway bridge on 130th Avenue, 0.5 mi downstream from Rustford Dam, and 5.2 mi east of Morley.

DRAINAGE AREA.--138 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 920 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 27, Dec. 29 to Jan. 1, Jan. 4, 5, 7, 8, 12-14, Jan. 22 to Feb. 3, and Feb. 11, 12, 16, 26, 27. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 131 ft<sup>3</sup>/s, 12.89 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,300 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 8.57 ft; minimum, 22 ft<sup>3</sup>/s, July 21, 1979; minimum gage height, 1.51 ft, July 28, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 6	0530	440	3.72	Apr. 15	2230	607	4.34
Nov. 28	1300	497	3.98	Apr. 29	1430	447	3.64
Mar. 2	2300	462	3.79	May 27	0330	488	3.91
Mar. 28	2030	*625	*4.45				

Minimum discharge, 64 ft<sup>3</sup>/s, Sept. 3, gage height, 1.78 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	74	119	265	165	120	124	285	321	216	74	79	70
2	76	120	219	160	121	336	254	273	215	86	75	67
3	78	115	196	157	122	401	236	245	203	82	90	68
4	100	122	193	155	123	314	225	229	181	75	90	75
5	97	218	187	150	160	242	240	223	166	77	81	70
6	87	410	180	145	170	235	237	262	142	75	74	67
7	86	374	174	144	169	231	225	254	128	73	73	68
8	97	312	173	143	160	198	239	231	123	80	77	68
9	157	252	173	143	167	193	354	233	119	75	91	68
10	290	215	183	134	161	189	387	219	111	70	81	121
11	351	191	178	122	140	185	347	200	115	68	76	110
12	307	176	172	125	130	175	291	203	110	87	72	90
13	237	166	178	125	123	169	260	319	103	232	69	85
14	190	159	165	130	120	164	281	217	100	191	67	99
15	226	157	157	130	120	164	459	221	145	140	67	157
16	214	157	156	134	119	167	584	194	133	114	67	160
17	220	152	159	137	118	169	492	204	114	102	87	134
18	244	147	190	134	114	203	365	217	106	95	103	116
19	230	144	190	133	143	222	298	208	100	89	121	108
20	201	141	171	137	164	221	266	188	96	71	146	102
21	180	150	164	132	181	223	246	174	90	73	113	98
22	167	179	178	130	205	242	234	170	100	113	97	94
23	158	171	172	125	167	275	221	202	109	113	89	95
24	151	162	158	120	156	313	214	306	96	84	84	94
25	145	154	152	120	140	295	203	241	89	77	93	93
26	139	146	142	120	130	264	197	395	80	73	90	108
27	134	206	144	120	125	350	205	464	75	72	85	103
28	130	448	145	120	121	605	383	376	73	72	83	95
29	125	431	160	120	---	581	437	268	72	82	80	96
30	122	347	175	120	---	434	397	231	75	97	78	94
31	120	---	170	120	---	329	---	226	---	85	70	---
TOTAL	5133	6241	5419	4150	3989	8213	9062	7714	3585	2897	2648	2873
MEAN	166	208	175	134	142	265	302	249	120	93.5	85.4	95.8
MAX	351	448	265	165	205	605	584	464	216	232	146	160
MIN	74	115	142	120	114	124	197	170	72	68	67	67
CFSM	1.20	1.51	1.27	.97	1.03	1.92	2.19	1.80	.87	.68	.62	.69
IN.	1.38	1.68	1.46	1.12	1.08	2.21	2.44	2.08	.97	.78	.71	.77

CAL YR 1990	TOTAL	51852	MEAN	142	MAX	679	MIN	59	CFSM	1.03	IN	13.98
WTR YR 1991	TOTAL	61924	MEAN	170	MAX	605	MIN	67	CFSM	1.23	IN	16.69

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04122000 MUSKEGON RIVER AT NEWAYGO, MI

LOCATION.--Lat 43°25'20", long 85°48'04", in NE1/4 NE1/4 sec.24, T.12 N., R.13 W., Newaygo County, Hydrologic Unit 04060102, on left bank near nonoperative powerplant in Newaygo, 600 ft downstream from Penoyer Creek, and at mile 39.1.

DRAINAGE AREA.--2,350 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July to December 1908, July 1909 to July 1915, January 1916 to December 1919, October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Records for June 1901 to December 1906, published in WSP 129, 170, and 206, are unreliable and should not be used.

REVISED RECORDS.--WSP 974: 1933, 1935, 1937-38. WSP 1307: 1940(M). See also PERIOD OF RECORD.

GAGE.--Water-stage recorder. Datum of gage is 625.83 ft above National Geodetic Vertical Datum of 1929. October 1930 to January 1939, nonrecording gage, and Jan. 31, 1939 to Sept. 30, 1963, water-stage recorder at present site at datum 40.0 ft lower.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplants upstream from station, the largest of which are Croton Dam, Hardy Dam (since 1931), and Rogers Dam. Since Dec. 27, 1965, powerplant at Newaygo nonoperative, and in January 1969, dam at Newaygo was removed. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--69 years (water years 1910-14, 1917-19, 1931-91), 2,023 ft<sup>3</sup>/s, 11.69 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 23,200 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 19.54 ft, from floodmark; minimum, 52 ft<sup>3</sup>/s, Oct. 2, 1965, gage height, 5.31 ft, result of regulation during pipeline repair; minimum daily, 330 ft<sup>3</sup>/s, Feb. 15, 1914.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,870 ft<sup>3</sup>/s, Apr. 16, 17, gage height, 10.95 ft; minimum, 981 ft<sup>3</sup>/s, Sept. 5, gage height, 6.71 ft; minimum daily discharge, 1,030 ft<sup>3</sup>/s, Sept. 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1630	2250	4910	2930	2570	2620	5880	5090	3580	1650	1640	1250
2	1630	2050	4610	2530	2570	3050	5470	4830	4130	1650	1690	1250
3	1690	2200	4260	2200	2570	3600	5180	4190	4660	1650	1710	1260
4	1780	2160	3910	2200	2580	3720	5030	3680	3400	1630	1700	1250
5	1830	2740	3670	2040	2580	3690	4890	3680	3260	1600	1690	1210
6	1820	4110	3570	1790	2760	3710	4580	3590	3120	1600	1690	1260
7	1850	4140	3400	2230	2950	3710	4260	3400	3090	1600	1690	1260
8	2040	4140	3240	1760	2940	3700	4090	3420	2860	2000	1800	1380
9	2220	4070	3020	1790	2970	3710	4730	3420	2580	1920	1930	1600
10	2660	3850	2930	1800	3090	3700	5720	3190	2600	1170	1880	1880
11	3730	3590	3050	1980	3210	3700	5710	2990	2550	1160	1820	2080
12	4500	3550	2540	1920	3100	3680	5750	2880	2300	1250	1740	1720
13	4370	3520	2880	2380	2740	3590	5870	3070	2070	1780	1420	1630
14	3980	3080	2440	2370	2580	3480	5790	2560	2090	2230	1130	1510
15	3880	2900	2230	2500	2620	3380	6230	2550	2360	2160	1170	1490
16	3770	2880	2440	2850	2600	3170	6840	2560	2710	1640	1320	1700
17	3670	2870	2710	2830	2510	2960	6850	2560	2690	1170	2200	1700
18	3710	2870	3010	2790	2470	2980	6790	2550	2590	1270	2570	1540
19	3690	2920	2980	2800	2540	3060	6770	2490	1910	1560	1910	1590
20	3690	3040	2960	2820	2600	3280	6260	2410	2030	1320	1180	1550
21	3650	2820	2960	2830	2600	3580	5630	2380	2190	1340	1360	1510
22	3310	2950	2920	2780	2750	3670	5270	2370	1990	1590	1690	1480
23	2770	3080	2870	2730	2970	3750	4330	2430	1960	1610	1210	1290
24	2660	3150	2890	2690	2740	3760	4200	2580	1950	1760	1790	1030
25	2670	3290	2650	2540	2570	3750	3920	2860	1940	1620	1790	1060
26	2660	3510	2160	2650	2560	3750	3680	4090	1950	1370	1770	1280
27	2600	3680	1920	2530	2490	4520	3660	6080	1880	1660	1510	1490
28	2350	3450	1710	2530	2460	6190	4310	5280	1790	1720	1260	1420
29	2070	5760	1830	2550	---	6480	5680	4720	1730	1790	1260	1300
30	2160	5310	2290	2590	---	6350	5360	4720	1630	1720	1260	1280
31	2300	---	3210	2580	---	6140	---	4300	---	1650	1250	---
TOTAL	87340	99930	92170	75510	75690	120430	158730	106920	75590	49840	50030	43250
MEAN	2817	3131	2973	2436	2703	3885	5291	3449	2520	1608	1614	1442
MAX	4500	5760	4910	2930	3210	6480	6850	6080	4660	2230	2570	2080
MIN	1630	2050	1710	1760	2460	2620	3660	2370	1630	1160	1130	1030
CFSM	1.20	1.42	1.27	1.04	1.15	1.65	2.25	1.47	1.07	.68	.69	.61
IN.	1.38	1.58	1.46	1.20	1.20	1.91	2.51	1.69	1.20	.79	.79	.68
CAL YR 1990	TOTAL	914730	MEAN	2506	MAX	6090	MIN	1020	CFSM	1.07	IN	14.48
WTR YR 1991	TOTAL	1035430	MEAN	2837	MAX	6850	MIN	1030	CFSM	1.21	IN	16.39

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04122100 BEAR CREEK NEAR MUSKEGON, MI.

LOCATION.--Lat 43°17'19", long 86°13'22", in SW1/4 NW1/4 sec.4, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060102, on left bank at upstream side of bridge on North Getty Street, 1.5 mi upstream from Little Bear Creek, and 3.9 mi northeast of Muskegon.

DRAINAGE AREA.--14.8 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-80-1: 1976(M), 1978(M), 1979(P).

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark). Prior to Mar. 17, 1978, at different datum.

REMARKS.--Estimated daily discharges: Dec. 24, 25, 27, Dec. 29 to Jan. 2, Jan. 4, 5, 7-9, 11, 12, Jan. 20 to Feb. 2, Feb. 12, 15-17, 26, and Aug. 16-27. Records good except for estimated daily discharges, which are poor. Some regulation during low flow by dams and irrigation upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 17.3 ft<sup>3</sup>/s, 15.87 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 930 ft<sup>3</sup>/s, Mar. 5, 1976, gage height, 11.00 ft, datum then in use; minimum, 1.0 ft<sup>3</sup>/s, Aug. 5, 17, 22, 1971.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 28	1400	106	14.10	Apr. 15	2330	*257	*15.15
Mar. 28	0630	214	14.85				

Minimum discharge, 3.4 ft<sup>3</sup>/s, July 27, gage height, 10.28 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.0	10	29	26	18	20	39	25	16	6.6	5.5	4.5
2	5.8	9.9	24	25	17	64	34	22	15	7.9	4.9	4.3
3	6.0	9.6	23	24	16	61	31	21	14	6.7	4.7	5.5
4	7.5	11	26	23	20	38	29	19	12	5.9	4.7	5.9
5	6.4	31	23	22	25	32	33	21	11	5.7	4.9	4.9
6	5.9	65	24	21	26	32	31	31	11	5.5	7.3	4.9
7	7.2	44	23	21	27	29	28	25	10	5.6	14	4.3
8	9.3	36	24	20	26	25	29	22	9.4	6.3	17	4.3
9	19	29	23	19	26	26	42	22	9.0	5.3	9.0	4.6
10	33	28	22	18	23	27	58	20	8.8	5.4	7.6	8.3
11	32	24	20	19	20	25	44	18	8.7	5.0	6.7	5.6
12	19	23	19	20	18	23	34	17	8.2	9.5	6.2	5.5
13	15	21	18	20	17	22	30	16	7.6	8.1	5.9	5.2
14	16	19	16	19	17	21	32	15	9.2	6.6	5.7	7.7
15	26	18	17	18	17	20	114	14	25	5.5	5.5	14
16	19	17	20	21	17	19	148	13	15	5.4	7.0	8.4
17	17	16	19	23	16	19	60	14	12	5.3	10	7.0
18	22	15	26	22	16	24	43	13	9.7	5.8	13	7.3
19	26	14	26	22	20	23	36	12	8.8	5.4	15	7.8
20	20	13	21	23	23	21	32	11	7.9	5.0	8.0	7.4
21	17	18	20	22	26	20	29	11	7.4	4.5	7.0	6.5
22	16	23	21	21	31	19	27	11	11	5.0	6.4	6.7
23	15	19	19	20	25	22	26	10	11	5.1	6.0	6.9
24	14	16	19	20	21	29	24	10	8.5	4.7	5.8	6.3
25	13	15	20	19	19	25	23	11	7.4	4.5	6.4	7.2
26	12	14	20	19	18	26	22	48	7.0	4.1	6.0	7.6
27	12	22	20	19	17	65	25	30	6.7	3.8	5.7	6.6
28	12	81	21	19	17	172	38	22	6.4	18	5.5	6.2
29	11	52	24	19	---	72	31	18	6.3	8.3	5.0	6.4
30	11	34	28	19	---	48	29	16	6.0	6.7	5.2	6.2
31	10	---	27	19	---	40	---	16	---	5.9	4.7	---
TOTAL	461.1	747.5	682	642	579	1109	1201	574	306.0	193.1	226.3	194.0
MEAN	14.9	24.9	22.0	20.7	20.7	35.8	40.0	18.5	10.2	6.23	7.30	6.47
MAX	33	81	29	26	31	172	148	48	25	18	17	14
MIN	5.8	9.6	16	18	16	19	22	10	6.0	3.8	4.7	4.3
CFSM	1.01	1.68	1.49	1.40	1.40	2.42	2.70	1.25	.69	.42	.49	.44
IN.	1.16	1.88	1.71	1.61	1.46	2.79	3.02	1.44	.77	.49	.57	.49

CAL YR 1990 TOTAL 6540.6 MEAN 17.9 MAX 128 MIN 4.0 CFSM 1.21 IN 16.44  
WTR YR 1991 TOTAL 6915.0 MEAN 18.9 MAX 172 MIN 3.8 CFSM 1.28 IN 17.38



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04122200 WHITE RIVER NEAR WHITEHALL, MI

LOCATION.--Lat 43°27'51", long 86°13'57", in SE1/4 NW1/4 sec.4, T.12 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, on right bank 30 ft downstream from bridge on Fruitvale Road, 6.3 mi downstream from North Branch, and 6.9 mi northeast of Whitehall.

DRAINAGE AREA.--406 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1957 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 594.1 ft above National Geodetic Vertical Datum of 1929. Nov. 18, 1957, to Oct. 22, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 26 to Jan. 18, Jan. 23 to Feb. 7, Feb. 13, 17-19, 23, 24, and Mar. 4, 5. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--34 years, 450 ft<sup>3</sup>/s, 15.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,400 ft<sup>3</sup>/s, Sept. 1, 1975, gage height, 7.46 ft; minimum, 163 ft<sup>3</sup>/s, Aug. 18, 19, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,920 ft<sup>3</sup>/s, Mar. 29, gage height, 5.68 ft; minimum, 253 ft<sup>3</sup>/s, Sept. 8-10, gage height, 1.58 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	319	421	906	560	450	450	1080	777	548	317	358	255
2	321	417	850	540	460	589	992	741	518	370	328	254
3	324	411	795	520	470	955	894	678	521	356	337	254
4	353	410	712	510	480	960	803	619	559	334	344	261
5	373	480	640	500	500	900	751	589	538	314	325	270
6	356	611	600	490	520	860	718	610	469	301	308	262
7	355	865	577	480	560	844	685	657	423	295	294	255
8	391	963	563	470	595	814	663	649	391	292	319	254
9	449	894	558	470	602	743	698	625	377	295	407	253
10	554	853	557	470	616	703	872	611	366	288	394	343
11	681	792	559	460	582	670	1070	588	360	281	342	524
12	861	709	550	460	514	637	1000	561	351	304	312	581
13	825	644	536	470	490	605	911	539	339	522	302	526
14	745	594	519	480	476	571	861	518	334	691	287	466
15	719	560	510	490	457	547	898	493	414	712	280	406
16	704	539	509	490	423	545	1460	470	490	606	273	430
17	668	519	512	500	440	556	1680	465	459	427	294	461
18	628	498	542	510	460	595	1250	467	403	361	343	431
19	630	480	595	511	480	665	1110	467	370	333	353	404
20	665	468	608	500	507	719	1010	452	345	316	352	399
21	655	477	586	497	536	718	894	437	334	310	332	391
22	612	526	567	442	589	713	791	420	334	329	317	372
23	564	588	567	440	550	720	718	417	369	431	298	363
24	526	581	536	440	520	763	667	416	373	392	285	361
25	493	556	479	440	516	900	626	419	353	342	273	355
26	465	522	460	440	474	915	598	498	326	321	267	367
27	447	527	420	440	458	909	576	638	312	302	263	375
28	436	637	410	440	454	1290	608	827	302	295	260	364
29	427	993	500	440	---	1740	745	754	295	327	257	354
30	422	1050	560	450	---	1310	822	706	290	400	256	345
31	422	---	570	450	---	1170	---	632	---	396	256	---
TOTAL	16390	18585	17853	14800	14179	25076	26451	17740	11863	11560	9616	10936
MEAN	529	620	576	477	506	809	882	572	395	373	310	365
MAX	861	1050	906	560	616	1740	1680	827	559	712	407	581
MIN	319	410	410	440	423	450	576	416	290	281	256	253
CFSM	1.30	1.53	1.42	1.18	1.25	1.99	2.17	1.41	.97	.92	.76	.90
IN.	1.50	1.70	1.64	1.36	1.30	2.30	2.42	1.63	1.09	1.06	.88	1.00

CAL YR 1990 TOTAL 181644 MEAN 498 MAX 1370 MIN 260 CFSM 1.23 IN 16.64  
WTR YR 1991 TOTAL 195049 MEAN 534 MAX 1740 MIN 253 CFSM 1.32 IN 17.87

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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04122500 PERE MARQUETTE RIVER AT SCOTTVILLE, MI

LOCATION.--Lat 43°56'42", long 86°16'43", in NW1/4 NW1/4 sec.19, T.18 N., R.16 W., Mason County, Hydrologic Unit 04060101, on right bank 20 ft upstream from highway bridge at south edge of Scottville, 1.4 mi upstream from India Creek, and 5.6 mi downstream from Big South Branch.

DRAINAGE AREA.--681 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1939 to current year. Prior to October 1942, published as "at Custer".

REVISED RECORDS.--WSP 1437: 1941(M), 1943(M), 1949(M), 1950. WDR MI-81: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 597.66 ft above National Geodetic Vertical Datum of 1929. Prior to June 12, 1943, nonrecording gage at bridge 4.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 26 to Jan. 16, Jan. 24 to Feb. 6, and Feb. 15-17. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--52 years, 698 ft<sup>3</sup>/s, 13.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,440 ft<sup>3</sup>/s, Sept. 13, 1986, gage height, 8.07 ft; minimum, 209 ft<sup>3</sup>/s, Dec. 11, 1962, discharge measurement; minimum daily, 310 ft<sup>3</sup>/s, Aug. 9, 10, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,110 ft<sup>3</sup>/s, Apr. 18, gage height, 4.95 ft; minimum, 444 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 1.60 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	636	733	1480	960	740	773	1740	1520	977	551	605	448
2	648	722	1430	920	750	1050	1540	1410	911	596	567	446
3	668	711	1300	900	760	1260	1440	1280	866	608	564	493
4	739	718	1220	870	780	1420	1370	1200	853	583	567	505
5	743	760	1150	850	820	1510	1290	1140	822	559	559	483
6	747	894	1080	830	880	1510	1220	1110	775	543	533	475
7	713	1070	1030	820	921	1480	1170	1110	739	531	515	462
8	671	1230	997	810	957	1470	1170	1120	712	531	537	457
9	692	1350	968	800	985	1420	1270	1090	692	539	562	456
10	805	1330	953	800	995	1310	1420	1070	675	539	577	484
11	963	1270	945	800	971	1250	1590	1050	662	523	553	505
12	1110	1200	938	800	890	1200	1660	1020	648	528	525	520
13	1220	1150	924	810	836	1130	1600	989	635	610	505	501
14	1270	1080	905	810	817	1080	1470	958	622	675	495	493
15	1220	1020	895	820	810	1040	1500	917	643	658	492	539
16	1160	981	869	820	800	1020	1850	876	710	600	484	582
17	1130	964	858	827	800	1040	2010	851	730	564	506	639
18	1120	945	890	833	794	1080	2090	832	692	543	527	665
19	1090	906	944	834	801	1140	1950	817	646	529	568	628
20	1080	866	987	835	833	1200	1660	798	616	515	550	595
21	1080	868	990	820	854	1260	1490	779	598	516	536	567
22	1050	896	990	770	886	1290	1380	766	591	583	513	549
23	984	919	996	740	903	1350	1290	760	599	613	495	543
24	926	950	1010	730	899	1440	1200	769	604	632	486	540
25	880	942	954	720	859	1540	1120	803	588	591	475	548
26	845	914	850	710	823	1620	1050	851	572	558	466	560
27	819	920	740	700	768	1660	1010	923	560	543	460	575
28	793	1020	700	700	756	1660	1040	1110	549	532	456	579
29	773	1180	850	700	---	1700	1190	1310	543	603	453	556
30	756	1350	940	710	---	1820	1410	1240	536	637	450	545
31	743	---	980	720	---	1920	---	1080	---	637	451	---
TOTAL	28074	29859	30763	24769	23688	41643	43190	31549	20366	17770	16032	15938
MEAN	906	995	992	799	846	1343	1440	1018	679	573	517	531
MAX	1270	1350	1480	960	995	1920	2090	1520	977	675	605	665
MIN	636	711	700	700	740	773	1010	760	536	515	450	446
CFSM	1.33	1.46	1.46	1.17	1.24	1.97	2.12	1.50	1.00	.84	.76	.78
IN.	1.53	1.63	1.68	1.35	1.29	2.27	2.36	1.72	1.11	.97	.88	.87
CAL YR 1990	TOTAL	324920	MEAN	890	MAX	2190	MIN	538	CFSM	1.31	IN	17.75
WTR YR 1991	TOTAL	323641	MEAN	887	MAX	2090	MIN	446	CFSM	1.30	IN	17.68

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04124000 MANISTEE RIVER NEAR SHERMAN, MI

LOCATION.--Lat 44°26'11", long 85°41'55", in NE1/4 NE1/4 sec.36, T.24 N., R.12 W., Wexford County, Hydrologic Unit 04060103, on right bank 50 ft downstream from bridge on State Highway 37, 200 ft upstream from Wheeler Creek, 0.9 mi north of Sherman, and at mile 60.8.

DRAINAGE AREA.--857 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1903 to May 1916, October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1004: 1936(M). WSP 1307: 1911, 1913-14(M), 1934(M), 1936(M), 1937, 1939-40(M). WSP 1437: 1911, 1913(M), 1937. WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 804 ft, from river profile map. Prior to Apr. 13, 1934, at various datums. Apr. 14, 1934 to Oct. 25, 1990, non-recording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 26 to Jan. 4, Jan. 6-7, 9-12, Jan. 22 to Feb. 7, and Feb. 13, 14, 16-19. Records fair except for estimated daily discharges and period of once daily observer readings Oct. 1-24, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--71 years (water years 1904-15, 1931, 1934-91), 1,061 ft<sup>3</sup>/s, 16.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,570 ft<sup>3</sup>/s, Mar. 25, 1913, gage height, 7.1 ft, from graph based on gage readings, datum then in use; minimum daily, 540 ft<sup>3</sup>/s, Feb. 21-23, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,190 ft<sup>3</sup>/s, Apr. 10, gage height, 14.19 ft; maximum gage height, 15.01 ft, Feb. 17, backwater from ice; minimum discharge, 770 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 10.85 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	946	947	1310	1100	860	918	1730	1300	1350	830	889	780
2	926	942	1230	1050	880	1090	1510	1230	1310	897	870	773
3	906	939	1170	1010	900	1260	1410	1180	1210	1070	904	846
4	918	967	1140	1000	940	1220	1360	1150	1170	1140	905	947
5	926	1030	1100	960	960	1160	1350	1140	1150	1070	877	889
6	942	1070	1070	965	980	1150	1360	1170	1110	1000	849	847
7	934	1120	1080	970	1000	1210	1370	1200	1050	949	831	816
8	910	1140	1080	976	1030	1140	1510	1200	1010	900	822	801
9	906	1130	1070	980	1040	1110	1940	1180	983	864	817	795
10	1110	1130	1090	985	1030	1100	2140	1150	969	848	818	844
11	1150	1110	1100	990	996	1070	2120	1140	985	834	806	853
12	1210	1080	1080	995	923	1040	1900	1120	972	827	800	868
13	1190	1040	1100	1010	920	1020	1690	1100	945	861	795	837
14	1190	1020	1090	1050	920	1010	1530	1080	925	865	795	820
15	1170	1100	1060	1070	931	997	1640	1070	925	842	797	879
16	1140	1250	1050	1080	900	1010	2060	1060	926	824	799	964
17	1150	1250	1050	1060	880	1050	2020	1050	944	814	818	961
18	1130	1220	1070	1020	900	1100	1850	1050	917	810	825	938
19	1130	1190	1070	987	950	1210	1720	1050	894	806	826	892
20	1120	1150	1050	986	968	1340	1540	1030	889	800	843	861
21	1090	1120	1040	961	945	1470	1420	1010	882	856	843	846
22	1060	1150	1110	920	942	1700	1350	994	873	1070	822	835
23	1020	1150	1160	880	918	1860	1310	1010	869	1160	805	833
24	986	1150	1080	860	917	2020	1280	1040	864	1120	796	821
25	973	1120	1000	840	926	1970	1240	1190	851	1020	793	831
26	959	1080	900	830	925	1870	1220	1300	842	924	792	863
27	946	1120	850	820	912	1870	1190	1540	838	878	787	855
28	952	1340	800	820	907	2070	1330	1450	833	867	782	863
29	961	1490	900	830	---	2160	1410	1310	832	904	778	875
30	970	1380	1100	840	---	2110	1350	1270	824	973	778	873
31	960	---	1200	850	---	1990	---	1330	---	948	782	---
TOTAL	31881	33925	33200	29695	26300	43295	46850	36094	29142	28571	25444	25706
MEAN	1028	1131	1071	958	939	1397	1562	1164	971	922	821	857
MAX	1210	1490	1310	1100	1040	2160	2140	1540	1350	1160	905	964
MIN	906	939	800	820	860	918	1190	994	824	800	778	773
CFSM	1.20	1.32	1.25	1.12	1.10	1.63	1.82	1.36	1.13	1.08	.96	1.00
IN.	1.38	1.47	1.44	1.29	1.14	1.88	2.03	1.57	1.26	1.24	1.10	1.12
CAL YR 1990	TOTAL	416477	MEAN	1141	MAX	3080	MIN	800	CFSM	1.33	IN	18.08
WTR YR 1991	TOTAL	390103	MEAN	1069	MAX	2160	MIN	773	CFSM	1.25	IN	16.93

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04126000 MANISTEE RIVER NEAR MANISTEE, MI

LOCATION.--Lat 44°16'14", long 86°11'56", in NW1/4 NW1/4 sec.36, T.22 N., R.16 W., Manistee County, Hydrologic Unit 04060103, on right bank 6.4 mi northeast of Manistee, 7.8 mi upstream from Manistee Lake, and at mile 10.8.

DRAINAGE AREA.--1,677 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1951 to current year. Monthly discharge only for October, November, 1951, published in WSP 1727.

REVISED RECORDS.--WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 585 ft, from river-profile map.

REMARKS.--Estimated daily discharges: Dec. 28, Jan. 4-6, 8, 9, Jan. 23 to Feb. 4, and Feb. 15, 16. Records good except for estimated daily discharges, which are fair. Flow regulated at all stages by Tippy Hydroelectric Powerplant 21 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 2,054 ft<sup>3</sup>/s, 16.63 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,280 ft<sup>3</sup>/s, Oct. 5, 1986, gage height, 8.44 ft; maximum gage height, 9.25 ft, Dec. 28, 1985, backwater from ice; minimum daily discharge, 570 ft<sup>3</sup>/s, June 18, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,770 ft<sup>3</sup>/s, Apr. 12, gage height, 7.99 ft; maximum gage height, 8.77 ft, Feb. 1, backwater from ice; minimum discharge, 1,310 ft<sup>3</sup>/s, July 17, gage height, 4.75 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1750	2080	3030	2600	2200	2050	4140	3010	2430	1710	1880	1540
2	2210	2020	2840	2550	2150	2230	4020	2780	2430	1880	1990	1540
3	1950	1970	2700	2430	2100	2770	3310	2670	2410	2050	1880	1640
4	2280	1970	2610	2200	2050	2810	2690	2560	2460	2060	1860	2380
5	2230	2030	2450	2100	2290	2870	2660	2500	2180	2020	1830	2030
6	2140	2590	2250	2050	2410	2760	2710	2570	1950	1860	1810	1580
7	1850	2700	2210	2000	2300	2660	2760	2580	1950	1830	1810	1550
8	1990	2600	2200	1900	2370	2440	2800	2570	2090	1810	1810	1560
9	2400	2460	2240	2100	2230	2650	3210	2660	2050	1720	1600	1670
10	1920	2380	2270	2550	2200	2650	4010	2610	1980	1710	1620	1590
11	2770	2370	2320	2030	1970	2070	4470	2460	2000	1770	1790	1580
12	2240	2440	2290	2260	1910	2280	4640	2560	1970	1690	1800	1680
13	2620	2260	2300	2580	2090	2330	4280	2450	1790	1660	1620	1770
14	2740	2210	2290	2120	2050	2140	4000	2700	1770	1710	1480	1740
15	2650	2160	2280	2020	1950	2090	3720	1930	1900	1680	1610	1830
16	2640	2200	2270	2050	1850	2150	4010	1940	1910	1670	1520	2060
17	2630	2610	2260	2250	1740	2130	4400	2340	1890	1400	1620	2050
18	2500	2700	2230	2250	1930	2290	4370	1910	1900	1790	1730	2080
19	2630	2520	2320	2170	2440	2690	4250	2140	2040	1680	1790	1760
20	2650	2380	2330	2140	2240	2680	4060	2000	1810	1670	1770	1810
21	2560	2320	2250	1990	2110	2910	3860	1990	1790	1550	1670	1720
22	2430	2450	2380	1910	2000	3470	3100	2000	1800	1870	1660	1700
23	2290	2490	2400	1650	1960	3910	2490	2120	2030	2430	1660	1700
24	2020	2460	2280	1750	1890	4100	2680	2130	1690	2210	1660	1690
25	1960	2400	2250	1850	1840	4270	2630	2140	1650	1660	1650	1670
26	2160	2270	2220	1850	1910	4310	2410	2390	1740	2030	1490	1800
27	2150	2320	1810	2250	1940	4250	2520	2750	1630	1790	1450	1870
28	2080	2580	1950	2000	2090	4150	2750	3090	1610	1710	1550	1740
29	2060	3060	2080	2100	---	4220	2780	3570	1680	1860	1550	1770
30	1930	3340	2570	2150	---	4330	3060	2970	1690	2290	1550	1760
31	2050	---	2300	2000	---	4340	---	2460	---	2420	1550	---
TOTAL	70480	72340	72180	65850	58210	93000	102790	76550	58220	57190	52260	52860
MEAN	2274	2411	2328	2124	2079	3000	3426	2469	1941	1845	1686	1762
MAX	2770	3340	3030	2600	2440	4340	4640	3570	2460	2430	1990	2380
MIN	1750	1970	1810	1650	1740	2050	2410	1910	1610	1400	1450	1540
CFSM	1.36	1.44	1.39	1.27	1.24	1.79	2.04	1.47	1.16	1.10	1.01	1.05
IN.	1.56	1.60	1.60	1.46	1.29	2.06	2.28	1.70	1.29	1.27	1.16	1.17

CAL YR 1990 TOTAL 877160 MEAN 2403 MAX 6660 MIN 1510 CFSM 1.43 IN 19.46  
WTR YR 1991 TOTAL 831930 MEAN 2279 MAX 4640 MIN 1400 CFSM 1.36 IN 18.45



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04126520 MANISTEE RIVER AT MANISTEE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 44°15'02", long 86°19'09", in SW1/4 SW1/4 sec.1, T.21 N., R.17 W., Manistee County, Hydrologic Unit 04060103, at upstream side of bridge on U.S. Highway 31 in Manistee, and 1.3 mi upstream from mouth.

DRAINAGE AREA.--1,928 mi<sup>2</sup>, revised.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: November 1974 to September 1981.

WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Mar. 18, 1977 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at Washington Street bridge. Water-discharge measurements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 1,680 microsiemens, Nov. 18, 1974; minimum, 226 microsiemens, Apr. 22, 1980.

WATER TEMPERATURE (water years 1975-81): Maximum, 26.5°C, July 8, 1981, minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, (PER-CENT SATUR-ATION) (00301)	COLI-FORM, DIS-SOLVED, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 01...	0900	1600	333	8.24	8.5	2.9	11.0	96	K15	K10
DEC 13...	0915	2920	--	8.10	2.5	2.3	12.2	87	K18	K5
MAR 21...	0930	2730	460	7.78	5.0	--	11.5	93	K12	K9
APR 25...	0930	2830	279	8.16	10.5	5.3	10.3	94	K10	K5
JUL 02...	1300	2180	454	8.15	22.5	3.5	7.4	88	120	K40
AUG 29...	0900	1770	457	8.08	23.0	2.4	8.2	97	K50	59

DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARE DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CACO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
NOV 01...	170	22	47	12	7.0	0.9	177	145	10	14
DEC 13...	180	36	51	12	13	1.3	172	141	15	40
MAR 21...	200	69	63	11	9.7	1.6	164	135	7.1	55
APR 25...	140	17	40	10	6.2	1.1	151	124	9.6	10
JUL 02...	210	61	64	13	11	1.7	182	149	14	56
AUG 29...	220	64	63	14	12	1.4	185	152	13	47

DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)
NOV 01...	<0.1	7.9	195	0.27	842	<0.01	<0.01	0.30	0.20	0.02
DEC 13...	0.2	7.8	229	0.31	1810	<0.01	<0.01	0.20	0.20	0.08
MAR 21...	0.2	7.5	277	0.38	2040	<0.01	<0.01	0.28	0.24	0.05
APR 25...	<0.1	6.2	164	0.22	1250	<0.01	0.02	0.25	0.22	0.02
JUL 02...	0.1	6.5	269	0.37	1580	0.01	<0.01	0.14	0.13	0.03
AUG 29...	0.1	6.9	255	0.35	1220	<0.01	<0.01	0.09	0.09	0.03

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04126520 MANISTEE RIVER AT MANISTEE, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
NOV 01...	0.02	0.4	0.02	0.02	0.02	<0.01	<10	<1	18	<0.5
DEC 13...	0.08	0.4	<0.01	0.01	<0.01	<0.01	--	--	--	--
MAR 21...	0.04	0.3	0.02	<0.01	0.02	<0.01	<10	<1	18	<0.5
APR 25...	0.02	0.3	0.03	<0.01	<0.01	<0.01	20	<1	16	<0.5
JUL 02...	0.03	0.6	0.01	<0.01	<0.01	<0.01	--	--	--	--
AUG 29...	0.02	0.3	0.01	<0.01	<0.01	<0.01	10	<1	30	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
NOV 01...	<1	1	<3	6	25	1	5	5	<0.1	<10
DEC 13...	--	--	--	--	--	--	--	--	--	--
MAR 21...	<1	<1	<3	<1	45	<1	19	11	<0.1	<10
APR 25...	2	1	<3	1	59	1	<4	5	0.1	<10
JUL 02...	--	--	--	--	--	--	--	--	--	--
AUG 29...	1	<1	<3	2	11	<1	16	3	0.2	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	
NOV 01...	2	<1	<1	130	<6	29	10	43	76	
DEC 13...	--	--	--	--	--	--	3	24	66	
MAR 21...	1	<1	<1	440	<6	7	10	74	96	
APR 25...	<1	<1	<1	100	<6	11	13	99	91	
JUL 02...	--	--	--	--	--	--	9	53	89	
AUG 29...	<1	<1	<1	400	<6	24	4	19	83	

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04126740 PLATTE RIVER AT HONOR, MI

LOCATION.--Lat 44°40'05", long 86°02'05", in SW1/4 NW1/4 sec.8, T.26 N., R.14 W., Benzie County, Hydrologic Unit 04060104, on right bank 20 ft downstream from bridge on U.S. Highway 31, 1.0 mi west of Honor.

DRAINAGE AREA.--118 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1990 to current year.

GAGE.--Water-stage recorder. Datum of gage is 589.73 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation bench mark).

REMARKS.--Estimated daily discharges: Dec. 26, 27, Jan. 8, 23-25, and Feb. 15. Records good except for estimated daily discharges, which are fair. Some diversion for fish hatchery 6 mi upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 447 ft<sup>3</sup>/s, June 17, 1990, gage height, 3.11 ft; minimum, 103 ft<sup>3</sup>/s, Aug. 16, 1990, gage height, 1.20 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 274 ft<sup>3</sup>/s, Apr. 15, gage height, 2.21 ft; minimum, 109 ft<sup>3</sup>/s, June 26, gage height, 1.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	127	117	129	135	126	127	156	144	140	138	135	127
2	122	116	126	133	127	190	152	142	138	180	142	125
3	122	117	129	131	128	149	151	141	136	142	154	164
4	132	124	133	131	133	139	149	140	133	134	141	141
5	121	132	132	131	132	136	148	146	130	132	137	133
6	118	145	132	131	130	146	147	157	128	129	135	131
7	117	144	131	130	131	143	144	147	127	127	134	129
8	116	134	131	131	132	137	159	145	126	126	134	128
9	116	135	131	132	131	137	171	146	125	124	134	132
10	134	133	133	130	128	136	186	143	124	123	132	132
11	132	130	130	131	125	134	167	142	121	122	131	129
12	123	126	130	132	123	132	160	142	122	125	131	127
13	121	123	132	131	125	131	156	138	119	130	130	126
14	129	124	127	132	126	130	162	136	121	123	131	128
15	132	127	129	131	126	130	204	134	124	121	130	168
16	123	126	129	131	126	131	185	137	122	120	130	152
17	128	124	132	131	126	132	166	147	120	123	146	139
18	144	123	139	131	126	137	161	140	119	123	146	153
19	142	122	135	131	133	142	157	137	117	122	146	141
20	129	121	132	131	129	143	154	134	116	122	141	142
21	127	133	138	127	128	160	151	134	117	165	139	134
22	126	133	145	128	128	154	150	134	118	151	137	132
23	123	132	135	125	125	183	149	134	115	140	135	131
24	122	127	131	125	126	179	146	135	128	136	134	127
25	121	126	134	125	125	156	143	145	116	138	133	152
26	119	123	133	129	125	158	142	204	112	133	131	152
27	120	141	133	130	125	172	143	156	112	132	130	134
28	119	143	132	129	125	193	162	146	113	134	130	128
29	117	131	151	128	---	165	150	149	114	157	130	124
30	117	129	141	127	---	158	149	144	114	147	130	121
31	116	---	136	127	---	156	---	142	---	137	128	---
TOTAL	3855	3861	4131	4027	3570	4616	4720	4461	3667	4156	4197	4082
MEAN	124	129	133	130	128	149	157	144	122	134	135	136
MAX	144	145	151	135	133	193	204	204	140	180	154	168
MIN	116	116	126	125	123	127	142	134	112	120	128	121
CFSM	1.05	1.09	1.13	1.10	1.09	1.26	1.33	1.22	1.03	1.14	1.14	1.15
IN.	1.22	1.22	1.30	1.27	1.13	1.46	1.49	1.41	1.16	1.31	1.32	1.29

WTR YR 1991 TOTAL 49343 MEAN 135 MAX 204 MIN 112 CFSM 1.14 IN 15.56

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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## 04127565 INTERMEDIATE RIVER AT BELLAIRE, MI

LOCATION.--Lat 44°58'42", long 85°12'36", in SE1/4 SE1/4 sec.24, T.30 N., R.8 W., Antrim County, Hydrologic Unit 04060105, on left bank at downstream side of bridge on State Highway 88 in Bellaire, 500 ft downstream from dam.

DRAINAGE AREA.--146 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1990 to September 1991 (discontinued).

GAGE.--Water-stage recorder. Datum of gage is 587.66 ft above National Geodetic Vertical Datum of 1929 (Lennox & Associates bench mark).

REMARKS.--Estimated daily discharges: Oct. 1-23, Dec. 25-28, Jan. 4, 5, 22-31, and Feb. 15. Records fair except for estimated daily discharges, which are poor. Flow regulated by dam upstream from station. Several measurements of water temperature were made during the year. The Michigan Department of Natural Resources collected water quality samples at the same time as discharge measurements for the period April 1990 to March 1991.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 472 ft<sup>3</sup>/s, Apr. 1, gage height, 5.04 ft; minimum, 111 ft<sup>3</sup>/s, Aug. 26-28, Sept. 2-5, 11, 12, gage height, 3.34 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	200	230	228	226	200	220	470	267	232	131	182	127
2	200	228	227	220	197	268	462	264	238	146	141	122
3	205	226	224	220	196	271	455	261	238	146	127	111
4	210	227	227	220	195	268	446	255	230	147	125	111
5	215	232	224	219	198	276	438	252	203	146	133	118
6	210	238	218	218	201	284	427	255	190	146	138	135
7	205	239	213	216	202	295	413	254	154	146	137	143
8	205	238	211	217	203	292	414	253	128	174	136	143
9	210	237	211	211	206	296	421	253	112	168	130	142
10	250	239	212	207	207	297	426	252	112	143	125	135
11	230	238	209	205	207	295	414	246	125	131	122	113
12	215	233	212	208	207	291	400	244	131	120	122	112
13	200	231	215	205	208	287	388	206	138	114	122	119
14	210	229	211	205	212	282	378	160	142	114	122	124
15	220	230	210	204	215	278	395	147	144	114	122	272
16	210	231	214	205	217	275	410	146	145	113	122	342
17	250	229	214	205	214	273	402	161	145	124	135	301
18	290	228	218	208	214	275	397	178	145	141	154	302
19	285	226	218	208	222	279	391	175	128	142	191	262
20	285	228	214	209	227	284	382	193	119	142	201	183
21	280	231	215	199	226	305	372	199	119	214	194	133
22	280	235	223	200	225	316	331	196	119	265	145	145
23	280	234	222	200	224	325	320	196	119	294	124	232
24	273	233	219	200	225	344	330	209	119	261	123	213
25	268	231	218	200	223	348	306	211	138	246	123	186
26	259	226	218	200	221	356	255	216	147	181	115	187
27	251	229	218	200	222	388	235	213	147	137	111	213
28	248	239	218	200	220	463	257	212	146	134	119	227
29	241	234	240	200	---	463	266	234	147	169	124	220
30	236	231	225	200	---	466	272	240	137	216	127	223
31	232	---	226	200	---	469	---	237	---	221	128	---
TOTAL	7353	6960	6772	6435	5934	9829	11273	6785	4537	5086	4220	5396
MEAN	237	232	218	208	212	317	376	219	151	164	136	180
MAX	290	239	240	226	227	469	470	267	238	294	201	342
MIN	200	226	209	199	195	220	235	146	112	113	111	111
CFSM	1.62	1.59	1.50	1.42	1.45	2.17	2.57	1.50	1.04	1.12	.93	1.23
IN.	1.87	1.77	1.73	1.64	1.51	2.50	2.87	1.73	1.16	1.30	1.08	1.37

WTR YR 1991 TOTAL 80580 MEAN 221 MAX 470 MIN 111 CFSM 1.51 IN. 20.53



## STREAMS TRIBUTARY TO LAKE MICHIGAN

445256085240001 ELK LAKE NEAR ELK RAPIDS, MI

LOCATION.--Lat 44°50'43", long 85°23'33", in SW1/4 SW1/4 sec.3, T.28 N., R.9 W., Grand Traverse County, Hydrologic Unit 04060105, at Gay Road, 3.5 mi south of Elk Rapids.

DRAINAGE AREA.--410 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1951 to current year.

GAGE.--Water-stage recorder. Datum of gage is 586.25 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 20, 1952, nonrecording gage at same datum.

REMARKS.--Elk Lake is at the end of a long chain of interconnected lakes and is contiguous with Lake Skegemog. The major inlet to these lakes is Torch River. Smaller inlets include Williamsburg, Battle, Barker, and Desmond Creeks. The outlet of Elk Lake is Elk River. Lake elevation controlled by dam at Elk Rapids. Established legal level; summer, 589.50 ft, winter, 588.90 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.88 ft, Oct. 6, 1986; minimum, 2.08 ft, Dec. 30, 31, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.29 ft, Sept. 16; minimum, 2.57 ft, Jan. 3, 22.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.22	2.63	2.66	2.59	2.66	2.66	2.74	3.19	3.17	3.09	---	3.09
2	3.22	2.62	2.66	2.59	2.68	2.74	2.78	3.18	3.17	3.18	---	3.08
3	3.21	2.62	2.68	2.58	2.68	2.74	2.83	3.18	3.17	3.18	---	3.10
4	3.20	2.65	2.71	2.60	2.65	2.71	2.88	3.17	3.15	3.18	---	3.13
5	3.20	2.69	2.73	2.62	2.62	2.68	2.93	3.18	3.11	3.16	---	3.11
6	3.19	2.77	2.70	2.64	2.60	2.69	2.97	3.18	3.09	3.15	---	3.10
7	3.18	2.80	2.67	2.65	2.60	2.72	3.01	3.17	3.06	3.14	---	3.10
8	3.16	2.80	2.65	2.66	2.61	2.71	3.09	3.17	3.06	3.12	---	3.10
9	3.15	2.80	2.64	2.66	2.60	2.68	3.17	3.17	3.05	3.11	---	3.10
10	3.17	2.78	2.64	2.67	2.60	2.67	3.21	3.17	3.03	3.09	---	3.09
11	3.15	2.75	2.64	2.68	2.60	2.65	3.21	3.16	3.04	3.09	---	3.09
12	3.11	2.73	2.63	2.69	2.61	2.64	3.20	3.17	3.07	3.10	---	3.08
13	3.06	2.74	2.61	2.67	2.61	2.64	3.18	3.16	3.08	---	---	3.09
14	3.01	2.73	2.62	2.66	2.63	2.63	3.17	3.15	3.10	---	---	3.11
15	2.96	2.73	2.62	2.64	2.64	2.63	3.19	3.14	3.13	---	---	3.21
16	2.90	2.73	2.64	2.64	2.62	2.63	3.23	3.14	3.14	---	---	3.25
17	2.87	2.73	2.64	2.64	2.60	2.62	3.23	3.15	3.16	---	---	3.19
18	2.84	2.73	2.66	2.64	2.60	2.63	3.23	3.14	3.16	---	---	3.14
19	2.84	2.72	2.67	2.63	2.62	2.65	3.22	3.12	3.16	---	---	3.10
20	2.80	2.70	2.66	2.62	2.62	2.68	3.21	3.09	3.16	---	---	3.09
21	2.75	2.69	2.65	2.60	2.63	2.71	3.22	3.08	3.16	---	---	3.10
22	2.74	2.68	2.65	2.58	2.64	2.72	3.22	3.08	3.15	---	3.15	3.10
23	2.71	2.66	2.65	2.59	2.64	2.70	3.22	3.09	3.13	---	3.13	3.10
24	2.68	2.65	2.63	2.61	2.65	2.69	3.22	3.11	3.12	---	3.12	3.12
25	2.66	2.63	2.63	2.61	2.67	2.67	3.21	3.13	3.11	---	3.09	3.14
26	2.65	2.64	2.62	2.61	2.67	2.66	3.21	3.19	3.09	---	3.07	3.17
27	2.63	2.66	2.61	2.60	2.67	2.71	3.21	3.19	3.07	---	3.07	3.19
28	2.66	2.68	2.59	2.59	2.66	2.78	3.23	3.19	3.06	---	3.09	3.18
29	2.68	2.68	2.62	2.59	---	2.78	3.25	3.20	3.06	---	3.09	3.18
30	2.65	2.67	2.63	2.59	---	2.77	3.23	3.20	3.06	---	3.10	3.16
31	2.63	---	2.60	2.62	---	2.75	---	3.19	---	---	3.11	---
MEAN	2.93	2.70	2.65	2.62	2.63	2.69	3.13	3.16	3.11	---	---	3.13
MAX	3.22	2.80	2.73	2.69	2.68	2.78	3.25	3.20	3.17	---	---	3.25
MIN	2.63	2.62	2.59	2.58	2.60	2.62	2.74	3.08	3.03	---	---	3.08

CAL YR 1990 MEAN 2.96 MAX 3.57 MIN 2.54

## STREAMS TRIBUTARY TO LAKE MICHIGAN

143

04127800 JORDAN RIVER NEAR EAST JORDAN, MI

LOCATION.--Lat 45°06'09", long 85°05'53", in NW1/4 NW1/4 sec.7, T.31 N., R.6 W., Antrim County, Hydrologic Unit 04060105, on right bank 300 ft downstream from Webster Bridge, 4.2 mi south of East Jordan, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--67.9 mi<sup>2</sup>.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1960-65. October 1966 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 596.43 ft above National Geodetic Vertical Datum of 1929 (Antrim County Road Commission bench mark). Nov. 19, 1959 to Sept. 30, 1966, nonrecording gage at present site and at site 600 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 25-29, Jan. 1, 5, 8, 9, 22-28, 30, 31, and Feb. 16. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by fish hatchery upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 188 ft<sup>3</sup>/s, 37.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,360 ft<sup>3</sup>/s, July 19, 1975, gage height, 6.51 ft; minimum, 91 ft<sup>3</sup>/s, Mar. 8, 1982, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 2	1600	460	4.80	Apr. 15	2100	429	4.71
Mar. 28	0400	*629	*5.29				

Minimum discharge, 152 ft<sup>3</sup>/s, Feb. 15, gage height, 3.04 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	181	168	184	185	181	182	215	188	171	170	168	161
2	186	168	180	180	178	362	207	189	177	205	168	161
3	168	171	181	177	181	269	211	184	172	182	176	178
4	178	193	185	177	200	214	211	182	167	174	169	182
5	163	192	183	178	203	200	214	183	166	171	166	165
6	161	206	184	179	191	222	211	203	165	176	165	164
7	161	207	184	177	193	222	204	194	165	173	164	164
8	160	196	187	177	196	200	241	187	164	169	164	165
9	161	192	187	178	197	197	261	190	163	166	164	165
10	203	198	195	179	188	195	270	183	163	166	163	169
11	195	192	184	178	182	190	241	180	162	165	161	165
12	169	181	187	181	180	186	222	180	161	165	162	164
13	165	177	195	178	180	186	211	177	162	171	161	164
14	172	178	178	181	181	185	210	174	163	170	161	169
15	185	209	180	181	173	186	292	171	164	165	161	301
16	167	201	184	182	175	189	282	172	165	163	160	236
17	247	185	184	182	179	196	222	184	161	164	190	181
18	209	179	192	184	178	217	209	180	160	164	186	190
19	219	179	186	183	184	241	202	172	161	161	175	181
20	181	178	180	184	184	252	196	170	160	162	169	179
21	174	201	186	177	182	304	194	169	162	220	166	175
22	176	210	226	177	184	276	190	170	162	207	165	171
23	172	192	195	177	178	279	192	180	160	198	164	179
24	169	196	188	177	181	294	193	185	159	173	169	178
25	169	187	195	177	179	240	187	176	160	190	165	180
26	167	182	198	177	177	255	185	184	160	173	162	234
27	169	199	200	177	181	364	185	175	160	170	161	211
28	175	228	200	177	179	480	213	171	159	169	161	188
29	169	194	215	177	---	263	195	232	162	178	161	175
30	168	185	202	178	---	224	191	189	161	177	162	174
31	167	---	193	180	---	217	---	174	---	170	161	---
TOTAL	5506	5724	5898	5552	5145	7487	6457	5648	4897	5427	5150	5469
MEAN	178	191	190	179	184	242	215	182	163	175	166	182
MAX	247	228	226	185	203	480	292	232	177	220	190	301
MIN	160	168	178	177	173	182	185	169	159	161	160	161
CFSM	2.62	2.81	2.80	2.64	2.71	3.56	3.17	2.68	2.40	2.58	2.45	2.68
IN.	3.02	3.14	3.23	3.04	2.82	4.10	3.54	3.09	2.68	2.97	2.82	3.00

CAL YR 1990	TOTAL	70546	MEAN	193	MAX	632	MIN	159	CFSM	2.84	IN	38.65
WTR YR 1991	TOTAL	68360	MEAN	187	MAX	480	MIN	159	CFSM	2.75	IN	37.45

STREAMS TRIBUTARY TO LAKE HURON  
04127918 PINE RIVER NEAR RUDYARD, MI

LOCATION.--Lat 46°11'09", long 84°35'52", in NW1/4 NE1/4 sec.30, T.44 N., R.2 W., Chippewa County, Hydrologic Unit 04070002, on right bank 15 ft upstream from bridge on Mackinac Trail, 3.2 mi south of Rudyard.

DRAINAGE AREA.--184 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1972 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 601.50 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 4, 1972, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 3 to Apr. 5. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--19 years, 235 ft<sup>3</sup>/s, 17.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft<sup>3</sup>/s, Mar. 30, 1986, gage height, 18.44 ft; minimum, 33 ft<sup>3</sup>/s, Nov. 16, 1989, result of freezeup; minimum gage height, 1.83 ft, July 29, 30, 1982.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
a	--	ice jam	*14.32	Apr. 13	2400	1,490	8.01
Apr. 7	2300	1,810	9.22	Apr. 15	2200	*2,740	12.52

a Sometime during period Mar. 26 to Apr. 4.

Minimum discharge, 45 ft<sup>3</sup>/s, Aug. 12-14, Sept. 1, 2, 3, gage height, 2.03 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	132	170	361	120	82	90	480	294	137	79	65	47
2	152	163	305	115	80	110	450	272	123	72	62	47
3	155	160	230	110	80	135	500	246	115	78	60	52
4	570	165	245	105	82	140	630	224	109	85	58	67
5	423	164	265	100	88	140	1000	206	98	83	55	64
6	288	161	255	98	92	140	1500	235	93	102	53	60
7	228	167	250	96	96	135	1710	265	90	142	52	60
8	192	168	235	95	98	135	1630	247	86	111	51	58
9	171	174	222	95	100	130	1640	225	83	90	52	58
10	165	200	220	94	100	130	1000	206	83	77	54	80
11	252	188	210	93	96	125	753	194	83	78	57	87
12	241	171	205	92	94	120	823	185	84	73	48	76
13	204	156	200	92	90	120	984	353	81	70	45	66
14	304	147	195	92	86	120	1480	826	83	69	53	63
15	577	226	190	94	84	125	2280	463	110	65	68	164
16	526	264	185	95	82	125	2210	312	105	61	97	242
17	642	267	178	96	82	125	1510	431	91	62	72	210
18	818	209	175	98	82	130	1040	362	82	69	69	184
19	701	186	165	98	84	140	764	268	77	63	65	197
20	468	173	160	98	86	165	582	224	72	62	64	168
21	511	303	155	92	88	180	453	195	71	64	60	145
22	564	884	150	85	88	195	374	177	75	83	59	128
23	399	565	150	84	88	230	325	167	73	167	60	143
24	319	393	150	84	86	320	300	158	69	140	58	148
25	267	310	145	84	86	480	278	165	66	102	58	185
26	228	243	145	82	84	650	258	167	66	83	57	408
27	205	674	145	82	84	800	246	219	65	75	56	312
28	205	841	140	82	84	760	243	196	63	69	54	253
29	199	614	135	82	---	640	243	181	70	67	53	210
30	189	412	130	82	---	550	281	168	90	68	52	187
31	179	---	125	82	---	500	---	151	---	68	48	---
TOTAL	10474	8918	6021	2897	2452	7885	25967	7982	2593	2577	1815	4169
MEAN	338	297	194	93.5	87.6	254	866	257	86.4	83.1	58.5	139
MAX	818	884	361	120	100	800	2280	826	137	167	97	408
MIN	132	147	125	82	80	90	243	151	63	61	45	47
CFSM	1.84	1.61	1.05	.51	.48	1.38	4.71	1.40	.47	.45	.32	.76
IN.	2.12	1.80	1.22	.59	.50	1.59	5.25	1.61	.52	.52	.37	.84

CAL YR 1990	TOTAL	87470	MEAN	240	MAX	1270	MIN	57	CFSM	1.30	IN	17.68
WTR YR 1991	TOTAL	83750	MEAN	229	MAX	2280	MIN	45	CFSM	1.25	IN	16.93

## STREAMS TRIBUTARY TO LAKE HURON

145

452600084472001 CROOKED LAKE NEAR CONWAY, MI

LOCATION.--Lat 45°23'52", long 84°49'22", in NE1/4 SW1/4 sec.29, T.35 N., R.4 W., Emmet County, Hydrologic Unit 04070004, at Minnehaha Creek Inlet on Channel Road, 2.5 mi southeast of Conway.

DRAINAGE AREA.--101 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1942 to July 1945 (summer months only), August 1945 to current year.

GAGE.--Water-stage recorder. Datum of gage is 593.38 ft above National Geodetic Vertical Datum of 1929. Prior to June 13, 1960, nonrecording gage at datum 1.00 ft higher. June 13, 1960 to June 29, 1964, nonrecording gage at same datum.

REMARKS.--Crooked Lake is the upstream end of the navigable inland water route. Major inlets are Minnehaha Creek, Round Lake Outlet, and Pickerel Lake Outlet. The outlet is Crooked River. Lake elevation controlled by dam and boat lock at Alanson.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.60 ft, Apr. 12, 1948 (present datum); minimum, 0.54 ft, Mar. 30, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.55 ft, May 18; minimum, 1.05 ft, Mar. 1.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.33	2.29	1.74	1.57	1.35	1.06	2.22	2.20	2.43	2.11	2.17	2.02
2	2.35	2.28	1.72	1.55	1.34	1.21	2.18	2.22	2.40	2.16	2.17	2.01
3	2.35	2.31	1.79	1.53	1.26	1.40	2.15	2.24	2.37	2.20	2.17	2.02
4	2.34	2.35	1.82	1.52	1.24	1.37	2.13	2.25	2.34	2.21	2.16	2.04
5	2.34	2.40	1.78	1.51	1.23	1.36	2.12	2.26	2.31	2.20	2.15	2.03
6	2.33	2.43	1.76	1.50	1.23	1.36	2.12	2.28	2.29	2.19	2.14	2.03
7	2.31	2.45	1.72	1.48	1.23	1.42	2.11	2.28	2.27	2.19	2.14	2.04
8	2.30	2.44	1.71	1.47	1.23	1.39	2.11	2.30	2.25	2.18	2.13	2.05
9	2.29	2.44	1.69	1.47	1.23	1.39	2.15	2.31	2.23	2.15	2.13	2.07
10	2.33	2.45	1.69	1.45	1.24	1.39	2.19	2.30	2.20	2.14	2.11	2.35
11	2.34	2.44	1.67	1.45	1.30	1.38	2.17	2.30	2.18	2.14	2.10	2.38
12	2.35	2.44	1.65	1.46	1.19	1.36	2.17	2.30	2.19	2.13	2.09	2.37
13	2.34	2.42	1.65	1.44	1.17	1.34	2.17	2.32	2.18	2.14	2.08	2.35
14	2.35	2.40	1.62	1.42	1.16	1.32	2.18	2.31	2.18	2.14	2.07	2.35
15	2.37	2.30	1.61	1.40	1.38	1.30	2.23	2.32	2.20	2.12	2.06	2.35
16	2.37	2.25	1.61	1.38	1.30	1.28	2.29	2.32	2.19	2.10	2.06	2.33
17	2.41	2.18	1.60	1.37	1.18	1.27	2.32	2.47	2.19	2.12	2.06	2.31
18	2.44	2.11	1.62	1.37	1.15	1.28	2.31	2.54	2.18	2.13	2.07	2.29
19	2.45	2.04	1.60	1.36	1.14	1.30	2.30	2.52	2.17	2.12	2.07	2.29
20	2.44	1.98	1.59	1.33	1.13	1.34	2.29	2.48	2.17	2.15	2.06	2.29
21	2.42	1.95	1.58	1.37	1.11	1.42	2.26	2.44	2.17	2.23	2.06	2.27
22	2.40	1.90	1.60	1.33	1.11	1.56	2.23	2.43	2.16	2.25	2.06	2.26
23	2.39	1.88	1.59	1.33	1.16	1.64	2.20	2.41	2.14	2.26	2.06	2.25
24	2.37	1.85	1.59	1.33	1.10	1.70	2.18	2.39	2.13	2.24	2.08	2.25
25	2.36	1.81	1.59	1.33	1.09	1.71	2.15	2.39	2.13	2.24	2.06	2.26
26	2.34	1.78	1.59	1.34	1.12	1.73	2.14	2.40	2.13	2.22	2.03	2.36
27	2.32	1.77	1.60	1.34	1.15	1.87	2.16	2.38	2.10	2.20	2.03	2.38
28	2.33	1.78	1.60	1.35	1.09	2.26	2.20	2.39	2.09	2.19	2.04	2.36
29	2.30	1.78	1.61	1.34	---	2.33	2.24	2.44	2.11	2.20	2.04	2.35
30	2.30	1.75	1.59	1.33	---	2.29	2.22	2.46	2.11	2.20	2.04	2.33
31	2.30	---	1.58	1.34	---	2.26	---	2.45	---	2.18	2.04	---
MEAN	2.35	2.16	1.65	1.41	1.20	1.53	2.20	2.36	2.21	2.18	2.09	2.23
MAX	2.45	2.45	1.82	1.57	1.38	2.33	2.32	2.54	2.43	2.26	2.17	2.38
MIN	2.29	1.75	1.58	1.33	1.09	1.06	2.11	2.20	2.09	2.10	2.03	2.01

WTR YR 1991 MEAN 1.97 MAX 2.54 MIN 1.06



## STREAMS TRIBUTARY TO LAKE HURON

04128000 STURGEON RIVER NEAR WOLVERINE, MI

LOCATION.--Lat 45°17'56", long 84°36'40", in SE1/4 NE1/4 sec.36, T.34 N., R.3 W., Cheboygan County, Hydrologic Unit 04070004, on left bank 1.8 mi north of Wolverine, 2.8 mi downstream from West Branch, and 9 mi upstream from mouth.

DRAINAGE AREA.--198 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1942 to current year.

REVISED RECORDS.--WSP 1307: 1944(M), 1948(M). WSP 1727: 1951(M). WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1942, nonrecording gage at site 1.0 mi upstream, and June 16, 1942, to Sept. 30, 1958, at site 0.7 mi upstream at different datums.

REMARKS.--Estimated daily discharges: Dec. 4, 5, 28-30, Jan. 1-14, Jan. 23 to Feb. 3, Feb. 12, 16-18, 24, 25, 27, 28, and Mar. 9. Records good except for estimated daily discharges, which are poor. Prior to July 1975, intermittent regulation at low flows from ponds 2.4 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 221 ft<sup>3</sup>/s, 15.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft<sup>3</sup>/s, Sept. 29, 1972, gage height, 3.72 ft; maximum gage height, 4.48 ft, Sept. 14, 1961; minimum discharge, 94 ft<sup>3</sup>/s, Jan. 19, 1971, result of freezeup; minimum daily, 113 ft<sup>3</sup>/s, Aug. 6, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 834 ft<sup>3</sup>/s, Mar. 28, gage height, 3.04 ft; minimum, 118 ft<sup>3</sup>/s, Feb. 26, gage height, 1.38 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	219	208	244	230	215	197	295	259	229	170	174	153
2	245	206	235	220	220	357	280	256	215	202	169	153
3	215	215	230	220	235	350	288	257	212	214	178	154
4	228	233	232	215	251	266	308	242	211	226	172	181
5	221	241	234	210	260	253	350	240	202	287	166	163
6	203	268	236	210	238	249	370	298	195	225	162	156
7	196	265	235	210	230	260	348	284	190	215	161	154
8	195	255	235	210	231	239	398	264	187	198	163	156
9	197	246	239	210	232	235	503	253	183	186	164	158
10	245	254	257	210	221	231	452	249	178	180	171	186
11	318	250	245	215	215	225	390	241	185	176	161	172
12	253	237	237	215	210	217	340	236	185	174	157	163
13	225	227	266	215	203	220	307	260	179	180	152	161
14	220	227	241	215	196	213	313	269	179	185	152	167
15	236	311	228	215	173	211	417	238	181	175	149	309
16	228	352	229	215	180	212	455	225	181	170	149	302
17	279	300	230	216	185	218	369	275	178	178	188	223
18	326	263	236	215	190	240	325	277	176	172	220	201
19	281	248	234	213	199	275	299	244	172	165	191	209
20	258	241	227	213	199	293	285	228	170	167	181	210
21	241	251	227	183	197	313	277	224	171	231	171	199
22	238	298	256	204	199	304	260	219	175	229	163	187
23	237	265	256	205	187	304	255	232	171	286	160	190
24	226	259	226	205	185	355	257	219	169	233	169	199
25	221	248	226	205	183	306	245	213	166	220	170	196
26	212	238	227	207	182	318	243	227	165	214	160	295
27	211	261	240	210	190	515	238	230	164	191	155	298
28	225	327	245	210	195	727	272	217	164	182	153	265
29	216	296	250	210	---	469	275	334	165	191	152	229
30	209	255	245	210	---	328	272	364	165	202	154	210
31	210	---	240	210	---	309	---	255	---	190	152	---
TOTAL	7234	7745	7388	6551	5801	9209	9686	7829	5463	6214	5139	5999
MEAN	233	258	238	211	207	297	323	253	182	200	166	200
MAX	326	352	266	230	260	727	503	364	229	287	220	309
MIN	195	206	226	183	173	197	238	213	164	165	149	153
CFSM	1.18	1.30	1.20	1.07	1.05	1.50	1.63	1.28	.92	1.01	.84	1.01
IN.	1.36	1.46	1.39	1.23	1.09	1.73	1.82	1.47	1.03	1.17	.97	1.13

CAL YR 1990 TOTAL 89233 MEAN 244 MAX 859 MIN 166 CFSM 1.23 IN 16.76  
WTR YR 1991 TOTAL 84258 MEAN 231 MAX 727 MIN 149 CFSM 1.17 IN 15.83

## STREAMS TRIBUTARY TO LAKE HURON

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## 04128990 PIGEON RIVER NEAR VANDERBILT, MI

LOCATION.--Lat 45°09'24", long 84°28'00", in NW1/4 NW1/4 sec.20, T.32 N., R.1 W., Otsego County, Hydrologic Unit 04070004, on left bank at Sturgeon Valley Road, 9.7 mi east of Vanderbilt, 1.0 mi downstream from Lansing Club Dam, and 28.5 mi upstream from Mullett Lake.

DRAINAGE AREA.--57.7 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1950 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 920 ft above National Geodetic Vertical Datum of 1929, from topographic map. September 1950 to October 1990, recording gage at site 2.5 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 26, 27, 31, Jan. 3, 7, 8, 10-12, 22-26, 28, 29, and Feb. 11, 12, 14, 15, 17, 24-26. Records good except for estimated daily discharges, which are poor. Prior to May 16, 1957, and since Apr. 22, 1958, occasional regulation by Lansing Club Dam 1.0 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 78.5 ft<sup>3</sup>/s, 18.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft<sup>3</sup>/s, May 15, 1957, gage height, 6.80 ft, site and datum then in use, from floodmark, from rating curve extended above 500 ft<sup>3</sup>/s, result of failure of Lansing Club Dam; minimum discharge, 12 ft<sup>3</sup>/s, Mar. 22, 1989; minimum gage height, 1.23 ft, Jan. 8, 1957, site and datum then in use; minimum daily discharge, 24 ft<sup>3</sup>/s, Jan. 8, 1957.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 431 ft<sup>3</sup>/s, Mar. 28, gage height, 4.39 ft; minimum, 28 ft<sup>3</sup>/s, Nov. 7, gage height, 1.97 ft; minimum daily, 44 ft<sup>3</sup>/s, Aug. 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	71	70	73	69	64	67	81	77	68	62	55	49
2	72	64	70	68	63	116	74	77	67	74	51	45
3	67	71	72	67	63	114	95	81	67	105	56	46
4	84	69	76	66	68	87	95	73	61	114	53	58
5	86	69	74	64	79	82	121	76	60	98	52	52
6	71	95	74	62	77	73	145	108	63	64	53	48
7	62	85	69	60	70	85	124	93	55	76	48	47
8	71	75	78	57	68	68	135	86	59	61	50	53
9	69	73	71	60	82	79	180	83	58	62	47	52
10	88	72	87	60	68	72	143	70	56	60	48	50
11	136	83	81	61	64	73	110	77	55	57	49	52
12	101	83	69	62	62	63	103	71	57	51	49	53
13	78	74	87	64	57	71	92	71	57	56	47	50
14	70	76	75	65	57	66	105	89	56	61	46	50
15	87	97	73	68	58	69	135	72	55	54	48	76
16	71	181	73	64	59	70	191	71	55	53	46	112
17	107	109	72	64	61	67	113	73	53	52	48	73
18	103	98	81	68	64	73	98	81	53	51	55	63
19	97	88	71	64	64	98	89	75	53	51	56	63
20	79	85	70	69	65	100	82	61	53	49	57	61
21	73	89	70	63	64	104	85	70	53	61	55	57
22	74	116	82	62	64	100	82	62	54	70	44	59
23	75	96	84	62	62	106	76	69	52	105	47	59
24	68	96	72	62	62	140	82	64	52	75	54	60
25	67	89	68	62	62	112	77	66	51	73	51	60
26	69	73	68	62	62	100	72	73	52	70	51	78
27	79	64	68	62	63	212	75	80	53	61	47	92
28	65	122	68	62	66	385	84	67	51	56	48	85
29	60	94	67	62	---	148	89	150	52	61	48	65
30	61	90	76	62	---	109	83	139	52	60	47	65
31	81	---	72	63	---	116	---	84	---	60	49	---
TOTAL	2442	2646	2291	1966	1818	3225	3116	2489	1683	2063	1555	1833
MEAN	78.8	88.2	73.9	63.4	64.9	104	104	80.3	56.1	66.5	50.2	61.1
MAX	136	181	87	69	82	385	191	150	68	114	57	112
MIN	60	64	67	57	57	63	72	61	51	49	44	45
CFSM	1.37	1.53	1.28	1.10	1.13	1.80	1.80	1.39	.97	1.15	.87	1.06
IN.	1.57	1.71	1.48	1.27	1.17	2.08	2.01	1.60	1.09	1.33	1.00	1.18
CAL YR 1990	TOTAL	29985	MEAN	82.2	MAX	416	MIN	51	CFSM	1.42	IN.	19.33
WTR YR 1991	TOTAL	27127	MEAN	74.3	MAX	385	MIN	44	CFSM	1.29	IN.	17.49

LOCATION.--Lat 45°34'38", long 84°29'15", in SW1/4 SW1/4 sec.19, T.37 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank of Cheboygan River, 300 ft downstream from Mullett Lake, 2.4 mi upstream from Black River, and 4.8 mi south of Cheboygan.

PERIOD OF RECORD.--November 1942 to current year.

REMARKS.--Mullett Lake is part of the navigable inland water route. The major inlet is Indian River. Other inlets are Pigeon, Little Pigeon, and Little Sturgeon Rivers and Negro and Scott Creeks. The outlet is Cheboygan River. Streamflow records were collected for Cheboygan River (station 04130000) from October 1942 to September 1982 and for Indian River (station 04128500) from April 1942 to September 1982. Lake level regulated by hydroelectric dam and spillway in Cheboygan.

EXTREMES FOR CURRENT YEAR.--Maximum daily gage height, 2.69 ft, Apr. 18, Sept. 10; minimum daily, 1.49 ft, Mar. 18.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.61	2.36	2.27	2.13	1.86	1.61	2.22	2.46	2.35	2.57	2.50	2.42
2	2.60	2.33	2.24	2.12	1.87	1.74	2.21	2.34	2.33	2.57	2.45	2.43
3	2.60	2.30	2.18	2.09	1.84	1.74	2.19	2.31	2.31	2.59	2.38	2.50
4	2.57	2.29	2.21	2.05	1.81	1.74	2.21	2.33	2.31	2.63	2.34	2.54
5	2.42	2.24	2.25	1.99	1.78	1.70	2.23	2.31	2.36	2.67	2.36	2.55
6	2.37	2.30	2.21	1.93	1.76	1.68	2.23	2.39	2.42	2.64	2.42	2.57
7	2.31	2.28	2.22	1.90	1.75	1.67	2.24	2.37	2.47	2.59	2.48	2.62
8	2.37	2.28	2.18	1.88	1.73	1.62	2.25	2.33	2.45	2.55	2.51	2.64
9	2.43	2.28	2.18	1.84	1.70	1.67	2.27	2.33	2.43	2.57	2.51	2.65
10	2.48	2.23	2.17	1.81	1.68	1.67	2.34	2.31	2.38	2.47	2.45	2.69
11	2.52	2.21	2.24	1.78	1.66	1.66	2.39	2.30	2.30	2.47	2.42	2.65
12	2.49	2.17	2.24	1.74	1.66	1.64	2.42	2.27	2.22	2.50	2.42	2.60
13	2.54	2.16	2.17	1.69	1.64	1.61	2.43	2.25	2.23	2.49	2.41	2.57
14	2.55	2.17	2.19	1.70	1.62	1.58	2.44	2.26	2.24	2.46	2.38	2.53
15	2.54	2.18	2.15	1.71	1.61	1.56	2.56	2.25	2.23	2.46	2.34	2.53
16	2.53	2.25	2.17	1.71	1.61	1.54	2.66	2.26	2.18	2.51	2.31	2.53
17	2.54	2.32	2.17	1.70	1.60	1.51	2.67	2.31	2.18	2.53	2.33	2.46
18	2.54	2.34	2.18	1.72	1.61	1.49	2.69	2.34	2.19	2.49	2.36	2.47
19	2.54	2.30	2.18	1.71	1.62	1.50	2.68	2.36	2.21	2.47	2.39	2.45
20	2.53	2.33	2.16	1.71	1.61	1.51	2.66	2.36	2.21	2.42	2.48	2.47
21	2.52	2.39	2.13	1.78	1.59	1.55	2.65	2.34	2.19	2.46	2.54	2.53
22	2.50	2.37	2.14	1.81	1.56	1.61	2.62	2.33	2.18	2.49	2.54	2.55
23	2.48	2.35	2.11	1.79	1.53	1.64	2.60	2.31	2.19	2.48	2.57	2.54
24	2.45	2.37	2.20	1.78	1.50	1.68	2.61	2.32	2.21	2.44	2.63	2.57
25	2.42	2.27	2.23	1.81	1.51	1.71	2.63	2.29	2.27	2.42	2.65	2.64
26	2.41	2.26	2.22	1.80	1.55	1.72	2.58	2.31	2.34	2.46	2.66	2.62
27	2.47	2.29	2.20	1.81	1.58	1.83	2.54	2.32	2.45	2.51	2.56	2.58
28	2.36	2.32	2.18	1.80	1.60	2.10	2.52	2.28	2.51	2.55	2.49	2.54
29	2.37	2.28	2.17	1.80	---	2.14	2.49	2.31	2.52	2.58	2.44	2.49
30	2.37	2.32	2.16	1.82	---	2.20	2.52	2.33	2.55	2.59	2.42	2.50
31	2.36	---	2.15	1.85	---	2.23	---	2.33	---	2.56	2.38	---
MEAN	2.48	2.28	2.19	1.83	1.66	1.70	2.46	2.32	2.31	2.52	2.46	2.55
MAX	2.61	2.39	2.27	2.13	1.87	2.23	2.69	2.46	2.55	2.67	2.66	2.69
MIN	2.31	2.16	2.11	1.69	1.50	1.49	2.19	2.25	2.18	2.42	2.31	2.42
CAL YR 1990	MEAN 2.28		MAX 2.92		MIN 1.51							
WTR YR 1991	MEAN 2.23		MAX 2.69		MIN 1.49							

STREAMS TRIBUTARY TO LAKE HURON

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04130500 BLACK RIVER NEAR TOWER, MI

LOCATION.--Lat 45°23'33", long 84°20'00", in SE1/4 NE1/4 sec.29, T.35 N., R.1 E., Cheboygan County, Hydrologic Unit 04070005, on right bank 400 ft downstream from Kleber Dam, 1,000 ft upstream from Milligan Creek, 3.0 mi northwest of Tower, and 10.8 mi upstream from Black Lake.

DRAINAGE AREA.--311 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for October 1942, published in WSP 1307.

REVISED RECORDS.--WSP 1307: 1942. WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 658.00 ft above National Geodetic Vertical Datum of 1929 (Stanley Engineering Co. bench mark). Prior to Aug. 1, 1949, at site 1 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Flow completely regulated by Kleber Dam 400 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 272 ft<sup>3</sup>/s, 11.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,340 ft<sup>3</sup>/s, Apr. 17, 1960, gage height, 7.13 ft; minimum, 0.60 ft<sup>3</sup>/s, Mar. 11, 1950; minimum daily, 4.0 ft<sup>3</sup>/s, Nov. 27, 1949.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,260 ft<sup>3</sup>/s, Dec. 17, gage height, 5.35 ft; minimum, 12 ft<sup>3</sup>/s, Sept. 9, gage height, 1.21 ft; minimum daily, 106 ft<sup>3</sup>/s, Sept. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	208	250	352	252	188	206	566	335	502	134	184	106
2	158	205	292	214	173	340	471	290	475	146	164	106
3	202	211	355	280	187	326	457	298	391	189	153	108
4	229	218	169	220	208	388	410	296	248	256	162	138
5	195	226	154	209	265	369	422	286	330	243	156	153
6	236	289	305	192	233	395	423	281	268	271	150	146
7	213	248	283	179	296	371	459	300	233	293	150	126
8	171	319	375	185	293	349	549	356	194	236	139	122
9	183	322	307	185	312	338	666	346	218	194	134	118
10	216	247	290	198	297	328	726	300	211	186	134	203
11	245	322	293	189	240	297	738	314	195	133	134	142
12	347	258	294	209	218	297	635	255	193	115	122	122
13	345	308	314	215	209	224	586	318	173	152	111	126
14	338	251	269	158	253	286	483	354	173	173	119	143
15	240	272	286	208	203	236	528	419	189	174	124	190
16	243	341	317	222	139	225	671	465	177	163	124	205
17	278	376	306	209	190	283	693	468	172	151	124	207
18	315	456	264	220	228	293	667	459	171	150	150	235
19	327	399	240	221	207	372	624	378	170	149	159	175
20	326	384	215	223	206	438	497	303	150	150	149	175
21	324	326	308	220	237	472	461	293	139	152	162	175
22	269	325	291	176	222	479	361	248	146	279	154	166
23	280	402	315	161	196	480	395	238	146	223	121	154
24	247	390	185	217	195	526	357	289	146	218	146	154
25	242	339	140	192	216	571	346	293	135	241	122	178
26	207	357	137	184	190	569	336	311	108	219	122	216
27	206	306	116	192	152	671	310	296	114	226	148	210
28	229	360	197	202	188	1030	321	292	119	193	127	231
29	227	343	300	194	---	859	303	461	141	173	123	194
30	199	364	294	184	---	772	333	466	152	172	132	198
31	187	---	263	194	---	728	---	490	---	183	122	---
TOTAL	7632	9414	8226	6304	6141	13518	14794	10498	6179	5937	4321	4922
MEAN	246	314	265	203	219	436	493	339	206	192	139	164
MAX	347	456	375	280	312	1030	738	490	502	293	184	235
MIN	158	205	116	158	139	206	303	238	108	115	111	106
CFSM	.79	1.01	.85	.65	.70	1.40	1.59	1.09	.66	.62	.45	.53
IN.	.91	1.13	.98	.75	.73	1.62	1.77	1.26	.74	.71	.52	.59

CAL YR 1990 TOTAL 104459 MEAN 286 MAX 1760 MIN 116 CFSM .92 IN 12.49  
WTR YR 1991 TOTAL 97886 MEAN 268 MAX 1030 MIN 106 CFSM .86 IN 11.71



LOCATION.--Lat 45°38'09", long 84°28'50", in SW1/4 SE1/4 sec.31, T.38 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank 660 ft downstream from Lincoln Avenue in Cheboygan, 1.8 mi upstream from mouth of Cheboygan River.

PERIOD OF RECORD.--November 1942 to current year.

REMARKS.--Cheboygan Pond is formed by an earthfill dam, hydro-electric dam, boat lock and concrete spillway which contains 6 vertical lift gates. Cheboygan Pond is part of the navigable inland water route. The inlet and outlet of Cheboygan Pond is the Cheboygan River. Other inlets are Black River and Tannery Gulley. Water quality records were collected from October 1974 to September 1986. Streamflow records for Cheboygan River (station 04130000) were collected from October 1942 to September 1982. Pond elevation regulated by hydroelectric dam and spillway.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.70 ft, Oct. 1; minimum, 0.51 ft, Mar. 7.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.42	2.88	2.55	2.34	2.45	2.24	1.94	2.24	2.66	3.38	2.98	3.34
2	3.26	2.70	2.53	2.39	2.44	2.17	1.76	1.81	2.64	3.30	2.90	3.37
3	3.16	2.62	2.46	2.28	2.29	2.05	1.78	1.97	2.69	3.26	2.83	3.49
4	2.85	2.67	2.44	2.03	2.10	1.94	2.05	2.36	2.83	3.25	2.87	3.47
5	2.46	2.55	2.55	1.78	1.98	1.72	2.05	2.39	3.04	3.18	3.14	3.49
6	2.41	2.58	2.47	1.64	1.95	1.51	2.02	2.52	3.22	3.06	3.40	3.54
7	2.61	2.57	2.50	1.80	1.93	1.24	2.04	2.52	3.29	2.94	3.41	3.55
8	3.23	2.59	2.45	1.88	1.90	1.05	1.99	2.42	3.14	3.06	3.45	3.53
9	3.30	2.58	2.46	1.71	1.77	1.78	1.98	2.52	2.98	3.29	3.28	3.34
10	3.22	2.49	2.58	1.78	1.75	1.77	2.09	2.50	2.71	2.83	3.04	3.12
11	3.12	2.55	2.86	1.77	1.79	1.74	2.20	2.45	2.57	3.15	3.06	3.15
12	3.12	2.47	2.66	1.54	1.90	1.74	2.28	2.33	2.54	3.35	3.15	3.13
13	3.32	2.49	2.46	1.44	1.92	1.62	2.29	2.21	2.74	3.28	3.12	3.10
14	3.13	2.48	2.46	1.73	1.81	1.56	2.33	2.21	2.78	3.16	2.99	3.03
15	3.12	2.65	2.44	1.94	1.84	1.55	2.54	2.30	2.66	3.24	2.91	3.05
16	3.08	3.02	2.46	1.92	1.95	1.51	2.65	2.37	2.65	3.33	2.93	3.02
17	3.07	2.94	2.43	1.97	1.99	1.50	2.56	2.42	2.77	3.30	3.11	3.05
18	3.07	2.91	2.47	2.09	2.08	1.44	2.57	2.49	2.85	3.17	3.29	3.07
19	3.10	2.69	2.47	2.02	2.05	1.48	2.53	2.53	2.96	3.05	3.34	3.33
20	3.02	2.77	2.38	2.10	2.01	1.52	2.49	2.54	2.96	2.96	3.47	3.40
21	3.02	2.82	2.35	2.44	1.91	1.51	2.47	2.49	2.93	3.01	3.46	3.43
22	3.00	2.57	2.37	2.48	1.79	1.55	2.40	2.48	2.93	3.03	3.41	3.47
23	3.00	2.61	2.35	2.17	1.66	1.50	2.33	2.45	2.97	2.97	3.53	3.44
24	2.97	2.74	2.23	2.22	1.54	1.51	2.62	2.45	3.08	2.95	3.57	3.50
25	2.91	2.36	2.25	2.34	1.77	1.49	2.76	2.44	3.21	3.09	3.60	3.56
26	2.87	2.42	2.27	2.24	2.09	1.50	2.48	2.46	3.32	3.35	3.35	3.30
27	3.15	2.50	2.28	2.25	2.18	1.63	2.41	2.47	3.45	3.44	3.01	3.11
28	2.78	2.45	2.30	2.19	2.28	1.93	2.35	2.44	3.50	3.49	3.01	2.98
29	2.80	2.50	2.32	2.26	---	1.74	2.32	2.44	3.45	3.42	2.99	3.02
30	2.94	2.55	2.34	2.38	---	1.84	2.31	2.46	3.48	3.33	3.03	3.22
31	2.91	---	2.35	2.43	---	1.97	---	2.51	---	3.16	3.19	---
MEAN	3.01	2.62	2.44	2.05	1.97	1.65	2.29	2.39	2.97	3.19	3.19	3.29
MAX	3.42	3.02	2.86	2.48	2.45	2.24	2.76	2.54	3.50	3.49	3.60	3.56
MIN	2.41	2.36	2.23	1.44	1.54	1.05	1.76	1.81	2.54	2.83	2.83	2.98
CAL YR 1990	MEAN	2.62	MAX	3.72	MIN	1.62						
WTR YR 1991	MEAN	2.59	MAX	3.60	MIN	1.05						

## STREAMS TRIBUTARY TO LAKE HURON

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04135000 THUNDER BAY RIVER NEAR ALPENA, MI  
(National stream quality accounting network station)

LOCATION.--Lat 45°05'39", long 83°29'59", in SW1/4 SE1/4 sec.7, T.31 N., R.8 E., Alpena County,  
Hydrologic Unit 04070006, on left bank 1,000 ft downstream from Thunder Bay Power Company Fourmile  
Dam, 2.5 mi upstream from Bagley Street in Alpena, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--1,238 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1901 to December 1908, October 1979 to current year. Occasional discharge  
measurements, water years 1945-50.

REVISED RECORDS.--WSP 1307: 1901-09. WDR MI-80: Drainage area.

GAGE.--Two water-stage recorders. Elevation of gage on main (north) channel and secondary gage on  
spill (south) channel is 615 ft above National Geodetic Vertical Datum of 1929, from topographic  
map.

REMARKS.--Estimated daily discharges: Dec. 16-21, 24, 25, Dec. 29 to Feb. 20 and Mar. 28-30. Records  
good except for estimated daily discharges, Mar. 28-30, which are fair, and estimated daily  
discharges, Dec. 16-21, 24, 25, and Dec. 29 to Feb. 20, which are poor. Flow regulated at all  
stages by hydroelectric plant 1,000 ft upstream.

AVERAGE DISCHARGE.--19 years (water years 1902-08, 1980-91), 905 ft<sup>3</sup>/s, 9.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 12,100 ft<sup>3</sup>/s, Mar. 28, 1986; minimum daily,  
30 ft<sup>3</sup>/s, June 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 5,030 ft<sup>3</sup>/s, Mar. 29; minimum daily, 92 ft<sup>3</sup>/s,  
June 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	475	844	1500	607	528	679	2610	824	2640	446	446	296
2	496	834	1530	593	532	684	1910	995	2310	426	352	169
3	477	1140	1610	588	554	750	1570	1050	1650	418	376	333
4	489	894	1560	583	605	1150	1520	1050	1320	716	354	486
5	478	515	1210	583	432	1480	1450	1020	1380	715	338	212
6	485	656	1120	583	339	1460	1420	1120	1050	717	335	322
7	491	739	1220	580	464	1400	1520	1170	819	733	381	243
8	461	1040	1240	572	505	1340	1560	1240	829	712	321	326
9	488	1270	1240	568	513	1210	1960	1260	833	426	334	330
10	585	1250	1370	559	541	1070	2610	1280	838	601	294	436
11	637	1110	1550	565	607	1240	2580	1300	806	161	269	433
12	506	1260	1410	565	516	1070	2870	1290	729	593	226	315
13	640	1330	1360	550	512	993	2650	1370	764	531	268	317
14	887	1360	1460	550	487	788	2040	1430	801	149	288	395
15	1110	1360	1420	551	838	698	2000	1350	788	555	516	322
16	1130	1370	1430	551	1000	684	2650	1470	778	327	408	465
17	1150	1380	1480	550	714	692	3700	1470	715	303	362	455
18	1230	1380	1440	550	647	1120	3650	1640	539	322	291	501
19	1200	1430	1410	556	709	1430	2880	1660	604	363	308	471
20	1150	1520	1360	568	741	1410	2210	1610	616	208	325	494
21	1140	1720	1340	562	695	1820	1890	1540	618	448	324	475
22	1150	1690	896	563	745	2050	1650	1300	616	576	323	484
23	822	1650	1180	556	720	2090	1620	1190	613	523	484	344
24	530	1620	1070	556	725	2760	1480	1180	369	341	301	288
25	525	1600	918	560	721	3220	1310	1170	129	571	321	331
26	904	1500	850	554	723	3070	1280	1190	116	530	294	518
27	1080	1420	885	549	708	2920	1280	1410	385	388	332	501
28	1080	1490	890	546	682	3830	1120	1770	377	456	382	239
29	799	1490	891	544	---	5030	1140	2590	103	341	305	325
30	745	1490	881	544	---	4250	1080	3010	92	490	286	348
31	516	---	881	540	---	3420	---	3120	---	419	339	---
TOTAL	23856	38352	38602	17446	17503	55808	59210	45069	24227	14505	10483	11174
MEAN	770	1278	1245	563	625	1800	1974	1454	808	468	338	372
MAX	1230	1720	1610	607	1000	5030	3700	3120	2640	733	516	518
MIN	461	515	850	540	339	679	1080	824	92	149	226	169
CFSM	.62	1.03	1.01	.46	.51	1.45	1.60	1.17	.65	.38	.27	.30
IN.	.72	1.15	1.16	.52	.53	1.68	1.78	1.35	.73	.44	.31	.34

CAL YR 1990 TOTAL 352516 MEAN 966 MAX 9680 MIN 148 CFSM .78 IN 10.59  
WTR YR 1991 TOTAL 356235 MEAN 976 MAX 5030 MIN 92 CFSM .79 IN 10.70

## STREAMS TRIBUTARY TO LAKE HURON

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1980 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: October 1979 to September 1985.

WATER TEMPERATURE: October 1979 to September 1985.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1985.

REMARKS.--Bimonthly cross-sectional samples were collected near the gage. From February 1979 to September 1979, samples were collected 6.9 mi downstream from gage (station 04135020).

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1980-83): Maximum, 511 microsiemens, Jan. 2, 1982; minimum measured, 120 microsiemens, Dec. 19, 1981.

WATER TEMPERATURE (water years 1980-83): Maximum, 31.0°C, July 11, 12, 1981; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV										
08...	1100	1010	355	8.13	4.0	2.5	12.4	96	K6	K11
DEC										
06...	0900	995	367	7.97	0.0	1.5	12.6	88	K18	K14
FEB										
21...	0930	701	435	7.77	0.0	1.0	12.6	88	K5	K7
APR										
18...	1030	3750	288	8.10	6.0	5.5	11.9	97	67	190
JUN										
05...	1100	1380	367	8.09	21.0	4.3	8.0	91	K7	K26
AUG										
16...	1315	461	340	8.30	23.0	1.5	8.2	98	K4	K17

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
NOV										
08...	190	14	54	14	5.5	0.9	218	179	8.3	9.7
DEC										
06...	190	19	54	14	5.1	1.1	211	173	16	8.1
FEB										
21...	230	10	64	17	6.3	1.1	268	220	11	8.6
APR										
18...	160	13	47	10	3.2	1.5	177	145	7.3	6.1
JUN										
05...	200	9	57	13	4.3	1.9	228	187	4.7	6.2
AUG										
16...	190	13	50	15	5.4	0.6	212	174	6.4	6.9

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
NOV										
08...	0.1	9.6	230	0.31	627	<0.01	<0.01	<0.10	<0.10	0.01
DEC										
06...	0.2	8.7	227	0.31	610	<0.01	<0.01	<0.10	<0.10	0.02
FEB										
21...	<0.1	10	251	0.34	475	<0.01	0.01	<0.10	0.10	0.07
APR										
18...	0.1	4.3	172	0.23	1740	0.03	<0.01	0.15	0.10	0.06
JUN										
05...	0.1	10	240	0.33	894	0.01	0.01	0.23	0.27	0.05
AUG										
16...	0.3	8.7	208	0.28	259	<0.01	<0.01	<0.05	<0.05	<0.01

STREAMS TRIBUTARY TO LAKE HURON  
04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA + DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
NOV 08...	0.02	0.5	<0.01	<0.01	0.02	<0.01	<10	<1	20	<0.5
DEC 06...	0.02	0.4	<0.01	<0.01	<0.01	<0.01	--	--	--	--
FEB 21...	0.06	0.4	0.01	<0.01	<0.01	<0.01	<10	<1	21	<0.5
APR 18...	<0.01	0.4	0.04	<0.01	0.01	<0.01	20	<1	16	<0.5
JUN 05...	0.04	1.1	0.04	0.03	<0.01	<0.01	--	--	--	--
AUG 16...	0.01	0.4	0.01	0.01	<0.01	0.01	<10	<1	29	<0.5

DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
NOV 08...	<1	<1	<3	1	28	<1	6	10	<0.1	<10
DEC 06...	--	--	--	--	--	--	--	--	--	--
FEB 21...	2	<1	<3	1	39	1	5	17	<0.1	<10
APR 18...	<1	<1	<3	<1	69	<1	<4	8	<0.1	<10
JUN 05...	--	--	--	--	--	--	--	--	--	--
AUG 16...	<1	<1	<3	1	11	<1	<4	2	<0.1	<10

DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, DIS- SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 08...	1	<1	<1	110	<6	<3	6	16	67
DEC 06...	--	--	--	--	--	--	3	8.1	77
FEB 21...	1	<1	<1	120	<6	5	16	30	88
APR 18...	<1	<1	<1	89	<6	11	15	152	21
JUN 05...	--	--	--	--	--	--	9	34	100
AUG 16...	<1	<1	<1	110	<6	19	3	3.7	86



## STREAMS TRIBUTARY TO LAKE HURON

04135470 AU SABLE RIVER AT POLLACK BRIDGE NEAR GRAYLING, MI

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°41'06", long 84°44'44", in SW1/4 SW1/4 sec.36, T.27 N., R.04 W., Crawford County, Hydrologic Unit 04070007, at bridge on Pollack Road, 2.2 mi northwest of Grayling and 118.5 mi upstream from mouth.

DRAINAGE AREA.--82.7 mi<sup>2</sup>.

PERIOD OF RECORD.--June to September 1991.

REMARKS.--Cross-sectional samples were collected near bridge.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
JUN										
18...	0950	42	308	18.5	2.0	8.0	89	9	1.0	77
24...	1440	36	331	20.0	0.50	10.0	114	5	0.49	--
JUL										
01...	1115	34	324	16.5	--	8.9	95	9	0.83	--
08...	1050	40	330	--	--	--	--	--	--	--
22...	1050	68	285	20.0	2.5	6.5	75	14	2.6	71
22...	1630	65	283	21.0	1.1	7.6	89	8	1.4	--
23...	1115	55	306	18.0	1.5	8.0	88	10	1.5	72
AUG										
05...	1500	38	335	19.0	0.40	10.1	113	5	0.51	75
19...	1215	35	316	16.0	0.50	9.0	95	4	0.38	92
27...	0920	31	--	--	--	--	--	--	--	--
SEP										
10...	0930	42	304	18.0	1.3	--	--	7	0.79	100
16...	1100	59	303	17.5	2.3	8.2	90	7	1.1	--
23...	1145	38	329	10.0	--	10.2	94	9	0.92	--
30...	0930	40	319	8.0	--	10.4	91	3	0.32	--

## STREAMS TRIBUTARY TO LAKE HURON

04135475 AU SABLE RIVER AT OLD DAM ROAD NEAR GRAYLING, MI

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°39'48", long 84°44'26", in SE1/4 NW1/4 sec.12, T.26 N., R.4 W., Crawford County, Hydrologic Unit 04070007, at bridge on Old Dam Road, 1 mi west of Grayling and 116.5 mi upstream from mouth.

DRAINAGE AREA.--85.7 mi<sup>2</sup>.

PERIOD OF RECORD.--June to September 1991.

REMARKS.--Cross-sectional samples were collected near bridge.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY) (80155)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM (70338)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
JUN											
18...	1050	47	295	22.0	1.6	10.2	121	6	0.76	--	69
18...	1205	70	291	22.0	1.8	10.0	119	12	2.3	--	80
24...	1335	56	320	19.0	1.0	8.9	99	6	0.91	--	--
JUL											
01...	0930	40	307	18.0	1.9	7.6	83	6	0.65	--	--
01...	1030	58	313	17.5	2.5	7.6	83	10	1.6	--	--
02...	0930	66	--	17.0	--	--	--	14	2.5	--	--
08...	0930	44	315	--	--	--	--	11	1.3	--	--
16...	0900	41	317	16.5	--	7.6	80	11	1.2	--	--
22...	1015	76	273	20.0	2.5	6.8	78	14	2.9	--	85
22...	1500	74	282	21.0	1.7	7.0	82	13	2.6	--	82
23...	1030	62	278	18.0	2.0	7.4	81	13	2.2	--	74
29...	0950	47	298	14.0	--	8.4	85	18	2.3	--	--
AUG											
02...	1900	46	308	12.5	3.5	--	--	25	3.1	--	--
05...	1430	44	325	19.5	3.5	8.5	96	23	2.7	--	76
13...	1000	38	301	16.0	6.5	8.0	84	64	6.6	--	--
19...	1045	50	306	15.0	4.5	8.5	87	59	8.0	--	90
27...	0845	38	305	20.0	--	--	--	226	23	--	--
29...	1530	38	312	25.0	--	7.8	98	77	7.9	--	76
SEP											
03...	1500	52	284	17.0	25	7.9	85	268	38	20	69
09...	1400	40	316	20.5	--	8.8	102	70	7.6	--	--
10...	0900	50	305	18.0	26	--	--	307	41	--	83
16...	0945	66	293	17.5	10	8.0	87	194	35	--	--
23...	1020	45	305	10.0	--	9.6	89	99	12	--	--
30...	0900	46	307	8.0	--	10.3	90	56	7.0	--	--

## STREAMS TRIBUTARY TO LAKE HURON

04135500 AU SABLE RIVER AT GRAYLING, MI

LOCATION.--Lat 44°39'35", long 84°42'45", in SE1/4 SE1/4 sec. 7, T.26 N., R.3 W., Crawford County, Hydrologic Unit 04070007, on right bank 65 ft upstream from bridge on Interstate Highway 75 (Business Loop) in Grayling, 0.7 mi upstream from East Branch, and 114 mi upstream from mouth.

DRAINAGE AREA.--110 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307. Prior to October 1954, published as Middle Branch Au Sable River at Grayling.

GAGE.--Water-stage recorder and steel-crested dam. Datum of gage is 1,123.49 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Prior to Dec. 31, 1952, diurnal fluctuation caused by powerplant 2.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 76.1 ft<sup>3</sup>/s, 9.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 274 ft<sup>3</sup>/s, June 2, 1943, gage height, 3.00 ft; minimum, 28 ft<sup>3</sup>/s, Apr. 21, 1946, gage height, 0.80 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 172 ft<sup>3</sup>/s, Mar. 28, gage height, 2.18 ft; minimum, 51 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 1.16 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	68	94	75	67	68	113	90	104	62	64	54
2	64	67	89	76	67	81	103	87	97	90	65	52
3	65	66	85	73	69	93	96	87	105	93	66	56
4	68	70	83	69	73	86	99	90	106	88	65	68
5	68	74	82	69	77	81	104	89	93	84	62	65
6	67	77	85	70	78	79	110	93	84	77	59	59
7	65	80	83	69	78	79	109	95	79	70	57	57
8	66	80	80	67	75	74	118	94	76	67	59	56
9	68	79	79	69	73	77	135	92	73	66	57	56
10	81	78	80	70	72	76	141	87	72	64	56	73
11	98	78	79	69	68	72	129	84	74	61	55	70
12	99	75	80	69	66	69	118	80	72	59	54	62
13	88	72	81	69	71	70	110	80	70	62	53	59
14	81	72	80	70	70	70	106	81	68	62	59	58
15	79	76	80	72	60	69	125	83	69	59	65	68
16	78	92	82	73	63	69	152	79	72	57	61	79
17	80	98	80	74	68	70	147	77	71	57	62	79
18	79	93	80	75	68	73	129	76	70	56	68	72
19	78	85	79	78	68	77	114	75	70	55	69	68
20	79	80	76	81	69	84	106	74	66	54	66	64
21	78	80	81	73	68	94	101	72	64	80	62	66
22	75	83	84	69	67	103	97	70	65	103	60	67
23	73	87	85	71	61	110	95	70	63	96	58	66
24	72	86	75	70	65	119	93	75	64	80	58	65
25	70	83	71	67	68	117	91	80	63	69	57	65
26	68	81	75	65	62	109	87	116	62	68	56	71
27	68	86	73	65	64	122	85	123	63	65	55	85
28	67	105	73	66	66	159	91	109	61	62	54	85
29	68	111	77	67	---	165	96	138	59	65	52	75
30	69	103	81	66	---	140	96	141	58	67	57	69
31	69	---	77	66	---	121	---	121	---	65	58	---
TOTAL	2291	2465	2489	2182	1921	2876	3296	2808	2213	2163	1849	1989
MEAN	73.9	82.2	80.3	70.4	68.6	92.8	110	90.6	73.8	69.8	59.6	66.3
MAX	99	111	94	81	78	165	152	141	106	103	69	85
MIN	63	66	71	65	60	68	85	70	58	54	52	52
CFSM	.67	.75	.73	.64	.62	.84	1.00	.82	.67	.64	.54	.60
IN.	.77	.83	.84	.74	.65	.97	1.11	.95	.75	.73	.63	.67
CAL YR 1990	TOTAL	29568	MEAN	81.0	MAX	235	MIN	55	CFSM	.74	IN	10.00
WTR YR 1991	TOTAL	28542	MEAN	78.2	MAX	165	MIN	52	CFSM	.71	IN	9.65

## STREAMS TRIBUTARY TO LAKE HURON

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04135700 SOUTH BRANCH AU SABLE RIVER NEAR LUZERNE, MI

LOCATION.--Lat 44°36'53", long 84°27'20", in SE1/4 SE1/4 sec.29, T.26 N., R.1 W., Crawford County, Hydrologic Unit 04070007, on right bank 10 ft upstream from Smith Bridge, 400 ft downstream from bridge on State Highway 72, 4.6 mi upstream from mouth, and 9.1 mi west of Luzerne.

DRAINAGE AREA.--401 mi<sup>2</sup>.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1951-66. October 1966 to September 1989, October 1990 to September 1991.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Apr. 19, 1951, to Nov. 14, 1966, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 4-21, Jan. 25 to Feb. 2, and Feb. 16, 24-27. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 248 ft<sup>3</sup>/s, 7.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,120 ft<sup>3</sup>/s, Mar. 28, 1976, gage height, 7.30 ft; maximum gage height, 7.75 ft, Jan. 28, 1986, backwater from ice; minimum discharge, 78 ft<sup>3</sup>/s, Feb. 12, 1981, gage height, 3.98 ft, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 758 ft<sup>3</sup>/s, Apr. 17, gage height, 6.40 ft; minimum, 118 ft<sup>3</sup>/s, Sept. 2, gage height, 4.29 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	165	189	341	241	155	141	494	428	510	162	158	125
2	165	190	326	225	155	176	441	407	458	242	153	122
3	166	188	305	216	153	192	401	388	420	263	162	127
4	176	200	275	215	156	187	379	371	389	273	168	137
5	176	211	253	210	160	188	380	359	365	296	169	137
6	182	225	257	205	166	190	381	375	342	324	163	135
7	181	234	257	205	170	198	387	375	322	301	156	129
8	181	242	260	205	176	183	410	370	304	255	150	127
9	191	245	258	205	178	191	502	366	286	216	145	125
10	248	247	261	205	175	180	565	359	272	181	144	148
11	282	245	259	210	173	183	589	347	268	161	141	153
12	275	239	258	210	167	182	560	331	253	152	137	155
13	275	234	269	210	162	190	518	319	242	163	135	147
14	275	230	247	210	158	179	490	329	234	166	134	143
15	278	240	244	215	145	179	565	322	235	162	133	161
16	264	283	247	220	145	185	672	305	243	155	132	161
17	255	286	248	225	141	191	727	318	236	151	157	156
18	256	278	250	230	141	199	722	315	232	146	180	159
19	251	280	247	240	143	221	637	296	226	143	182	154
20	241	272	229	250	143	249	571	286	217	140	184	149
21	235	268	237	220	147	295	518	276	209	165	170	143
22	229	276	265	212	155	343	488	265	203	174	155	137
23	223	268	261	204	150	418	481	256	197	188	144	135
24	217	263	234	192	145	478	463	248	190	188	141	133
25	211	258	230	190	140	476	438	207	186	186	139	136
26	207	251	225	180	135	447	419	283	179	175	137	142
27	205	259	225	175	135	471	406	360	175	163	133	142
28	202	326	225	170	138	599	415	403	170	158	131	142
29	197	336	224	165	---	659	422	561	166	161	133	137
30	195	336	232	160	---	649	436	586	163	165	130	133
31	192	---	237	155	---	563	---	546	---	164	128	---
TOTAL	6796	7599	7886	6375	4307	9182	14877	10957	7892	5939	4624	4230
MEAN	219	253	254	206	154	296	496	353	263	192	149	141
MAX	282	336	341	250	178	659	727	586	510	324	184	161
MIN	165	188	224	155	135	141	379	207	163	140	128	122
CFSM	.55	.63	.63	.51	.38	.74	1.24	.88	.66	.48	.37	.35
IN.	.63	.70	.73	.59	.40	.85	1.38	1.02	.73	.55	.43	.39

WTR YR 1991 TOTAL 90664 MEAN 248 MAX 727 MIN 122 CFSM .62 IN 8.41



LOCATION.--Lat 44°55'52", long 84°41'33", in SW1/4 SE1/4 sec.5, T.29 N., R.3 W., Otsego County, Hydrologic Unit 04070007, at Otsego Lake State Park, 200 ft northwest of boat ramp, 6.7 mi south of Gaylord.

PERIOD OF RECORD.--August 1942 to current year, except for winter months 1942-43, 1943-44, 1977-78.

GAGE.--Water-stage recorder. Datum of gage is 1,270.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 18, 1958, nonrecording gage at datum 2.0 ft higher.

REMARKS.--Otsego Lake has no natural inlets or outlets. In December 1972 an outlet tube and pump system was installed connecting the lake with the North Branch Au Sable River to lower lake levels. Established legal level; maximum, 1,273.5 ft, minimum, 1,272.0 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 5.10 ft, May 6, 7, 1972; minimum, 0.96 ft, Aug. 14, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.78 ft, Apr. 10-12, 16, 17; minimum, 2.18 ft, Sept. 14, 15.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.91	3.01	3.33	3.57	3.54	3.43	3.69	3.55	3.37	2.75	2.63	2.29
2	2.91	3.01	3.33	3.57	3.53	3.46	3.70	3.53	3.35	2.80	2.62	2.25
3	2.91	3.02	3.35	3.57	3.53	3.49	3.70	3.52	3.33	2.81	2.62	2.24
4	2.92	3.03	3.37	3.37	3.52	3.50	3.70	3.50	3.32	2.85	2.62	2.26
5	2.94	3.05	3.38	3.32	3.52	3.51	3.70	3.48	3.30	2.85	2.60	2.25
6	2.95	3.11	3.39	3.37	3.51	3.51	3.70	3.47	3.27	2.84	2.58	2.24
7	2.95	3.13	3.39	3.42	3.51	3.52	3.70	3.46	3.25	2.84	2.56	2.23
8	2.95	3.16	3.39	3.45	3.50	3.53	3.71	3.46	3.23	2.83	2.55	2.23
9	2.95	3.16	3.40	3.48	3.49	3.53	3.74	3.45	3.22	2.80	2.54	2.21
10	2.96	3.16	3.40	3.50	3.48	3.54	3.77	3.44	3.20	2.78	2.53	2.22
11	2.99	3.18	3.39	3.52	3.47	3.54	3.78	3.43	3.18	2.76	2.51	2.23
12	3.00	3.18	3.40	3.53	3.46	3.54	3.77	3.42	3.16	2.74	2.49	2.21
13	3.01	3.18	3.40	3.54	3.46	3.54	3.76	3.42	3.14	2.74	2.48	2.20
14	3.00	3.19	3.40	3.55	3.45	3.54	3.74	3.42	3.11	2.74	2.47	2.19
15	3.00	3.18	3.41	3.56	3.45	3.53	3.75	3.41	3.08	2.71	2.46	2.22
16	3.00	3.19	3.42	3.56	3.44	3.53	3.78	3.40	3.08	2.69	2.44	2.29
17	3.00	3.20	3.43	3.56	3.44	3.53	3.78	3.40	3.07	2.66	2.43	2.30
18	3.01	3.19	3.45	3.57	3.43	3.53	3.77	3.40	3.05	2.65	2.46	2.28
19	3.04	3.20	3.46	3.56	3.43	3.53	3.76	3.38	3.03	2.63	2.46	2.28
20	3.04	3.19	3.47	3.57	3.43	3.53	3.75	3.36	2.99	2.62	2.44	2.26
21	3.03	3.19	3.47	3.56	3.43	3.53	3.73	3.35	2.98	2.66	2.42	2.25
22	3.03	3.21	3.48	3.56	3.43	3.54	3.71	3.34	2.95	2.67	2.40	2.22
23	3.03	3.22	3.49	3.55	3.43	3.55	3.69	3.32	2.91	2.70	2.39	2.23
24	3.03	3.25	3.49	3.55	3.43	3.56	3.66	3.32	2.89	2.67	2.39	2.23
25	3.03	3.26	3.49	3.55	3.43	3.58	3.65	3.32	2.87	2.69	2.37	2.22
26	3.02	3.27	3.51	3.55	3.43	3.58	3.62	3.33	2.85	2.69	2.36	2.27
27	3.01	3.27	3.51	3.54	3.43	3.60	3.61	3.33	2.81	2.67	2.34	2.35
28	3.03	3.29	3.52	3.55	3.43	3.65	3.59	3.33	2.83	2.65	2.34	2.35
29	3.02	3.32	3.54	3.54	---	3.68	3.59	3.35	2.80	2.66	2.33	2.35
30	3.01	3.32	3.55	3.54	---	3.69	3.57	3.37	2.78	2.66	2.32	2.32
31	3.02	---	3.56	3.54	---	3.69	---	3.37	---	2.64	2.32	---
MEAN	2.99	3.18	3.44	3.52	3.47	3.55	3.71	3.41	3.08	2.72	2.47	2.26
MAX	3.04	3.32	3.56	3.57	3.54	3.69	3.78	3.55	3.37	2.85	2.63	2.35
MIN	2.91	3.01	3.33	3.32	3.43	3.43	3.57	3.32	2.78	2.62	2.32	2.19

CAL YR 1990	MEAN 3.18	MAX 3.64	MIN 2.79
WTR YR 1991	MEAN 3.15	MAX 3.78	MIN 2.19

STREAMS TRIBUTARY TO LAKE HURON

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04136500 AU SABLE RIVER AT MIO, MI

LOCATION.--Lat 44°39'36", long 84°07'52", in SE1/4 NE1/4 sec.12, T.26 N., R.2 E., Oscoda County, Hydrologic Unit 04070007, on right bank 150 ft upstream from bridge on State Highway 33 in Mio, 500 ft downstream from Mio hydroelectric plant, 9.5 mi downstream from Big Creek, and 73.0 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1952 to current year.

GAGE.--Water-stage recorder. Datum of gage is 929.60 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharge: May 24. Records good. Flow regulated by Mio Dam 500 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 995 ft<sup>3</sup>/s, 12.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,380 ft<sup>3</sup>/s, Sept. 30, 1986, gage height, 6.16 ft; minimum, 7.0 ft<sup>3</sup>/s, Aug. 4, 1977, gage height, -0.09 ft; minimum daily, 21 ft<sup>3</sup>/s, Aug. 9, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,130 ft<sup>3</sup>/s, Apr. 15, gage height, 6.12 ft; minimum, 17 ft<sup>3</sup>/s, gage height, 0.08 ft, Sept. 17, but may have been lower on May 24, result of dam shutdown; minimum daily, 538 ft<sup>3</sup>/s, May 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	898	855	1140	849	823	839	1470	1310	1360	758	768	650
2	789	853	1090	960	848	1010	1330	1240	1360	952	780	654
3	882	878	1280	934	845	1060	1300	1260	1320	1130	827	674
4	719	895	1010	804	905	970	1240	1240	1360	1130	824	862
5	883	922	1270	829	972	969	1260	1210	1220	1030	790	779
6	797	986	1170	906	970	913	1300	1310	1210	1030	771	624
7	846	1000	722	853	907	930	1300	1430	886	1030	771	724
8	818	1030	889	760	830	930	1630	1330	946	1020	776	781
9	926	1040	1020	863	852	941	2080	1270	1250	854	774	762
10	1150	993	1030	905	874	919	1970	1250	960	899	775	744
11	1340	994	1020	829	859	879	1890	1210	769	764	717	768
12	1210	996	989	856	821	865	1890	1180	1150	804	648	782
13	1100	912	998	819	845	842	1690	1140	915	754	628	782
14	1040	922	1020	877	839	846	1550	1240	770	808	671	781
15	983	974	996	912	730	853	1910	1200	885	863	778	781
16	1230	1320	977	887	650	857	2750	1130	947	716	812	947
17	905	1280	979	923	884	872	2600	1180	1130	736	883	831
18	1200	1170	979	877	939	922	2460	1250	911	783	930	811
19	1000	1100	979	866	861	946	2390	1170	704	733	871	776
20	1010	1030	981	865	778	1080	2130	1100	1120	734	800	759
21	993	1050	959	820	784	1260	1890	1050	907	1030	732	759
22	923	1140	997	641	799	1320	1710	811	703	1030	677	759
23	909	1160	1110	683	767	1530	1260	622	870	909	714	759
24	924	1120	908	780	792	1850	1370	538	1120	915	743	760
25	924	1050	750	679	838	1620	1260	641	914	942	743	760
26	917	1020	822	709	720	1450	1330	665	692	829	741	762
27	907	1090	720	917	781	1880	1510	1070	684	736	725	839
28	889	1460	803	916	834	2450	1380	1340	674	776	679	881
29	867	1450	1110	828	---	2010	1440	1480	676	804	653	854
30	856	1190	1090	808	---	1810	1390	2120	680	878	693	791
31	856	---	941	795	---	1710	---	1590	---	862	703	---
TOTAL	29691	31880	30749	25950	23347	37333	50680	36577	29093	27239	23397	23196
MEAN	958	1063	992	837	834	1204	1689	1180	970	879	755	773
MAX	1340	1460	1280	960	972	2450	2750	2120	1360	1130	930	947
MIN	719	853	720	641	650	839	1240	538	674	716	628	624
CFSM	.87	.97	.90	.76	.76	1.10	1.54	1.07	.88	.80	.69	.70
IN.	1.00	1.08	1.04	.88	.79	1.26	1.71	1.24	.98	.92	.79	.78

CAL YR 1990 TOTAL 350772 MEAN 961 MAX 2900 MIN 607 CFSM .87 IN 11.86  
WTR YR 1991 TOTAL 369132 MEAN 1011 MAX 2750 MIN 538 CFSM .92 IN 12.48

## STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 44°26'09", long 83°26'28", in NE1/4 NW1/4 sec.35, T.24 N., R.8 E., Iosco County, Hydrologic Unit 04070007, at bridge on Rea Road, 5.5 mi northwest of Au Sable, and 10.4 mi upstream from mouth.

DRAINAGE AREA.--1,540 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1987 to current year. Records for July 1939 to September 1940, published in WSP 874, 894, and 1307, have been found to be unreliable and should not be used.

GAGE.--Water-stage recorder. Datum of gage is 583.93 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: June 21 to July 19. Water-discharge records good, except for estimated daily discharges, which are fair. Flow regulated by Foote Dam 0.6 mi upstream.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,850 ft<sup>3</sup>/s, Mar. 28, 1991, gage height, 16.27 ft; minimum, 337 ft<sup>3</sup>/s, Sept. 14, 1990, gage height, 7.24 ft; minimum daily, 460 ft<sup>3</sup>/s, Aug. 13, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,850 ft<sup>3</sup>/s, Mar. 28, gage height, 16.27 ft; minimum, 467 ft<sup>3</sup>/s, May 20, gage height, 7.58 ft; minimum daily, 584 ft<sup>3</sup>/s, Nov. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1250	1380	1910	1210	1040	1240	2310	2060	2240	950	1250	798
2	1270	842	1820	1130	1150	1680	2110	1910	2330	1400	1210	835
3	1500	1170	1430	1170	1250	2150	1950	1720	1740	1300	1230	859
4	1340	1540	1550	1110	1340	1880	1800	1720	1550	2100	1260	1030
5	986	1810	1950	1370	1670	1580	1830	1680	1770	1700	1260	1180
6	1180	1970	1900	1690	1870	1700	1950	1830	1670	1500	1170	1100
7	1590	1650	1480	1350	1730	1670	2000	2120	1410	1700	1150	923
8	1430	1680	1230	1100	1620	1200	2550	2040	1250	1500	1190	985
9	1260	1570	1220	1170	1250	1040	3000	1890	1600	1200	1180	1120
10	2010	1640	1700	1230	1180	1120	2920	1850	1890	1050	1210	1560
11	2480	1830	1510	1270	1260	1170	2630	1800	1540	1200	1200	1700
12	2200	2150	1560	1400	1210	1260	2810	1710	1200	1300	1060	1290
13	1830	2310	1520	1430	1320	1490	2860	1820	1230	1350	1020	999
14	1600	2220	1590	1560	1330	1590	2340	1790	1240	1450	963	1040
15	1580	1200	1210	1440	1100	1190	2420	1820	1260	1300	1090	1140
16	1810	584	1220	1420	942	1130	3410	1400	1540	1200	1250	1420
17	2110	962	1350	1280	1040	1250	3440	1580	1710	1150	1380	1210
18	1830	1270	1500	1290	1810	1700	3120	1720	1560	1000	1930	1230
19	938	1530	1470	1680	1600	1330	3080	2110	1170	920	1650	1230
20	1040	1380	1490	1840	1050	1690	3050	1150	974	1140	1100	1230
21	1850	1150	1490	1350	1100	1730	2770	1480	1300	1200	887	1050
22	1500	1950	1870	891	1220	1660	2460	1180	1000	1530	867	931
23	1220	2180	1820	917	1210	2320	1940	1020	1300	1760	908	1030
24	1250	1760	1470	872	1240	3080	2140	1020	1700	1410	938	1100
25	1260	1630	1260	685	1280	3090	1990	1110	1400	1090	949	1060
26	1290	1720	1180	1250	1270	2580	1680	2060	1200	906	1000	1130
27	1200	1470	1040	1810	1190	2160	1760	1930	1200	822	1100	1230
28	1120	1850	1210	1060	1190	3440	2130	2090	1150	1380	1300	1470
29	911	2180	1650	992	---	3130	1900	2440	920	1260	1340	1340
30	1530	1870	1630	1050	---	2480	1960	2560	920	1250	1320	1070
31	1500	---	1420	1010	---	2490	---	2350	---	1250	806	---
TOTAL	45865	48448	46650	39027	36462	57220	72310	54960	42964	40268	36168	34290
MEAN	1480	1615	1505	1259	1302	1846	2410	1773	1432	1299	1167	1143
MAX	2480	2310	1950	1840	1870	3440	3440	2560	2330	2100	1930	1700
MIN	911	584	1040	685	942	1040	1680	1020	920	822	806	798
CFSM	.96	1.05	.98	.82	.85	1.20	1.57	1.15	.93	.84	.76	.74
IN.	1.11	1.17	1.13	.94	.88	1.38	1.75	1.33	1.04	.97	.87	.83
CAL YR 1990	TOTAL	547099	MEAN	1499	MAX	3700	MIN	584	CFSM	.97	IN	13.22
WTR YR 1991	TOTAL	554632	MEAN	1520	MAX	3440	MIN	584	CFSM	.99	IN	13.40

## STREAMS TRIBUTARY TO LAKE HURON

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04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: April 1978 to September 1981.

WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1978-79): Maximum daily, 346 microsiemens, Nov. 21, 1978; minimum daily, 229 microsiemens, Apr. 19, 21, 1979.

WATER TEMPERATURE (water years 1979-80): Maximum measured, 28.0°C, Aug. 8, 1979; minimum daily, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--Specific conductance of 354 microsiemens was measured Feb. 3, 1988.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED SATUR- ATION (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
NOV 07...	1100	1350	307	7.92	7.5	1.0	11.0	94	K2	<1
DEC 05...	1100	1860	--	8.05	3.0	1.1	12.4	93	K1	K1
FEB 20...	1230	965	329	7.85	1.5	1.6	12.2	89	<1	<1
APR 17...	1300	3310	245	7.98	7.5	3.0	10.8	92	<1	--
JUN 04...	1330	2040	270	8.18	20.0	1.8	7.8	87	K5	47
AUG 15...	1100	1210	296	8.17	23.0	1.5	8.0	96	K1	K110

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
NOV 07...	160	10	46	11	4.7	0.7	183	150	13	7.5
DEC 05...	150	6	43	11	4.6	0.6	179	147	7.8	6.9
FEB 20...	170	12	49	12	5.3	0.6	195	160	9.3	7.2
APR 17...	130	3	37	8.0	3.4	0.8	149	122	7.3	5.2
JUN 04...	150	12	43	9.6	4.3	0.7	165	135	7.8	6.3
AUG 15...	160	11	45	11	4.7	0.5	179	147	10	5.1

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
NOV 07...	<0.1	8.9	180	0.24	656	<0.01	<0.01	<0.10	<0.10	<0.01
DEC 05...	0.1	8.0	175	0.24	879	<0.01	<0.01	<0.10	<0.10	0.03
FEB 20...	<0.1	9.6	187	0.25	487	<0.01	<0.01	0.14	0.14	0.02
APR 17...	0.2	6.2	--	0.19	1270	0.02	<0.01	0.15	0.14	0.02
JUN 04...	0.2	7.3	166	0.23	914	<0.01	<0.01	--	0.19	0.02
AUG 15...	0.1	10	186	0.25	608	<0.01	<0.01	<0.05	<0.05	<0.01



## STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
NOV 07...	<0.01	0.4	<0.01	<0.01	0.02	<0.01	<10	<1	21	<0.5
DEC 05...	0.04	0.7	<0.01	<0.01	<0.01	<0.01	--	--	--	--
FEB 20...	0.01	0.2	0.01	<0.01	<0.01	<0.01	<10	<1	19	<0.5
APR 17...	<0.01	--	0.03	<0.01	<0.01	<0.01	<10	<1	17	<0.5
JUN 04...	0.02	0.4	0.02	0.02	<0.01	<0.01	--	--	--	--
AUG 15...	0.01	0.7	0.02	<0.01	<0.01	<0.01	<10	2	35	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
NOV 07...	<1	<1	<3	1	8	<1	<4	1	<0.1	<10
DEC 05...	--	--	--	--	--	--	--	--	--	--
FEB 20...	<1	<1	<3	2	14	1	<4	8	<0.1	<10
APR 17...	<1	<1	<3	<1	32	<1	<4	2	0.3	<10
JUN 04...	--	--	--	--	--	--	--	--	--	--
AUG 15...	<1	<1	<3	3	5	<1	<4	<1	--	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. % FINER DIAM. THAN .062 MM (70331)	
NOV 07...	1	<1	<1	74	<6	6	5	18	61	
DEC 05...	--	--	--	--	--	--	1	5.0	65	
FEB 20...	<1	<1	<1	73	<6	5	4	10	86	
APR 17...	1	<1	<1	55	<6	7	8	71	44	
JUN 04...	--	--	--	--	--	--	5	28	63	
AUG 15...	<1	<1	<1	78	<6	19	3	9.8	83	

## STREAMS TRIBUTARY TO LAKE HURON

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04142000 RIFLE RIVER NEAR STERLING, MI  
(National stream quality accounting network station)

LOCATION.--Lat 44°04'21", long 84°01'12", in NE1/4 SW1/4 sec.5, T.19 N., R.4 E., Arenac County, Hydrologic Unit 04080101, on left bank 30 ft downstream from bridge on Melita Road, 2.8 mi north of Sterling, and 20 mi upstream from mouth.

DRAINAGE AREA.--320 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1905 to December 1908 (gage heights and discharge measurements only), October 1936 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Rifle River at Michigan Highway 70 near Sterling 1936-61.

REVISED RECORDS.--WSP 1437: 1937(M), 1939-40(M).

GAGE.--Water-stage recorder. Datum of gage is 649.48 ft above National Geodetic Vertical Datum of 1929. November 1905 to December 1908, nonrecording gage at site 400 ft downstream at different datum. Jan. 13, 1937, to Jan. 10, 1939, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 3-8, 12-16, 22, 23, and Dec. 26 to Mar. 2. Water-discharge records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station.

AVERAGE DISCHARGE.--55 years, 501 ft<sup>3</sup>/s, 13.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,340 ft<sup>3</sup>/s, Mar. 28, 1950, gage height, 13.74 ft, from rating curve extended above 3,800 ft<sup>3</sup>/s; minimum, 75 ft<sup>3</sup>/s, Nov. 22, 1964, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,600 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0400	1,660	6.42	Apr. 9	2100	3,420	10.27
Mar. 3	0700	*3,980	*11.33	Apr. 16	1200	3,400	10.23
Mar. 24	0200	1,790	6.76	May 27	1200	2,700	8.82
Mar. 28	2100	3,180	9.80	May 31	0400	3,320	10.08

Minimum discharge, 157 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 1.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	198	278	665	370	250	300	872	766	1670	185	180	163
2	199	271	561	360	260	1000	749	612	1010	232	177	161
3	204	263	470	350	270	3330	666	510	853	323	657	161
4	248	288	430	330	300	1850	621	438	631	354	554	190
5	243	495	400	310	400	1020	665	421	502	290	338	193
6	219	919	390	290	500	730	687	613	442	250	253	171
7	251	859	390	270	400	751	622	688	398	221	217	166
8	280	747	390	260	370	580	1020	538	367	204	201	168
9	379	632	386	250	350	528	3050	473	347	192	198	170
10	972	579	422	250	340	479	2820	439	326	186	192	252
11	1480	534	430	250	320	506	1790	408	327	183	185	277
12	993	464	390	250	310	460	1220	388	307	192	178	207
13	656	419	380	260	300	434	927	393	277	263	175	189
14	532	384	370	270	290	407	843	532	262	241	175	188
15	719	377	370	275	280	415	1750	408	300	202	181	200
16	668	434	370	280	270	450	3130	352	388	189	333	227
17	585	445	389	285	260	496	2230	631	312	180	290	239
18	560	389	456	285	270	531	1340	675	253	178	489	204
19	508	355	477	285	300	595	1000	526	239	175	354	195
20	447	335	407	280	370	688	838	424	226	170	276	187
21	400	349	380	270	410	796	741	335	218	236	234	190
22	403	482	390	260	380	942	660	317	222	284	209	182
23	388	474	400	250	340	1400	584	306	219	296	195	184
24	375	430	408	250	310	1740	534	335	207	225	189	177
25	354	390	397	250	300	1360	467	500	201	200	184	179
26	348	349	350	250	290	1020	428	1380	196	193	180	199
27	345	393	320	250	280	1270	410	2500	195	184	176	202
28	320	1230	320	250	270	2890	1250	1960	192	180	173	190
29	322	1310	340	250	---	2550	1350	1880	189	194	170	186
30	305	907	370	250	---	1510	1010	2020	186	215	168	186
31	286	---	380	250	---	1070	---	2850	---	196	168	---
TOTAL	14187	15781	12598	8540	8990	32098	34274	24618	11462	6813	7649	5783
MEAN	458	526	406	275	321	1035	1142	794	382	220	247	193
MAX	1480	1310	665	370	500	3330	3130	2850	1670	354	657	277
MIN	198	263	320	250	250	300	410	306	186	170	168	161
CFSM	1.43	1.64	1.27	.86	1.00	3.23	3.57	2.48	1.19	.69	.77	.60
IN.	1.65	1.83	1.46	.99	1.05	3.73	3.98	2.86	1.33	.79	.89	.67

CAL YR 1990	TOTAL	119241	MEAN	327	MAX	2860	MIN	150	CFSM	1.02	IN	13.86
WTR YR 1991	TOTAL	182793	MEAN	501	MAX	3330	MIN	161	CFSM	1.57	IN	21.25

## STREAMS TRIBUTARY TO LAKE HURON

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-72, 1974 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: November 1974 to September 1981.

WATER TEMPERATURE: November 1974 to September 1981.

SUSPENDED-SEDIMENT DISCHARGE: April to September 1966, October 1969 to September 1970, January to April 1971, April to September 1972.

INSTRUMENTATION.--Water-quality monitor from Aug. 28, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-77, 1979-80): Maximum recorded (more than 20 percent missing record), 567 microsiemens, Sept. 6, 1979; minimum, 157 microsiemens, Aug. 31, 1975, but may have been lower during instrument malfunction Sept. 1-10, 1975.

WATER TEMPERATURE (water years 1976-77, 1980): Maximum, 30.5°C, July 20, 1977; minimum, 0.0°C on many days during winter.

SEDIMENT CONCENTRATION (water years 1970, 1972): Maximum daily mean, 304 mg/L, Apr. 13, 1972; minimum daily, 0 mg/L on several days in water year 1972.

SEDIMENT LOAD (water years 1970, 1972): Maximum daily, 1,760 tons, Apr. 13, 1972; minimum daily, 0 ton on several days during 1972.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A suspended-sediment concentration of 647 mg/L was measured Mar. 27, 1967, and a sediment load of 3,270 tons was calculated Mar. 27, 1967.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 04...	1215	239	425	8.30	12.0	4.6	10.4	99	K760	K820
FEB 15...	1230	254	440	7.60	0.0	3.5	13.6	96	49	K46
APR 19...	1030	1020	315	8.11	9.0	16	9.6	85	240	120
SEP 25...	1010	169	430	8.37	10.0	1.4	11.0	100	55	K39

DATE	HARD-NESS TOTAL (MG/L AS CaCO3) (00900)	HARD-NESS NONCARB DISSOLV FLD. AS CaCO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS Ca) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS Mg) (00925)	SODIUM, DIS-SOLVED (MG/L AS Na) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	CAR-BONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CaCO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
OCT 04...	210	26	61	15	10	1.3	230	--	189	27
FEB 15...	220	36	62	15	10	1.6	220	--	180	30
APR 19...	160	25	46	11	7.3	2.1	165	--	135	17
SEP 25...	220	26	63	16	9.5	1.1	193	1	193	28

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS Cl) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
OCT 04...	16	<0.1	8.5	254	0.35	164	<0.01	<0.01	<0.10	<0.10
FEB 15...	15	0.1	9.3	252	0.34	173	<0.01	<0.01	0.36	0.32
APR 19...	10	0.1	5.0	179	0.24	493	0.01	0.01	0.28	0.27
SEP 25...	12	0.1	8.2	254	0.35	116	0.01	<0.01	0.08	0.08

## STREAMS TRIBUTARY TO LAKE HURON

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04142000 RIFLE RIVER NEAR STERLING, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, DIS- TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
OCT 04...	0.02	0.01	0.3	0.03	0.01	<0.01	<0.01	<10	1	51
FEB 15...	0.05	0.06	0.4	0.02	0.01	0.01	<0.01	<10	1	42
APR 19...	0.09	0.08	0.6	0.07	0.02	0.02	<0.01	30	1	30
SEP 25...	<0.01	<0.01	0.3	0.01	<0.01	0.02	<0.01	<10	2	51
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
OCT 04...	<0.5	<1	<1	<3	3	31	1	6	10	<0.1
FEB 15...	<0.5	1	<1	<3	2	64	<1	6	26	<0.1
APR 19...	<0.5	2	<1	<3	2	130	2	<4	10	0.2
SEP 25...	<0.5	<1	<1	<3	1	20	<1	8	6	<0.1
DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, DIS- SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 04...	<10	2	<1	<1	230	<6	3	27	17	71
FEB 15...	<10	1	<1	<1	220	<6	7	10	6.9	77
APR 19...	<10	<1	<1	<1	140	<6	50	63	174	66
SEP 25...	<10	<1	<1	<1	240	<6	5	7	3.2	20



## STREAMS TRIBUTARY TO LAKE HURON

04143900 SHIAWASSEE RIVER AT LINDEN, MI

LOCATION.--Lat 42°48'56", long 83°48'08", in SW1/4 sec.19, T.5 N., R.6 E., Genesee County, Hydrologic Unit 04080203, on right bank at upstream side of bridge on Hogan Road, 1.0 mi west of Linden.

DRAINAGE AREA.--83.7 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1967 to current year.

REVISED RECORDS.--WDR MI-87: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 844.96 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 25-28, Dec. 31 to Jan. 14, Jan. 21 to Feb. 1, Feb 12-16, and June 27 to July 25. Records good except for estimated daily discharges, June 27 to July 25, which are poor. Flow regulated by dam at Linden since 1967. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 61.3 ft<sup>3</sup>/s, 9.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 476 ft<sup>3</sup>/s, Apr. 22, 1975, gage height, 7.43 ft; minimum, 0.74 ft<sup>3</sup>/s, May 22, 23, 1971; minimum gage height, 2.82 ft, Aug. 2, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 149 ft<sup>3</sup>/s, Oct. 16, gage height, 5.63 ft; minimum, 5.7 ft<sup>3</sup>/s, Sept. 17, gage height, 3.41 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	32	22	101	105	62	96	116	101	80	20	20	13
2	29	30	103	110	60	93	115	95	79	19	20	12
3	28	38	106	110	59	91	111	87	73	19	23	8.1
4	37	44	108	115	61	97	107	81	67	20	24	9.3
5	46	68	106	120	64	107	103	76	58	21	21	9.1
6	51	91	103	125	68	116	97	74	51	22	20	9.2
7	57	103	101	120	72	125	92	73	46	24	20	8.9
8	64	115	99	110	74	119	89	72	38	25	17	11
9	73	126	96	105	80	119	88	75	33	26	19	14
10	92	132	94	100	80	118	94	77	33	25	20	15
11	106	135	92	95	80	115	92	76	36	23	21	15
12	115	133	89	90	78	110	89	73	42	22	20	13
13	126	125	80	87	77	106	91	72	43	21	20	6.9
14	137	117	79	85	74	98	93	71	37	20	20	6.8
15	146	109	83	84	71	95	95	67	36	19	19	6.8
16	149	102	83	83	67	87	95	64	48	19	19	6.1
17	145	98	82	83	64	84	96	64	46	18	19	6.0
18	140	92	84	83	64	85	95	62	41	18	20	6.5
19	129	87	84	85	76	82	96	55	39	17	28	6.2
20	117	82	82	88	85	79	105	49	35	17	35	6.3
21	111	77	82	92	90	77	110	45	33	18	33	6.3
22	106	77	85	94	97	76	114	40	31	18	28	6.4
23	101	74	86	95	100	71	116	39	28	17	25	7.5
24	94	74	82	92	103	71	119	33	23	16	25	8.0
25	87	68	80	90	104	81	120	14	24	15	24	8.7
26	79	65	79	87	107	73	117	28	27	15	20	8.9
27	69	71	78	83	105	74	124	47	27	15	20	9.0
28	61	94	76	79	102	87	119	59	23	15	20	9.4
29	51	98	81	72	---	96	114	70	21	16	19	9.8
30	39	98	100	65	---	106	109	76	20	20	18	10
31	28	---	100	63	---	113	---	80	---	20	13	---
TOTAL	2645	2645	2784	2895	2224	2947	3121	1995	1218	600	670	273.2
MEAN	85.3	88.2	89.8	93.4	79.4	95.1	104	64.4	40.6	19.4	21.6	9.11
MAX	149	135	108	125	107	125	124	101	80	26	35	15
MIN	28	22	76	63	59	71	88	14	20	15	13	6.0
CFSM	1.02	1.05	1.07	1.12	.95	1.14	1.24	.77	.49	.23	.26	.11
IN.	1.18	1.18	1.24	1.29	.99	1.31	1.39	.89	.54	.27	.30	.12
CAL YR 1990	TOTAL	28089.4	MEAN	77.0	MAX	182	MIN	8.2	CFSM	.92	IN	12.48
WTR YR 1991	TOTAL	24017.2	MEAN	65.8	MAX	149	MIN	6.0	CFSM	.79	IN	10.67

## STREAMS TRIBUTARY TO LAKE HURON

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## 04144500 SHIAWASSEE RIVER AT OWOSSO, MI

LOCATION.--Lat 43°00'54", long 84°10'52", in SW1/4 sec.12, T.7 N., R.2 E., Shiawassee County, Hydrologic Unit 04080203, on right bank on grounds of sewage-treatment plant, 1.5 mi north of Owosso.

DRAINAGE AREA.--538 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1904, 1910-30 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1949(M). WSP 1337: 1932, 1934, 1936-38, 1944.

GAGE.--Water-stage recorder. Datum of gage is 707.25 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 15, 1933, at site 1.5 mi upstream at datum 5.46 ft higher.

REMARKS.--Estimated daily discharges: Jan. 2-18, Jan. 23 to Feb. 3, Feb. 10-18, June 23 to July 20, and July 30 to Sept. 3. Records good except for estimated daily discharges, which are fair. Flow regulated below about 800 ft<sup>3</sup>/s by powerplant at Shiawassee town prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--60 years, 343 ft<sup>3</sup>/s, 8.66 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,240 ft<sup>3</sup>/s, Apr. 6, 1947, gage height, 10.35 ft; minimum, 0.2 ft<sup>3</sup>/s, July 27, 1934, gage height, 1.12 ft; minimum daily, 2.0 ft<sup>3</sup>/s, July 28, 1934.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 6	0600	1,520	5.66	Dec. 30	1500	1,670	5.73
Nov. 28	2200	*1,850	*6.00	Apr. 28	1500	1,640	5.98

Minimum daily discharge, 28 ft<sup>3</sup>/s, Sept. 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	135	255	1280	1200	350	593	819	733	300	130	115	83
2	132	221	1190	1050	350	962	718	617	305	125	120	80
3	130	198	1070	1000	350	1220	669	554	296	125	125	75
4	158	196	950	930	496	970	647	490	307	135	110	69
5	134	615	840	850	781	876	663	470	342	130	100	67
6	149	1480	801	780	872	929	653	515	357	140	95	72
7	162	1280	808	700	833	1030	628	481	333	165	90	79
8	164	1050	743	650	799	889	598	465	275	175	95	77
9	293	980	724	600	794	847	977	478	242	160	100	79
10	710	908	753	560	700	790	1240	455	221	150	110	81
11	1060	837	699	510	600	716	937	423	223	145	125	68
12	884	784	619	470	530	689	843	392	234	140	115	64
13	811	688	638	460	460	661	790	366	245	135	100	68
14	858	630	600	470	400	630	691	349	252	130	90	69
15	961	589	574	480	360	600	788	329	280	130	86	67
16	861	557	562	510	330	571	792	314	327	125	90	65
17	725	491	560	550	340	522	700	312	274	120	100	58
18	638	436	602	610	420	523	666	318	239	115	120	38
19	596	405	597	698	578	532	628	316	224	110	150	30
20	574	381	575	776	916	536	789	306	207	105	115	28
21	548	361	574	809	931	534	1070	289	195	118	120	30
22	514	343	635	647	1090	496	1010	259	217	126	125	39
23	447	337	636	540	1010	488	980	225	190	144	130	55
24	416	333	604	500	906	485	1100	195	175	116	120	49
25	380	320	466	480	826	475	1020	200	165	99	110	46
26	352	305	433	460	727	463	932	279	155	100	100	69
27	335	433	393	440	659	512	941	376	145	103	95	78
28	310	1530	468	420	625	1030	1520	394	140	99	88	81
29	304	1710	854	400	---	1140	1280	376	135	104	86	67
30	311	1390	1600	380	---	966	951	350	135	115	85	68
31	297	---	1410	360	---	896	---	332	---	115	84	---
TOTAL	14349	20043	23258	19290	18033	22571	26040	11958	7135	3929	3294	1899
MEAN	463	668	750	622	644	728	868	386	238	127	106	63.3
MAX	1060	1710	1600	1200	1090	1220	1520	733	357	175	150	83
MIN	130	196	393	360	330	463	598	195	135	99	84	28
CFSM	.86	1.24	1.39	1.16	1.20	1.35	1.61	.72	.44	.24	.20	.12
IN.	.99	1.39	1.61	1.33	1.25	1.56	1.80	.83	.49	.27	.23	.13

CAL YR 1990	TOTAL	189327	MEAN	519	MAX	2330	MIN	59	CFSM	.97	IN	13.09
WTR YR 1991	TOTAL	171799	MEAN	471	MAX	1710	MIN	28	CFSM	.88	IN	11.88

## STREAMS TRIBUTARY TO LAKE HURON

04145000 SHIAWASSEE RIVER NEAR FERGUS, MI

LOCATION.--Lat 43°15'17", long 84°06'20", in sec.22, T.10 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, on right bank at downstream side of bridge on Fergus Road, 1.2 mi east of Fergus, 1.8 mi upstream from Bear Creek, and 14 mi upstream from mouth.

DRAINAGE AREA.--637 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1939 to September 1984, October 1988 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1940(M), 1941-42, 1943(M), 1944, 1945(M), 1946, 1947(M), 1948, 1950. WSP 1627: 1952, 1954(M), 1957.

GAGE.--Water-stage recorder. Datum of gage is 585.80 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 22, 1968, nonrecording gage at same site and datum. Prior to Oct. 1, 1970, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Dec. 24 to Mar. 3 and Sept. 16-30. Records good except for estimated daily discharges, which are fair. Some regulation at low stages by powerplant at Shiawassee town prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 430 ft<sup>3</sup>/s, 9.17 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,500 ft<sup>3</sup>/s, Apr. 6, 1947, including overflow by-passing gage; maximum gage height, 15.44 ft, present datum, Mar. 29, 1960; minimum discharge, 27 ft<sup>3</sup>/s, Aug. 8, 1966.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,890 ft<sup>3</sup>/s, Nov. 28, gage height, 10.24 ft; minimum daily, 35 ft<sup>3</sup>/s, Sept. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	154	363	1570	1900	520	870	1090	1090	389	153	135	100
2	152	310	1420	1600	500	1600	971	909	386	158	133	103
3	151	281	1290	1450	520	2300	866	789	420	144	140	97
4	234	271	1150	1300	700	1390	832	714	388	140	151	91
5	229	927	1020	1200	1000	1230	884	651	409	161	129	77
6	190	3410	948	1100	1200	1280	884	735	442	151	122	74
7	191	2230	953	1000	1150	1470	829	724	432	162	110	75
8	196	1610	911	950	1100	1200	776	655	371	218	102	81
9	389	1360	862	880	1100	1100	1780	670	298	207	114	83
10	1220	1240	1040	800	1000	1070	2540	663	265	181	121	89
11	2000	1130	967	750	900	983	1420	604	250	174	126	91
12	1410	1050	831	700	800	904	1140	555	282	168	152	80
13	1120	948	796	660	700	872	1050	509	266	173	136	77
14	1040	833	749	670	600	833	935	478	274	167	116	82
15	1180	783	683	700	530	791	1320	447	303	164	103	81
16	1160	742	678	750	480	743	1520	422	573	159	98	78
17	1060	689	675	800	500	698	1010	417	410	149	106	74
18	928	594	796	850	600	724	899	418	292	140	123	60
19	817	571	805	950	900	761	839	419	254	137	144	45
20	731	541	711	1050	1200	714	984	404	234	128	179	38
21	684	516	691	1100	1500	700	1410	380	218	121	146	35
22	641	511	870	950	1700	680	1330	353	227	133	132	38
23	583	490	840	800	1500	639	1230	315	254	165	147	45
24	518	491	750	720	1300	677	1630	279	227	168	145	65
25	495	478	680	690	1100	654	1600	254	213	127	138	60
26	450	456	620	650	1000	616	1230	349	204	110	128	55
27	424	811	550	620	930	958	1150	457	188	110	121	75
28	408	3370	650	600	900	2080	2460	525	173	112	107	90
29	389	2850	1200	580	---	1700	2050	491	166	111	99	95
30	391	1940	2800	560	---	1350	1400	456	161	122	99	80
31	395	---	2500	540	---	1180	---	430	---	138	103	---
TOTAL	19930	31796	31006	27870	25930	32767	38059	16562	8969	4651	3905	2214
MEAN	643	1060	1000	899	926	1057	1269	534	299	150	126	73.8
MAX	2000	3410	2800	1900	1700	2300	2540	1090	573	218	179	103
MIN	151	271	550	540	480	616	776	254	161	110	98	35
CFSM	1.01	1.66	1.57	1.41	1.45	1.66	1.99	.84	.47	.24	.20	.12
IN.	1.16	1.86	1.81	1.63	1.51	1.91	2.22	.97	.52	.27	.23	.13
CAL YR 1990	TOTAL	241867	MEAN 663	MAX 3640	MIN 65	CFSM 1.04	IN 14.12					
WTR YR 1991	TOTAL	243659	MEAN 668	MAX 3410	MIN 35	CFSM 1.05	IN 14.23					

## STREAMS TRIBUTARY TO LAKE HURON

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04146000 FARMERS CREEK NEAR LAPEER, MI

LOCATION.--Lat 43°02'41", long 83°20'14", in sec.6, T.7 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, on left bank on grounds of Oakdale Regional Center for Developmental Disabilities, 2.0 mi west of Lapeer.

DRAINAGE AREA.--55.3 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1940. WSP 1084: 1942(M), 1943. WSP 1337: 1934-38, 1940(M), 1944(M), 1945, 1946(M), 1948-51(M). WSP 1727: 1952 (M). WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Concrete control since Oct. 12, 1938. Datum of gage is 805.79 ft above National Geodetic Vertical Datum of 1929. Prior to May 25, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 12 to Nov. 15, Dec. 24-27, Jan. 22 to Feb. 4, Feb. 11-19, 23, 26, 27, and Apr. 24 to May. 1. Records good except for estimated daily discharges, which are fair. Prior to 1941, occasional regulation caused by dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--59 years, 31.7 ft<sup>3</sup>/s, 7.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,380 ft<sup>3</sup>/s, Sept. 9, 1985, gage height, 20.95 ft, from floodmark; minimum, 0.14 ft<sup>3</sup>/s, Sept. 16, 18, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 130 ft<sup>3</sup>/s, Oct. 12, no peak discharge above base discharge of 160 ft<sup>3</sup>/s; minimum, 1.3 ft<sup>3</sup>/s, Sept. 16, gage height, 15.00 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	22	88	112	33	53	106	42	27	5.7	2.6	11
2	11	22	86	121	32	60	91	41	23	5.2	2.6	7.5
3	11	21	79	115	33	64	78	41	22	5.8	3.8	5.5
4	39	21	74	101	37	76	62	39	23	8.3	3.9	4.1
5	40	28	69	82	49	78	54	38	19	11	4.5	2.9
6	40	45	66	72	55	84	50	40	11	12	4.4	2.1
7	38	70	62	65	64	87	48	42	9.1	12	3.9	1.6
8	34	100	59	57	70	89	49	44	7.0	12	3.7	1.6
9	43	115	56	53	72	88	59	46	6.4	12	4.4	1.5
10	65	105	55	50	71	83	73	47	5.9	10	18	1.6
11	91	90	53	46	63	76	93	47	7.4	8.7	22	1.9
12	130	80	52	44	57	69	110	44	10	6.8	13	1.7
13	120	66	51	44	50	63	108	44	14	6.2	9.4	1.5
14	115	56	49	47	46	58	96	46	15	5.9	7.4	1.5
15	105	48	48	48	42	53	87	48	16	4.7	6.2	1.5
16	95	44	50	50	40	48	71	47	24	4.0	5.3	1.4
17	85	41	49	53	38	45	69	43	32	3.4	4.9	1.5
18	75	38	50	54	37	46	71	38	35	3.1	4.2	2.0
19	60	35	52	57	45	46	71	33	33	3.0	5.6	3.1
20	50	33	53	62	64	47	73	29	26	2.9	8.2	5.1
21	46	32	55	57	79	47	76	25	20	3.5	8.9	14
22	43	32	56	56	90	47	97	23	17	3.6	8.3	17
23	40	31	56	54	90	49	117	21	15	3.2	6.5	14
24	36	31	50	52	85	50	125	20	14	3.5	5.2	11
25	33	30	47	50	77	49	120	20	12	3.5	4.5	8.6
26	30	29	44	46	65	47	100	23	10	3.1	4.0	7.0
27	28	37	41	43	58	58	85	26	9.1	2.6	3.6	4.6
28	26	55	42	40	56	83	70	30	8.1	2.3	3.1	3.3
29	24	61	61	38	---	99	60	32	6.8	3.3	3.1	2.5
30	23	79	74	36	---	115	50	32	6.2	3.9	3.2	2.1
31	22	---	82	35	---	117	---	31	---	3.3	11	---
TOTAL	1609	1497	1809	1840	1598	2074	2419	1122	484.0	178.5	199.4	144.7
MEAN	51.9	49.9	58.4	59.4	57.1	66.9	80.6	36.2	16.1	5.76	6.43	4.82
MAX	130	115	88	121	90	117	125	48	35	12	22	17
MIN	11	21	41	35	32	45	48	20	5.9	2.3	2.6	1.4
CFSM	.94	.90	1.06	1.07	1.03	1.21	1.46	.66	.29	.10	.12	.09
IN.	1.08	1.01	1.22	1.24	1.07	1.40	1.63	.75	.33	.12	.13	.10
CAL YR 1990	TOTAL	14543.5	MEAN	39.8	MAX	175	MIN	1.6	CFSM	.72	IN	9.78
WTR YR 1991	TOTAL	14974.6	MEAN	41.0	MAX	130	MIN	1.4	CFSM	.74	IN	10.07



## STREAMS TRIBUTARY TO LAKE HURON

04146063 SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI

LOCATION.--Lat 43°09'34", long 83°21'03", in NE1/4 NE1/4 sec.36, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, on right bank at upstream side of bridge on Columbiaville Road, 3.0 mi east of Columbiaville, and 3.2 mi upstream from confluence of North and South Branches.

DRAINAGE AREA.--221 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1980 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 765 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 25 to Feb. 7, Feb. 12-19, 26, 27, July 25, and Aug. 21 to Sept. 5. Records poor. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--11 years, 184 ft<sup>3</sup>/s, 11.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,090 ft<sup>3</sup>/s, Sept. 9, 1985, gage height, 9.60 ft; maximum gage height, 9.61 ft, Feb. 26, 1985, backwater from ice; minimum discharge, 12 ft<sup>3</sup>/s, July 11, 1988, gage height, 1.22 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 719 ft<sup>3</sup>/s, Mar. 29, gage height, 4.33 ft; maximum gage height, 5.19 ft, Dec. 31, backwater from ice; minimum daily discharge, 21 ft<sup>3</sup>/s, Sept. 14, 15, 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	52	104	328	520	115	202	399	203	146	48	47	36
2	49	104	309	460	110	268	341	198	142	47	41	39
3	48	96	278	420	115	407	291	187	134	45	48	40
4	81	94	258	390	150	370	249	179	123	74	50	35
5	137	166	256	350	200	352	235	173	112	86	48	25
6	135	479	254	300	335	371	231	211	96	81	44	24
7	124	559	250	260	340	472	222	227	86	69	40	23
8	115	466	235	220	329	415	210	212	99	60	40	22
9	146	430	226	200	329	362	278	210	108	70	47	22
10	297	380	238	190	309	343	469	212	84	62	45	23
11	497	309	237	180	259	308	531	197	79	56	59	22
12	531	261	226	170	230	273	443	185	111	55	52	22
13	485	228	214	160	200	243	403	186	108	55	43	22
14	462	206	202	160	170	220	343	176	98	58	39	21
15	393	181	187	165	150	208	344	165	90	60	35	21
16	327	168	205	180	140	198	434	154	155	54	34	23
17	277	163	212	220	140	188	411	150	162	53	34	23
18	258	158	223	240	160	211	371	147	140	50	46	21
19	237	150	235	250	250	252	334	143	126	54	50	22
20	208	144	220	270	430	244	407	130	109	54	62	24
21	183	136	208	320	400	230	591	121	88	56	57	27
22	166	136	236	300	425	213	637	125	77	59	60	38
23	152	142	240	250	385	215	595	121	85	64	53	43
24	139	142	220	220	345	229	541	118	79	68	45	43
25	130	141	200	200	308	227	484	125	78	53	40	42
26	124	135	195	180	250	213	404	164	64	46	36	42
27	116	149	190	170	235	235	337	199	66	42	35	40
28	108	362	185	150	218	497	285	199	55	38	35	36
29	103	461	220	140	---	690	246	194	51	36	36	32
30	106	356	350	130	---	550	221	175	47	64	36	31
31	105	---	600	120	---	458	---	164	---	52	34	---
TOTAL	6291	7006	7637	7485	7027	9664	11287	5350	2998	1769	1371	884
MEAN	203	234	246	241	251	312	376	173	99.9	57.1	44.2	29.5
MAX	531	559	600	520	430	690	637	227	162	86	62	43
MIN	48	94	185	120	110	188	210	118	47	36	34	21
CFSM	.92	1.06	1.11	1.09	1.14	1.41	1.70	.78	.45	.26	.20	.13
IN.	1.06	1.18	1.29	1.26	1.18	1.63	1.90	.90	.50	.30	.23	.15

CAL YR 1990 TOTAL 66923 MEAN 183 MAX 846 MIN 31 CFSM .83 IN 11.26  
WTR YR 1991 TOTAL 68769 MEAN 188 MAX 690 MIN 21 CFSM .85 IN 11.58

STREAMS TRIBUTARY TO LAKE HURON

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04147000 HOLLOWAY RESERVOIR NEAR OTISVILLE, MI

LOCATION.--Lat 43°07'15", long 83°29'45", in NW1/4 sec.11, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, in gatehouse on right side of Holloway Dam on Flint River, 3.5 mi southeast of Otisville.

DRAINAGE AREA.--526 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1954 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by City of Flint).

REMARKS.--Reservoir is formed by an earth-fill dam with concrete spillway completed in 1953. Capacity of reservoir, 1,256,000,000 ft<sup>3</sup> at elevation 760.00 ft. The spillway section includes two 90-foot drum gates with minimum crest elevation of 751 ft, maximum at 755 ft, three 20-foot radial gates with sill elevation of 745 ft, and 2 sluices (each 4 by 6 ft), one on each side with valve controls. Entrance elevation of sluiceways is 724 ft. Reservoir is used to regulate flow for sewage dilution for City of Flint.

COOPERATION.--Reservoir elevations furnished by City of Flint.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 996,000,000 ft<sup>3</sup>, Mar. 8, 1956, elevation, 757.4 ft; minimum, reservoir empty at times during October, November, 1954, January, February, 1955, October, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 830,300,000 ft<sup>3</sup>, Oct. 15, elevation, 755.67 ft; minimum, 492,800,000 ft<sup>3</sup>, Nov. 25, 27, elevation, 751.33 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Elevation (feet)	Contents (millions of cubic feet)	Change in contents (millions of cubic feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 . . . . .	754.45	723	--	--
Oct. 31 . . . . .	754.95	766	+43	+16.1
Nov. 30 . . . . .	751.88	529	-237	-91.4
Dec. 31 . . . . .	751.98	536	+7	+2.6
CAL YR 1990 . . . . .	--	--	+56	+1.8
Jan. 31 . . . . .	751.41	498	-38	-14.2
Feb. 28 . . . . .	751.70	516	+18	+7.4
Mar. 31 . . . . .	752.48	571	+55	+20.5
Apr. 30 . . . . .	752.42	566	-5	-1.9
May 31 . . . . .	755.24	792	+226	+84.4
June 30 . . . . .	754.74	747	-45	-17.4
July 31 . . . . .	754.69	742	-5	-1.9
Aug. 31 . . . . .	754.55	731	-11	-4.1
Sept. 30 . . . . .	752.70	586	-145	-55.9
WTR YR 1991 . . . . .	--	--	-137	-4.3

## STREAMS TRIBUTARY TO LAKE HURON

04147500 FLINT RIVER NEAR OTISVILLE, MI

LOCATION.--Lat 43°06'40", long 83°31'10", in SE1/4 sec.9, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 15, 1.5 mi downstream from Holloway Reservoir, 3.5 mi upstream from Powers-Cullen Drain, and 3.8 mi south of Otisville.

DRAINAGE AREA.--530 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1952 to September 1989, October 1990 to September 1991.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 721.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Holloway Reservoir, 1.5 mi upstream from station (see preceding page). Several measurements of water temperature were made during the year. City of Flint gage-height telemeter at station.

AVERAGE DISCHARGE.--38 years, 326 ft<sup>3</sup>/s, 8.35 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,150 ft<sup>3</sup>/s, Apr. 1, 1960, gage height, 14.97 ft; minimum, 2.1 ft<sup>3</sup>/s, Oct. 11, 12, 1971, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,620 ft<sup>3</sup>/s, Mar. 30, gage height, 9.43 ft; minimum, 63 ft<sup>3</sup>/s, Sept. 4, gage height, 2.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	96	199	803	1020	253	455	1320	118	507	103	98	68
2	96	198	793	1110	245	526	1120	119	489	96	99	66
3	96	198	777	1060	244	742	949	174	514	94	101	64
4	98	199	650	865	274	836	815	370	516	111	99	66
5	97	260	616	724	403	896	743	474	456	120	98	71
6	96	636	582	631	580	1020	677	519	398	140	97	75
7	97	952	551	561	703	1160	634	550	340	142	93	96
8	99	1050	520	494	769	1210	623	569	287	149	94	112
9	111	1140	491	454	796	1110	856	558	244	141	96	112
10	218	1050	484	429	780	1010	1020	533	198	134	93	114
11	458	1020	488	410	710	911	1240	495	207	130	92	113
12	662	1010	484	379	600	820	1370	474	230	123	93	111
13	731	1000	485	351	558	744	1260	452	217	124	91	112
14	739	990	494	343	510	661	1100	414	200	118	85	111
15	723	978	470	352	434	596	959	387	215	114	80	113
16	657	968	458	370	334	548	992	357	286	108	76	114
17	671	951	458	403	322	510	1010	412	314	102	75	113
18	651	599	468	435	345	468	965	389	318	101	81	111
19	551	242	486	456	396	468	897	341	288	95	89	109
20	413	320	491	493	568	554	993	305	257	92	94	119
21	306	298	475	537	713	588	1130	287	223	95	91	135
22	328	291	479	503	815	610	1300	266	212	99	90	134
23	324	276	513	473	855	570	1440	248	199	98	90	134
24	301	283	498	470	810	586	1410	236	177	93	88	134
25	279	277	431	441	739	594	1260	252	170	92	80	134
26	257	291	376	398	655	571	1100	320	159	91	74	132
27	232	295	343	359	555	604	942	388	145	88	70	130
28	218	466	354	326	492	916	914	458	124	85	69	129
29	211	711	472	300	---	1270	577	536	105	85	68	129
30	203	787	749	285	---	1570	212	536	109	98	66	124
31	202	---	935	270	---	1530	---	524	---	99	70	---
TOTAL	10221	17935	16674	15702	15458	24654	29828	12061	8104	3360	2680	3285
MEAN	330	598	538	507	552	795	994	389	270	108	86.5	110
MAX	739	1140	935	1110	855	1570	1440	569	516	149	101	135
MIN	96	198	343	270	244	455	212	118	105	85	66	64
MEAN+	346	506	540	492	559	816	992	473	253	106	82.4	53.6
CFSM+	.65	.95	1.02	.93	1.05	1.54	1.87	.89	.48	.20	.16	.10
IN.+	.75	1.07	1.18	1.07	1.10	1.77	2.09	1.03	.53	.23	.18	.11

WTR YR 1991 TOTAL 159962 MEAN 438 MAX 1570 MIN 64 MEAN+ 434 CFSM+ .82 IN+ 11.11

+ Adjusted for change in contents in Holloway Reservoir.

STREAMS TRIBUTARY TO LAKE HURON

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04148140 KEARSLEY CREEK NEAR DAVISON, MI

LOCATION.--Lat 43°02'01", long 83°34'53", in NE1/4 sec.12, T.7 N., R.7 E., Genesee County, Hydrologic Unit 04080204, on right bank 10 ft upstream from bridge on Davison Road, 1.4 mi downstream from Black Creek, and 3.3 mi west of Davison.

DRAINAGE AREA.--99.4 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area. WDR MI-85: 1968(M), 1973(M), 1975, 1982(P).

GAGE.--Water-stage recorder. Datum of gage is 747.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 24-29, Dec. 31 to Feb. 5, and Feb. 11-18, 23-28. Records good except for estimated daily discharges, which are fair. Some diurnal fluctuation caused by small dams, and occasional diversion for sprinkler irrigation upstream from station. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--26 years, 72.9 ft<sup>3</sup>/s, 9.96 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft<sup>3</sup>/s, Sept. 9, 1985, gage height, 11.85 ft, from floodmark; minimum, 1.6 ft<sup>3</sup>/s, July 9, 1988, gage height, 2.62 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0100	354	7.32	Dec. 29	2400	450	8.14
Nov. 6	0500	485	8.42	Mar. 28	0800	447	8.12
Nov. 28	1400	*487	*8.44	Apr. 20	1800	402	7.74

Minimum discharge, 3.3 ft<sup>3</sup>/s, July 20, gage height, 2.72 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	26	222	205	50	83	175	89	61	13	15	9.4
2	11	26	166	180	49	143	145	82	57	12	13	9.1
3	11	26	141	165	50	210	128	77	52	7.5	18	8.5
4	25	27	139	150	70	185	116	73	46	17	15	9.1
5	23	194	127	135	120	190	117	74	39	27	15	8.9
6	32	421	120	120	183	248	105	94	34	42	14	11
7	33	289	106	105	172	241	97	88	30	32	11	9.7
8	30	261	86	95	158	188	98	91	28	30	12	8.7
9	83	235	87	90	155	183	244	96	25	24	13	8.4
10	232	193	101	85	137	150	270	89	22	24	12	8.9
11	302	137	95	80	125	131	185	81	41	20	11	8.4
12	227	112	93	76	110	119	172	76	38	16	9.9	7.6
13	216	97	91	73	90	109	161	100	53	16	8.2	7.4
14	193	86	82	71	70	100	142	117	49	15	7.4	7.5
15	164	78	85	70	55	92	159	133	47	15	7.7	7.8
16	108	72	108	80	57	82	176	113	108	18	8.4	7.2
17	87	67	103	95	60	78	160	99	75	25	9.6	7.1
18	87	62	119	100	70	102	162	51	59	9.9	17	7.6
19	84	59	110	105	189	105	144	49	44	5.1	37	6.7
20	75	55	100	120	206	100	321	48	39	4.0	32	7.0
21	66	54	99	140	198	99	324	45	36	9.3	34	8.3
22	56	53	121	120	211	97	285	40	27	14	29	7.6
23	44	46	111	105	160	100	259	36	25	14	28	10
24	27	50	100	90	135	106	249	37	23	17	32	9.3
25	28	50	85	85	120	103	208	37	22	17	13	11
26	31	48	80	76	100	99	171	114	19	12	6.3	12
27	31	113	75	70	90	163	143	115	17	11	5.3	11
28	31	426	70	65	85	386	144	119	15	9.9	7.1	11
29	29	326	250	60	---	287	127	113	14	15	8.5	11
30	28	261	387	55	---	253	111	85	13	18	8.9	11
31	27	---	260	51	---	217	---	75	---	15	9.1	---
TOTAL	2432	3950	3919	3117	3275	4749	5298	2536	1158	524.7	467.4	268.2
MEAN	78.5	132	126	101	117	153	177	81.8	38.6	16.9	15.1	8.94
MAX	302	426	387	205	211	386	324	133	108	42	37	12
MIN	11	26	70	51	49	78	97	36	13	4.0	5.3	6.7
CFSM	.79	1.33	1.27	1.02	1.18	1.54	1.78	.82	.39	.17	.15	.09
IN.	.91	1.48	1.47	1.17	1.23	1.78	1.98	.95	.43	.20	.17	.10

CAL YR 1990 TOTAL 32268.1 MEAN 88.4 MAX 475 MIN 4.2 CFSM .89 IN 12.08  
WTR YR 1991 TOTAL 31694.3 MEAN 86.8 MAX 426 MIN 4.0 CFSM .87 IN 11.86



## STREAMS TRIBUTARY TO LAKE HURON

04148500 FLINT RIVER NEAR FLINT, MI

LOCATION.--Lat 43°02'20", long 83°46'18", in SW1/4 sec.4, T.7 N., R.6 E., Genesee County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant, 1.2 mi upstream from Pirnie Creek, and 5.0 mi downstream from Swartz Creek.

DRAINAGE AREA.--956 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1903 to March 1904 (gage heights only), August 1932 to current year. Gage-height records for flood seasons collected in this vicinity 1911-32, are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1933-34(M), 1935-37. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 678.80 ft above National Geodetic Vertical Datum of 1929 (levels by the National Weather Service and City of Flint).

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs upstream from station (station 04147000). Occasional diversion for industrial use. Since Dec. 17, 1967, flow contains up to 50 ft<sup>3</sup>/s as sewage effluent which originates outside the basin. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 619 ft<sup>3</sup>/s, 8.79 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,900 ft<sup>3</sup>/s, Apr. 6, 1947, gage height, 16.35 ft; maximum gage height, 16.95 ft, Sept. 6, 1985; minimum discharge, 9.0 ft<sup>3</sup>/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,800 ft<sup>3</sup>/s, Mar. 28, gage height, 9.28 ft; minimum, 69 ft<sup>3</sup>/s, Sept. 7, gage height, 2.73 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	178	333	1630	2040	481	856	2270	688	831	188	188	129
2	198	322	1540	1740	464	1420	1970	593	842	196	181	125
3	174	330	1540	1710	496	2060	1710	480	781	209	289	130
4	415	362	1270	1550	650	1890	1380	579	761	320	196	131
5	241	1290	1120	1200	1080	1640	1110	759	683	216	167	127
6	195	2170	1100	1150	1290	2040	1210	1070	608	220	182	117
7	214	2210	1060	1020	1410	2600	1140	1080	532	280	171	113
8	235	1990	990	869	1460	2150	1150	977	462	373	194	150
9	760	1940	918	859	1510	1840	2660	1030	404	266	193	171
10	1820	1640	971	811	1450	1880	2850	979	367	240	169	191
11	1610	1420	919	741	1230	1720	2250	902	713	228	160	177
12	1370	1470	891	742	1070	1370	2240	759	498	221	141	163
13	1350	1440	876	655	995	1270	1950	838	413	222	206	169
14	1310	1210	857	673	918	1180	1860	770	383	204	164	165
15	1280	1320	859	695	772	803	2020	747	709	178	150	158
16	799	1330	927	832	629	856	1970	707	968	190	141	165
17	904	1250	904	1000	582	848	1680	1190	676	182	232	222
18	1180	1170	1010	1010	658	1130	1640	822	535	184	368	145
19	916	497	967	1040	1280	976	1610	651	478	160	851	137
20	789	499	918	1320	1820	988	2920	555	428	164	442	181
21	505	530	943	1370	1620	952	2990	495	381	252	237	152
22	399	554	1040	1130	1710	1040	2700	475	438	369	208	199
23	516	502	1040	974	1570	1020	2640	459	374	265	198	205
24	491	498	952	916	1520	1050	2530	500	316	198	186	188
25	448	478	828	816	1240	1030	2290	488	294	180	186	203
26	414	493	688	741	1190	1030	1890	1210	274	168	152	219
27	380	901	648	691	1010	1630	1710	998	254	158	170	157
28	366	3000	652	623	948	3530	2290	843	235	148	159	167
29	349	2400	1830	564	---	2940	1610	918	208	313	147	180
30	349	1700	3060	529	---	2660	908	918	192	314	138	234
31	340	---	2340	498	---	2480	---	952	---	208	141	---
TOTAL	20495	35249	35288	30509	31053	48879	59148	24432	15038	7014	6707	4970
MEAN	661	1175	1138	984	1109	1577	1972	788	501	226	216	166
MAX	1820	3000	3060	2040	1820	3530	2990	1210	968	373	851	234
MIN	174	322	648	498	464	803	908	459	192	148	138	113
MEAN+	677	1084	1141	970	1116	1597	1970	873	484	224	212	110
CFSM+	.71	1.13	1.19	1.01	1.17	1.67	2.06	.91	.51	.23	.22	.12
IN.+	.82	1.26	1.38	1.17	1.22	1.93	2.30	1.05	.56	.27	.26	.13

CAL YR 1990 TOTAL 288305 MEAN 790 MAX 3460 MIN 132 MEAN+ 792 CFSM+ .83 IN+ 11.24  
WTR YR 1991 TOTAL 318782 MEAN 873 MAX 3530 MIN 113 MEAN+ 869 CFSM+ .91 IN+ 12.34

+ Adjusted for change in contents in Holloway Reservoir.

STREAMS TRIBUTARY TO LAKE HURON

175

04149000 FLINT RIVER NEAR FOSTERS, MI

LOCATION.--Lat 43°18'30", long 83°57'13", in SE1/4 SE1/4 sec.35, T.11 N., R.4 E., Saginaw County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 13, 2 mi west of Fosters, and 6.5 mi downstream from Silver Creek. Records include flow of Birch Run.

DRAINAGE AREA.--1,188 mi<sup>2</sup>, includes that of Birch Run upstream from State Highway 13.

PERIOD OF RECORD.--October 1939 to September 1984, October 1987 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-20, 1922-27 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1940, 1942, 1943-44(M), 1945, 1946-47(M), 1948-50. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1969, nonrecording gage at site 2.2 mi upstream at datum 582.22 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 5 to Dec. 13, Dec. 25 to Feb. 7, Feb. 15-21, May 17, 18, June 12, and July 8-23. Records fair. Some regulation by reservoirs upstream from the city of Flint.

AVERAGE DISCHARGE.--49 years, 753 ft<sup>3</sup>/s, 8.61 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,000 ft<sup>3</sup>/s, Apr. 7, 1947, including flow by-passing gage; maximum gage height, 18.6 ft, Feb. 2, 1968, site and datum then in use; minimum discharge observed, 27 ft<sup>3</sup>/s, Aug. 6, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of March 1904 reached a stage of 18.4 ft, from National Weather Service data, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,020 ft<sup>3</sup>/s, Apr. 10, gage height, 13.75 ft; maximum gage height, 13.82 ft, Dec. 30, backwater from ice; minimum daily discharge, 160 ft<sup>3</sup>/s, Sept. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	232	448	2400	2700	630	1120	2660	1490	1140	287	299	194
2	233	440	2100	2100	610	1740	2360	1170	1000	294	268	181
3	255	426	2000	1950	600	3430	2060	956	1040	291	288	176
4	318	435	1900	2000	650	2710	1810	791	945	363	391	185
5	516	700	1750	1900	850	2280	1620	892	892	449	280	185
6	342	1500	1500	1600	1300	2310	1480	1370	817	321	246	177
7	279	2700	1400	1450	1600	2950	1510	1390	746	343	250	171
8	291	2800	1350	1300	1780	2800	1400	1340	674	380	243	160
9	683	2600	1300	1150	1860	2180	3240	1210	615	500	282	191
10	1820	2400	1250	1050	1820	2100	4800	1310	547	400	284	233
11	3110	2100	1200	1000	1590	2090	3520	1200	532	330	246	243
12	1980	1900	1150	950	1370	1790	2890	1110	900	310	227	233
13	1660	1650	1100	900	1230	1550	2620	1040	650	305	213	222
14	1520	1800	1060	860	1150	1420	2290	1050	557	300	263	220
15	1530	1700	995	840	1050	1320	2340	950	562	280	234	223
16	1250	1650	1090	900	950	984	2850	921	1420	250	216	218
17	1120	1600	1100	1000	850	1050	2350	1050	1160	260	208	216
18	1310	1550	1220	1200	750	1230	2240	1400	839	250	503	269
19	1400	1300	1270	1250	900	1410	2080	952	706	245	570	203
20	1090	700	1140	1300	1800	1260	2740	824	636	220	1110	182
21	923	640	1070	1600	2000	1210	3970	726	590	220	527	219
22	615	660	1300	1700	2160	1190	3320	675	554	400	336	206
23	615	700	1310	1500	1970	1280	2980	646	607	550	293	257
24	663	670	1200	1300	1790	1270	2950	622	534	371	277	259
25	624	640	1150	1200	1660	1290	2890	699	466	287	258	243
26	578	620	1050	1050	1380	1240	2390	1040	429	261	255	261
27	537	620	900	950	1310	1470	2090	1570	398	243	224	276
28	500	950	850	870	1170	3700	2830	1180	371	232	231	207
29	479	3800	1500	800	---	3990	3210	1090	342	217	224	215
30	465	3300	4000	730	---	3270	2060	1100	310	466	206	231
31	459	---	3400	670	---	2930	---	1200	---	402	199	---
TOTAL	27397	42999	46005	39770	36780	60564	77550	32964	20979	10027	9651	6456
MEAN	884	1433	1484	1283	1314	1954	2585	1063	699	323	311	215
MAX	3110	3800	4000	2700	2160	3990	4800	1570	1420	550	1110	276
MIN	232	426	850	670	600	984	1400	622	310	217	199	160
CAL YR 1990	TOTAL	357577	MEAN	980	MAX	4500	MIN	164				
WTR YR 1991	TOTAL	411142	MEAN	1126	MAX	4800	MIN	160				

## STREAMS TRIBUTARY TO LAKE HURON

04150500 CASS RIVER AT CASS CITY, MI

LOCATION.--Lat 43°35'03", long 83°10'34", in NE1/4 NE1/4 sec.4, T.13 N., R.11 E., Tuscola County, Hydrologic Unit 04080205, on left bank 600 ft downstream from bridge on Cemetery Road, 0.3 mi downstream from confluence of North and South Branches, and 1.1 mi south of Cass City.

DRAINAGE AREA.--359 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1947 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1949-50. WSP 1727: 1948(M), 1950. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 697.92 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 14, 1952, nonrecording gage at site 600 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 25-28 and Jan. 1 to Mar. 2. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 222 ft<sup>3</sup>/s, 8.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 19.82 ft, from floodmark; minimum, 0.50 ft<sup>3</sup>/s, Sept. 26, 1948.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	1700	2,420	10.06	Apr. 10	0800	4,070	12.03
Nov. 6	2000	3,010	10.87	Apr. 16	0900	1,810	8.98
Nov. 29	0300	1,740	8.86	Apr. 21	0200	1,710	8.81
Dec. 30	1700	2,860	10.52	Apr. 28	2200	2,450	9.94
Mar. 3	0400	2,780	10.40	May 26	2100	4,200	12.19
Mar. 7	0800	2,270	9.68	May 29	1800	3,340	11.14
Mar. 28	1600	*5,010	*13.10				

Minimum discharge, 3.8 ft<sup>3</sup>/s, Sept. 11, 13, 24; minimum gage height, 4.44 ft, Sept. 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	97	675	1000	115	210	669	807	706	24	17	4.4
2	21	91	440	600	110	800	543	512	549	24	13	4.6
3	20	88	344	400	120	2370	445	384	339	24	22	4.8
4	35	86	338	310	200	1410	382	311	239	28	24	4.9
5	56	272	367	270	600	942	385	269	187	28	24	4.9
6	60	2400	378	220	800	994	413	300	150	30	21	4.8
7	60	2380	346	200	700	2050	431	301	125	28	17	4.6
8	55	1490	325	190	540	1120	412	273	104	27	16	4.5
9	123	875	299	180	450	761	2660	249	87	28	16	4.2
10	801	548	516	170	370	877	3780	241	76	26	16	4.2
11	2210	395	602	165	300	878	2240	226	75	22	15	4.2
12	1920	315	516	160	250	660	1160	206	83	20	14	4.5
13	1280	263	479	160	210	467	694	316	79	22	12	4.6
14	766	225	401	165	170	366	517	337	71	24	11	4.8
15	533	202	317	170	150	316	699	244	67	25	9.9	5.0
16	433	190	281	190	130	290	1620	194	67	20	14	4.9
17	453	181	255	210	135	290	1010	284	77	17	14	4.7
18	608	170	311	230	150	501	655	227	71	15	14	5.3
19	562	161	378	260	190	901	473	171	58	14	16	5.2
20	453	149	323	280	500	668	940	153	50	11	19	5.1
21	346	142	276	300	640	524	1570	137	45	12	14	5.0
22	274	157	380	320	680	480	1330	121	41	13	11	4.9
23	226	171	467	300	550	444	855	107	41	15	10	4.8
24	192	184	365	250	400	499	677	95	41	15	8.9	4.3
25	171	182	240	230	300	504	592	244	39	13	8.2	4.6
26	153	168	210	225	250	418	474	3120	36	11	7.4	5.1
27	140	202	190	190	200	1310	395	3360	34	9.9	6.4	5.3
28	128	1160	180	160	180	4510	1660	1530	31	9.0	5.8	4.9
29	114	1640	528	140	---	3280	2030	2890	28	8.9	6.6	4.5
30	104	1160	2430	130	---	1730	1410	2390	26	12	6.1	4.4
31	99	---	1980	120	---	958	---	1230	---	15	5.1	---
TOTAL	12416	15744	15137	7895	9390	31528	31121	21229	3622	590.8	414.4	142.0
MEAN	401	525	488	255	335	1017	1037	685	121	19.1	13.4	4.73
MAX	2210	2400	2430	1000	800	4510	3780	3360	706	30	24	5.3
MIN	20	86	180	120	110	210	382	95	26	8.9	5.1	4.2
CFSM	1.12	1.46	1.36	.71	.93	2.83	2.89	1.91	.34	.05	.04	.01
IN.	1.29	1.63	1.57	.82	.97	3.27	3.22	2.20	.38	.06	.04	.01
CAL YR 1990	TOTAL	105274.4	MEAN 288	MAX 3700	MIN 6.5	CFSM .80	IN 10.91					
WTR YR 1991	TOTAL	149229.2	MEAN 409	MAX 4510	MIN 4.2	CFSM 1.14	IN 15.46					



## STREAMS TRIBUTARY TO LAKE HURON

177

04150800 CASS RIVER AT WAHJAMEGA, MI

LOCATION.--Lat 43°27'02", long 83°26'29", in NW1/4 NW1/4 sec.20, T.12 N., R.9 E., Tuscola County, Hydrologic Unit 04080205, on right bank 90 ft upstream from bridge on Chambers Road, on grounds of Caro Regional Center at Wahjamega, 1.9 mi downstream from Michigan Sugar Co. dam, and 40 mi upstream from mouth.

DRAINAGE AREA.--645 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1968 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 632.60 ft above National Geodetic Vertical Datum of 1929 (levels by Edmonds Engineering, Inc.). Prior to June 19, 1969, nonrecording gage at bridge 90 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 3-14, Jan. 21 to Feb. 2, Feb. 10-21, and Feb. 24 to Mar. 1. Records good except for estimated daily discharges, which are poor. Some regulation by dam at Michigan Sugar Co., 1.9 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--23 years, 456 ft<sup>3</sup>/s, 9.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 26.66 ft, from floodmark; minimum, 16 ft<sup>3</sup>/s, July 14, 15, 16, 1988, gage height, 2.80 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 12	0200	3,020	10.64	Apr. 10	1000	7,180	15.97
Nov. 7	0800	4,350	12.58	Apr. 16	1700	2,620	9.97
Nov. 29	0300	2,970	10.56	Apr. 21	1000	2,920	10.48
Dec. 31	0200	4,190	12.36	Apr. 29	0200	5,550	14.10
Mar. 3	1100	4,720	13.07	May 27	1300	6,800	15.55
Mar. 7	1800	3,240	10.97	May 30	0700	4,030	12.13
Mar. 29	0300	*7,800	*16.63				

Minimum discharge, 19 ft<sup>3</sup>/s, Sept. 15; minimum gage height, 2.84 ft, Sept. 8, 9, 12-15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	196	1230	2120	230	410	1200	1680	1100	61	42	26
2	57	190	845	1330	230	1540	965	1060	791	58	42	25
3	56	181	689	820	238	4350	802	798	635	63	54	25
4	92	185	676	620	409	2560	700	668	470	76	65	24
5	96	350	671	530	1100	1700	698	588	383	89	59	22
6	114	2840	687	470	1620	1500	742	652	331	85	53	22
7	113	4050	655	410	1540	2870	763	670	278	78	50	22
8	111	2510	626	380	1150	2140	764	605	236	84	52	21
9	186	1520	579	360	992	1360	3750	556	205	83	54	21
10	838	1010	749	350	920	1330	6980	549	185	73	50	22
11	2660	767	942	340	730	1420	4880	506	176	67	46	21
12	2720	638	854	330	540	1110	2290	464	182	64	43	20
13	1780	543	791	330	420	876	1330	569	176	79	42	20
14	1150	476	725	340	340	705	967	876	159	82	41	20
15	830	430	602	367	310	628	1050	694	163	77	40	19
16	711	406	553	382	270	578	2320	517	169	67	42	20
17	681	388	523	422	280	562	1850	515	196	58	46	20
18	856	370	561	492	300	668	1180	616	180	54	54	20
19	844	351	680	512	350	1250	867	481	152	49	51	20
20	723	334	625	567	720	1120	1340	399	128	47	48	20
21	602	318	547	640	1100	879	2750	350	110	47	46	20
22	508	331	597	660	1410	805	2270	313	102	53	42	20
23	442	354	773	600	1310	751	1610	274	104	59	40	21
24	394	376	666	510	860	810	1250	240	98	54	38	21
25	354	376	450	450	630	840	1220	285	93	51	35	22
26	320	355	410	440	500	755	919	2910	87	48	33	22
27	283	397	370	390	410	1470	774	6300	80	45	32	22
28	262	1720	360	330	380	6070	3340	4000	76	42	31	22
29	235	2780	653	280	---	6850	4830	2820	70	41	30	23
30	217	1940	3030	250	---	3520	2860	3690	68	43	30	23
31	207	---	3570	240	---	1830	---	1990	---	42	29	---
TOTAL	18499	26682	25689	16262	19289	53257	57261	36635	7183	1919	1360	646
MEAN	597	889	829	525	689	1718	1909	1182	239	61.9	43.9	21.5
MAX	2720	4050	3570	2120	1620	6850	6980	6300	1100	89	65	26
MIN	56	181	360	240	230	410	698	240	68	41	29	19
CFSM	.93	1.38	1.29	.81	1.07	2.66	2.96	1.83	.37	.10	.07	.03
IN.	1.07	1.54	1.48	.94	1.11	3.07	3.30	2.11	.41	.11	.08	.04

CAL YR 1990	TOTAL	180773	MEAN	495	MAX	6190	MIN	31	CFSM	.77	IN	10.43
WTR YR 1991	TOTAL	264682	MEAN	725	MAX	6980	MIN	19	CFSM	1.12	IN	15.27



## STREAMS TRIBUTARY TO LAKE HURON

04151500 CASS RIVER AT FRANKENMUTH, MI

LOCATION.--Lat 43°19'40", long 83°44'53", in NW1/4 SE1/4 sec.27, T.11 N., R.6 E., Saginaw County, Hydrologic Unit 04080205, on right bank 2,000 ft downstream from dam in Frankenmuth, 3,600 ft upstream from highway bridge on Dehmel Road, 3.4 mi upstream from Dead Creek, and 17 mi upstream from mouth.

DRAINAGE AREA.--841 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1908 to March 1909, July 1935 to September 1936, June 1939 to current year.

REVISED RECORDS.--WSP 1307: 1936(M), 1940(M). WSP 1727: 1952. WSP 1911: 1952. WDR MI-78: Drainage area.

GAGE--Water-stage recorder. Datum of gage is 583.96 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1908 to March 1909, nonrecording gage at site 2,000 ft upstream at datum 1.81 ft lower. July 18 to September 11, 1935, nonrecording gage; Sept. 12, 1935, to Sept. 30, 1936, and June 20, 1939, to Sept. 30, 1949, water-stage recorder, at site 3,600 ft downstream at datum 0.04 ft higher.

REMARKS.--Estimated daily discharges: Dec. 25-28 and Jan. 1 to Mar. 1. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Prior to 1950, regulation at low and medium flows by mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--53 years, 520 ft<sup>3</sup>/s, 8.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,200 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 27.52 ft; minimum daily, about 1.5 ft<sup>3</sup>/s, Aug. 6, 1944.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 7	1600	4,800	15.68	Mar. 29	1400	*8,380	*19.14
Nov. 29	0900	3,790	14.44	Apr. 10	2000	8,160	18.95
Dec. 31	1500	6,870	17.81	Apr. 29	0700	7,370	18.27
Mar. 3	2100	5,410	16.35	May 27	2200	7,160	18.08
Mar. 8	0200	3,510	14.06	May 30	1500	4,190	14.95

Minimum discharge, 34 ft<sup>3</sup>/s, Sept. 13, 14, 18; minimum gage height, 3.22 ft, Sept. 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	109	259	1870	2500	300	540	1810	2560	2250	102	72	40
2	102	247	1370	1500	300	1530	1460	1740	1520	97	68	37
3	95	237	1080	1000	350	4780	1230	1330	1140	103	74	38
4	109	232	1040	800	700	4120	1060	1090	793	163	91	37
5	160	591	1030	650	1500	2370	1070	952	584	191	95	36
6	151	2830	989	550	2100	2100	1120	1090	461	163	93	36
7	153	4630	971	520	1700	2890	1120	1110	387	156	83	36
8	149	3500	912	490	1400	2980	1110	977	330	171	81	37
9	179	2120	864	470	1200	1930	4020	884	289	156	87	37
10	478	1530	970	460	1100	1710	7700	867	258	136	84	40
11	1600	1180	1230	450	850	1790	7060	790	259	120	76	37
12	2830	947	1210	440	680	1590	3570	700	260	119	70	38
13	2730	790	1120	430	500	1310	2000	720	247	161	66	35
14	1910	672	1020	440	430	1080	1510	1530	228	165	65	36
15	1400	591	878	460	380	938	1510	1250	257	143	64	37
16	1110	541	807	520	350	842	2380	844	338	127	64	40
17	988	511	768	580	360	802	2530	806	307	109	75	37
18	1150	476	821	630	400	919	1770	922	279	99	83	36
19	1230	447	941	700	700	1380	1380	748	240	95	101	57
20	1040	428	911	750	1300	1550	1670	575	207	84	95	60
21	865	397	809	840	1600	1290	3130	490	179	87	88	51
22	715	415	863	860	1800	1130	2930	425	171	96	80	48
23	588	457	1020	760	1300	1060	2260	372	179	100	75	51
24	507	485	998	640	950	1110	1850	336	165	97	67	49
25	442	485	550	580	750	1170	1800	458	151	85	61	47
26	388	451	520	560	600	1100	1460	2260	144	77	56	47
27	345	576	480	480	520	1570	1220	6350	132	75	54	46
28	321	2130	460	410	490	5820	4070	5730	123	70	51	44
29	298	3620	1110	350	---	8090	7060	2940	115	69	49	43
30	278	2680	3650	330	---	5570	4540	3960	107	85	49	41
31	265	---	6500	310	---	2660	---	2900	---	77	45	---
TOTAL	22685	34455	37762	20460	24610	67721	77400	47706	12100	3578	2262	1254
MEAN	732	1149	1218	660	879	2185	2580	1539	403	115	73.0	41.8
MAX	2830	4630	6500	2500	2100	8090	7700	6350	2250	191	101	60
MIN	95	232	460	310	300	540	1060	336	107	69	45	35
CFSM	.87	1.37	1.45	.79	1.05	2.60	3.07	1.83	.48	.14	.09	.05
IN.	1.00	1.52	1.67	.91	1.09	3.00	3.42	2.11	.54	.16	.10	.06

CAL YR 1990 TOTAL 240757 MEAN 660 MAX 7590 MIN 46 CFSM .79 IN 10.65  
WTR YR 1991 TOTAL 351993 MEAN 964 MAX 8090 MIN 35 CFSM 1.15 IN 15.57

## STREAMS TRIBUTARY TO LAKE HURON

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04152238 SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI

LOCATION.--Lat 43°52'01", long 84°32'43", in SE1/4 NE1/4 sec.16, T.17 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, on left bank 40 ft upstream from bridge on Grout Road, 3.0 mi upstream from Ross Lake, and 3.2 mi southwest of Beaverton.

DRAINAGE AREA.--160 mi<sup>2</sup>.

PERIOD OF RECORD.--January 1987 to current year.

GAGE.--Water-stage recorder. Datum of gage is 709.92 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 3-7, 13, 14, and Dec. 22 to Mar. 8. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,450 ft<sup>3</sup>/s, Apr. 16, 1991, gage height, 10.74 ft; maximum gage height, 11.06 ft, Mar. 12, 1990, backwater from ice; minimum discharge, 39 ft<sup>3</sup>/s, July 6, Sept. 9, 1988; minimum gage height, 3.26 ft, July 6, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,450 ft<sup>3</sup>/s, Apr. 16, gage height, 10.74 ft; minimum, 62 ft<sup>3</sup>/s, Aug. 16, 17, 23, gage height, 3.81 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	84	112	242	140	74	120	257	388	139	70	80	66
2	88	109	210	130	80	330	219	289	128	72	76	65
3	87	105	170	120	90	700	208	224	128	74	102	65
4	108	109	160	110	120	210	190	215	130	77	119	67
5	129	192	150	100	240	200	205	204	113	83	96	66
6	115	654	145	90	340	190	215	289	99	77	83	64
7	111	778	145	85	320	185	190	292	101	76	77	63
8	167	484	148	80	280	180	379	245	101	80	73	63
9	229	306	151	78	270	178	1110	222	92	80	82	63
10	443	241	187	78	260	178	1220	209	87	74	84	69
11	636	231	185	78	190	177	821	196	84	71	77	87
12	573	197	168	78	140	166	428	186	82	68	69	79
13	268	173	155	80	130	155	289	179	75	96	68	75
14	197	157	150	82	120	148	278	173	75	149	65	76
15	277	150	142	83	110	149	686	157	87	117	65	83
16	298	154	138	84	105	156	1340	143	157	92	64	99
17	237	151	141	85	120	161	1080	141	153	80	68	87
18	251	139	198	86	110	181	559	164	118	76	102	86
19	268	131	220	84	140	229	332	153	100	74	114	84
20	211	127	172	82	210	237	289	137	87	76	196	77
21	179	128	152	80	250	227	263	127	77	82	138	73
22	161	197	150	76	280	238	222	119	76	107	104	74
23	147	190	155	74	210	283	216	117	79	125	74	75
24	143	167	155	74	160	352	203	123	77	108	76	76
25	130	149	155	74	130	295	192	126	75	91	77	76
26	128	136	140	74	120	245	184	340	75	78	74	86
27	128	156	125	74	110	372	181	523	75	79	72	95
28	125	583	125	74	115	1040	712	326	74	77	72	88
29	122	857	130	74	---	1050	1150	211	71	78	71	85
30	119	500	140	74	---	543	710	166	71	93	71	85
31	117	---	145	74	---	289	---	154	---	91	71	---
TOTAL	6276	7763	4949	2655	4824	9164	14328	6538	2886	2671	2660	2297
MEAN	202	259	160	85.6	172	296	478	211	96.2	86.2	85.8	76.6
MAX	636	857	242	140	340	1050	1340	523	157	149	196	99
MIN	84	105	125	74	74	120	181	117	71	68	64	63
CFSM	1.26	1.62	1.00	.54	1.08	1.85	2.99	1.32	.60	.54	.54	.48
IN.	1.46	1.80	1.15	.62	1.12	2.13	3.33	1.52	.67	.62	.62	.53
CAL YR 1990	TOTAL	52876	MEAN	145	MAX	1290	MIN	54	CFSM	.91	IN	12.29
WTR YR 1991	TOTAL	67011	MEAN	184	MAX	1340	MIN	63	CFSM	1.15	IN	15.58

## STREAMS TRIBUTARY TO LAKE HURON

## 04154000 CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI

LOCATION.--Lat 43°37'32", long 84°42'28", in NW1/4 NW1/4 sec.8, T.14 N., R.3 W., Isabella County, Hydrologic Unit 04080202, on right bank 12 ft downstream from bridge on South Leaton Road, 3.8 mi northeast of Mount Pleasant, and 36 mi upstream from mouth.

DRAINAGE AREA.--416 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-27, are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1337: 1931, 1933-40, 1945, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 710.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 21, 1938, nonrecording gage at site 30 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 25 to Jan. 17, Jan. 21 to Feb. 6, and Feb. 11, 12, 16, 17. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation below 750 ft<sup>3</sup>/s caused by powerplant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968, occasional regulation by control structures on lake outlets. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--60 years, 320 ft<sup>3</sup>/s, 10.45 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 15.58 ft, from floodmark; minimum, 12 ft<sup>3</sup>/s, Aug. 18, 1945; minimum gage height, 2.70 ft, Oct. 8, 1966; minimum daily discharge, 19 ft<sup>3</sup>/s, Aug. 16, 1936.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,000 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	1000	1,240	6.71	Mar. 28	2000	1,730	8.33
Nov. 6	1900	1,440	7.37	Apr. 10	0400	1,310	6.96
Nov. 28	2300	1,340	7.06	Apr. 16	1200	2,170	9.33
Mar. 3	0500	1,220	6.66	Apr. 28	2300	*2,220	*9.43

Minimum discharge, 163 ft<sup>3</sup>/s, Sept. 9, gage height, 3.01 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	217	390	911	450	320	349	1060	1590	732	194	239	175
2	218	387	800	440	330	770	910	1330	575	203	222	169
3	215	384	703	430	340	1090	797	1120	511	204	253	167
4	265	394	653	420	450	693	714	953	460	205	241	175
5	272	545	592	410	650	604	688	845	426	200	235	175
6	258	1270	557	400	550	579	672	875	398	192	221	173
7	253	1180	530	385	477	558	652	823	374	190	208	170
8	255	931	514	370	444	537	670	764	358	222	206	166
9	431	849	504	360	449	537	965	761	342	216	217	165
10	785	796	571	350	443	521	1280	738	329	212	215	170
11	1200	718	540	330	390	507	1250	682	311	201	210	182
12	1040	643	518	340	380	483	1170	639	294	233	203	187
13	901	583	521	350	373	463	1040	605	277	410	191	187
14	776	539	492	350	362	446	940	582	265	365	183	187
15	813	513	471	360	353	435	1300	546	292	330	179	215
16	744	495	461	360	345	429	2020	511	291	282	179	247
17	663	474	455	360	340	430	1710	486	289	246	181	225
18	683	458	524	368	332	489	1450	467	282	227	194	208
19	692	445	528	370	388	541	1240	454	267	212	227	202
20	611	432	489	390	477	538	1050	436	250	201	252	192
21	563	441	475	370	448	556	911	421	237	215	271	187
22	519	488	496	360	506	525	813	409	233	324	265	185
23	481	476	498	340	421	669	734	404	239	335	245	186
24	475	462	470	330	404	815	674	422	230	280	222	180
25	447	447	440	320	380	795	628	434	221	249	209	179
26	441	437	410	320	370	765	592	597	216	227	202	188
27	440	486	390	320	359	886	595	738	210	215	196	191
28	435	1080	410	320	349	1550	1660	833	207	206	190	188
29	412	1190	450	320	---	1600	2000	811	201	223	184	185
30	398	984	480	320	---	1420	1800	711	196	235	186	185
31	393	---	470	320	---	1260	---	637	---	242	180	---
TOTAL	16296	18917	16323	11233	11430	21840	31985	21624	9513	7496	6606	5591
MEAN	526	631	527	362	408	705	1066	698	317	242	213	186
MAX	1200	1270	911	450	650	1600	2020	1590	732	410	271	247
MIN	215	384	390	320	320	349	592	404	196	190	179	165
CFSM	1.26	1.52	1.27	.87	.98	1.70	2.56	1.68	.76	.58	.51	.45
IN.	1.46	1.69	1.46	1.00	1.02	1.95	2.86	1.93	.85	.67	.59	.50

CAL YR 1990 TOTAL 147143 MEAN 403 MAX 1430 MIN 169 CFSM .97 IN 13.16  
WTR YR 1991 TOTAL 178854 MEAN 490 MAX 2020 MIN 165 CFSM 1.18 IN 15.99

## STREAMS TRIBUTARY TO LAKE HURON

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## 04155000 PINE RIVER AT ALMA, MI

LOCATION.--Lat 43°22'46", long 84°39'20", in SW1/4 SE1/4 sec.34, T.12 N., R.3 W., Gratiot County, Hydrologic Unit 04080202, on right bank 270 ft downstream from Superior Street Bridge in Alma, 0.6 mi downstream from municipal reservoir, and 38 mi upstream from mouth.

DRAINAGE AREA.--288 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to current year. Gage-height records for flood seasons collected in this vicinity 1910-28 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1307: 1945(M). WSP 1337: 1931, 1932-34(M), 1936, 1939, 1945, 1949.

GAGE.--Water-stage recorder. Datum of gage is 718.37 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 10, 1930, nonrecording gage at Superior Street Bridge at different datum. Dec. 10, 1930, to June 15, 1938, nonrecording gage at site 70 ft downstream from bridge, and June 16 to Oct. 25, 1938, nonrecording gage at bridge at present datum.

REMARKS.--Estimated daily discharges: Dec. 24-27, Dec. 31 to Jan. 13, Jan. 21 to Feb. 3, Feb. 11-16, and Feb. 23 to Mar. 1. Records good except for estimated daily discharges, which are poor. Flow regulated by dam 0.6 mi upstream from station, and by variable backwater from powerplant at St. Louis, 5.2 mi downstream. About 2.5 ft<sup>3</sup>/s diverted upstream from station for municipal and industrial use; sewage effluent is returned downstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--61 years, 224 ft<sup>3</sup>/s, 10.56 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,160 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 12.82 ft, from floodmark; minimum daily, 0.40 ft<sup>3</sup>/s, Sept. 6, 1964, caused by closing dam during construction of waterworks.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,800 ft<sup>3</sup>/s, Apr. 9, gage height, 7.49 ft; minimum, 75 ft<sup>3</sup>/s, Aug. 31, gage height, 0.92 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	130	234	1070	450	170	200	867	929	253	135	161	78
2	148	230	912	400	170	621	710	849	267	123	133	80
3	169	228	750	350	200	630	581	683	256	131	145	84
4	227	252	626	300	306	577	519	554	234	177	149	87
5	201	506	535	270	386	733	494	497	207	139	156	91
6	226	1070	501	250	376	898	457	507	194	137	139	95
7	221	956	478	240	419	740	428	488	195	155	117	91
8	198	1020	447	235	463	551	478	499	175	146	111	86
9	284	1030	434	230	481	511	1370	551	150	124	116	85
10	628	885	474	230	436	454	1550	514	136	120	129	100
11	770	718	469	225	350	413	1240	470	149	107	130	103
12	688	586	466	225	260	391	1140	434	156	144	116	114
13	750	513	466	230	220	357	911	420	173	192	107	122
14	772	470	431	234	200	325	771	388	160	241	96	109
15	757	424	406	259	190	308	1160	353	208	273	87	118
16	606	396	401	298	185	316	1360	317	241	290	88	140
17	551	365	380	303	178	303	1280	279	230	179	89	148
18	578	346	399	304	212	358	1270	264	179	153	98	161
19	500	336	406	308	348	414	1030	267	150	151	143	145
20	463	324	410	345	444	436	850	263	159	139	128	129
21	444	321	425	330	447	473	701	252	167	134	129	121
22	410	351	448	250	526	481	622	236	182	264	120	117
23	373	381	435	180	420	511	549	223	190	326	111	115
24	345	395	340	175	340	560	515	225	249	339	104	113
25	315	397	260	175	280	568	495	235	202	334	100	120
26	298	366	200	170	230	587	463	288	148	244	94	119
27	293	390	190	170	180	746	441	339	138	174	88	115
28	278	1200	200	170	170	1070	578	391	139	134	86	123
29	264	1110	398	170	---	956	522	463	137	137	82	125
30	249	1080	629	170	---	1070	634	449	132	156	78	127
31	240	---	500	170	---	1030	---	320	---	179	76	---
TOTAL	12376	16880	14486	7816	8587	17588	23986	12947	5556	5677	3506	3361
MEAN	399	563	467	252	307	567	800	418	185	183	113	112
MAX	772	1200	1070	450	526	1070	1550	929	267	339	161	161
MIN	130	228	190	170	170	200	428	223	132	107	76	78
CFSM	1.39	1.96	1.62	.88	1.07	1.97	2.78	1.45	.64	.64	.39	.39
IN.	1.60	2.18	1.87	1.01	1.11	2.27	3.10	1.67	.72	.73	.45	.43

CAL YR 1990 TOTAL 113515 MEAN 311 MAX 2330 MIN 52 CFSM 1.08 IN 14.66  
WTR YR 1991 TOTAL 132766 MEAN 364 MAX 1550 MIN 76 CFSM 1.26 IN 17.15



## STREAMS TRIBUTARY TO LAKE HURON

04155500 PINE RIVER NEAR MIDLAND, MI

LOCATION.--Lat 43°33'52", long 84°22'09", in SW1/4 NW1/4 sec.4, T.13 N., R.1 E., Midland County, Hydrologic Unit 04080202, on left bank at downstream side of bridge on Meridian Road, 7.2 mi southwest of Midland, and 7.8 mi upstream from Chippewa River.

DRAINAGE AREA.--390 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--May 1934 to September 1938, February 1948 to current year.

REVISED RECORDS.--WSP 1207: Drainage area. WSP 1307: 1935(M). WSP 1337: 1936-38, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 623.94 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1938, nonrecording gage at same site at datum 5.55 ft lower. Feb. 3, 1948, to Dec. 13, 1951, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 24 to Mar. 9. Records good except for estimated daily discharges, which are poor. Regulation at low and medium flows by hydroelectric powerplant at St. Louis. Some diversion upstream from station for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 310 ft<sup>3</sup>/s, 10.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,360 ft<sup>3</sup>/s, Sept. 12, 1986, gage height, 11.74 ft; maximum gage height, 12.08 ft, Feb. 2, 1968, backwater from ice; minimum discharge since 1953, 7.6 ft<sup>3</sup>/s, July 1, 2, 1988; minimum daily, 7.8 ft<sup>3</sup>/s, July 2, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0300	2,460	6.38	Mar. 28	1600	2,430	6.25
Nov. 6	0900	2,540	6.45	Apr. 10	0400	*3,290	*7.14
Nov. 28	2100	2,990	6.84	Apr. 16	0500	2,810	6.66
Dec. 30	1500	ice jam	6.44	Apr. 28	2400	1,250	4.77
Mar. 6	2200	ice jam	6.19				

Minimum discharge, 29 ft<sup>3</sup>/s, July 19, gage height, 2.21 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	180	1260	520	190	220	1190	889	317	121	185	86
2	69	181	1000	450	190	700	913	1100	229	153	169	89
3	86	163	890	400	220	720	881	871	263	143	86	96
4	176	127	645	340	350	650	644	636	282	69	111	99
5	350	398	595	310	420	900	579	602	269	194	128	105
6	182	2330	450	290	430	1150	584	540	216	117	142	109
7	192	1740	456	270	470	900	549	573	176	97	148	114
8	197	1150	472	260	510	700	526	548	199	137	122	121
9	260	1140	431	255	530	600	1960	558	200	179	115	121
10	1050	1070	519	250	470	595	3000	678	192	130	111	124
11	1960	839	574	250	390	539	1950	536	169	115	113	123
12	1190	604	542	250	290	475	1560	492	173	88	117	125
13	881	506	510	260	250	512	1360	388	170	258	104	130
14	920	425	481	270	230	446	1040	411	191	266	96	163
15	1100	408	457	300	210	389	1630	387	224	351	97	156
16	929	335	393	330	200	314	2520	350	273	237	84	149
17	834	328	423	340	200	412	1800	343	295	528	87	172
18	542	284	457	340	250	452	1630	277	298	67	91	152
19	811	251	457	350	400	529	1500	257	221	59	131	186
20	444	236	443	380	480	597	1180	254	137	105	277	185
21	428	240	451	360	520	591	1000	254	118	108	231	173
22	416	256	496	280	570	619	686	246	155	115	143	163
23	379	300	527	210	480	685	806	243	229	421	109	165
24	311	313	380	200	380	809	643	215	188	346	110	160
25	300	303	300	190	310	784	544	245	299	266	99	154
26	249	293	230	190	250	741	559	356	278	358	90	167
27	223	310	210	190	200	938	542	338	146	198	91	178
28	217	1870	230	190	190	2160	673	367	117	197	91	167
29	207	2190	450	190	---	1400	767	437	119	168	92	161
30	202	1220	700	190	---	1350	600	506	120	125	97	175
31	186	---	600	190	---	1290	---	558	---	177	88	---
TOTAL	15428	19990	16029	8795	9580	23167	33816	14455	6263	5893	3755	4268
MEAN	498	666	517	284	342	747	1127	466	209	190	121	142
MAX	1960	2330	1260	520	570	2160	3000	1100	317	528	277	186
MIN	69	127	210	190	190	220	526	215	117	59	84	86
CFSM	1.28	1.71	1.33	.73	.88	1.92	2.89	1.20	.54	.49	.31	.36
IN.	1.47	1.91	1.53	.84	.91	2.21	3.23	1.38	.60	.56	.36	.41

CAL YR 1990	TOTAL	139704	MEAN	383	MAX	3320	MIN	39	CFSM	.98	IN	13.33
WTR YR 1991	TOTAL	161439	MEAN	442	MAX	3000	MIN	59	CFSM	1.13	IN	15.40

## 04156000 TITTABAWASSEE RIVER AT MIDLAND, MI

LOCATION.--Lat 43°35'43", long 84°14'08", in NW1/4 NE1/4 sec.28, T.14 N., R.2 E., Midland County, Hydro-logic Unit 04080201, on right bank 2,000 ft downstream from dam at Dow Chemical Co. in Midland, 0.7 mi upstream from Bullock Creek, 1.4 mi downstream from Chippewa River, and 23 mi upstream from mouth.

DRAINAGE AREA.--2,400 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1936 to current year. Gage-height records for flood seasons collected in this vicinity 1910-26, 1928, and since 1946 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 1045: 1945. WSP 1144: 1948.

GAGE.--Water-stage recorder. Datum of gage is 580.28 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1955, at datum 10.00 ft higher.

REMARKS.--Estimated daily discharges: Dec. 24 to Feb. 6, Feb. 10-19, and Feb. 22 to Mar. 1. Records good except for estimated daily discharges, which are poor. Water is diverted from river a short distance upstream from station for industrial use. Small part returned to river 0.25 mi downstream from station, remainder returned 1 mi downstream. Extremes and daily discharges not adjusted for diversion. Prior to May 20, 1970, discharge below 4,000 ft<sup>3</sup>/s regulated by dam 2,000 ft upstream from station; fixed crest dam since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--55 years, 1,755 ft<sup>3</sup>/s, 9.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 38,700 ft<sup>3</sup>/s, Sept. 13, 1986, gage height, 33.89 ft, from floodmark; minimum, 39 ft<sup>3</sup>/s, Oct. 1, 1942; minimum gage height, 8.78 ft, July 2, 3, 1988; minimum daily discharge, 111 ft<sup>3</sup>/s, Aug. 21, 1949.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 7,000 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	1900	13,100	21.46	Apr. 10	1400	20,000	25.43
Nov. 7	0530	14,500	22.34	Apr. 16	2330	*20,400	*25.62
Nov. 29	1100	16,200	23.31	Apr. 29	1830	16,600	23.58
Mar. 3	1200	11,700	20.52	May 27	0600	10,600	19.78
Mar. 25	0200	8,060	17.95	May 31	0300	9,800	19.24
Mar. 29	0530	18,700	24.72				

Minimum discharge, 300 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 9.21 ft; minimum daily, 303 ft<sup>3</sup>/s, Sept. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	766	1930	7830	3600	2000	1800	6140	8260	4780	776	965	310
2	890	1920	5760	3100	1100	4180	5070	6540	3460	863	968	303
3	776	1160	5060	3200	830	11000	4500	5250	2860	896	869	645
4	1160	787	4400	3600	1400	9410	4060	4350	2380	514	548	545
5	1460	2230	4220	2700	2800	5250	3860	3600	2230	950	1040	522
6	930	11000	3670	1500	4300	4740	3090	4080	2470	1520	1270	668
7	550	14300	3370	2000	4890	5360	3330	4660	1110	523	1280	377
8	1180	10800	2970	2500	3960	4420	3490	4240	1280	821	1250	332
9	2260	7130	2230	2500	3740	3920	11900	4050	933	934	1170	805
10	4680	5740	2470	2400	2600	3800	19500	3740	1030	846	568	564
11	11900	4920	3330	1800	2500	3630	16800	2410	1080	678	432	689
12	11400	4240	3360	1800	2300	3240	11100	2260	1050	884	793	735
13	6800	3870	4030	1700	1800	3030	8280	2530	1040	911	846	788
14	4720	3470	3860	2100	1700	3310	5880	3400	1080	1030	612	458
15	5080	3280	3390	2300	1600	2590	9510	3310	653	1250	583	406
16	6190	2460	1940	2700	1300	2230	18600	2930	1270	1130	751	728
17	4810	2120	2270	2800	830	2450	19200	2330	1760	1260	469	981
18	4280	1760	3020	2800	1100	3680	13400	2490	1790	995	407	841
19	4120	1860	3170	1700	1500	4320	8790	1230	1400	809	1060	957
20	3720	2030	3730	1200	2480	4330	6520	1610	1180	658	1540	988
21	3120	2080	3390	1700	3270	4130	5220	2030	930	746	1600	485
22	2890	2390	3700	2100	4100	4150	3920	2100	572	1080	1540	372
23	2270	2670	3850	2600	3200	4890	3650	2050	548	1520	1170	669
24	1940	3370	3000	2700	1900	7280	3340	1560	903	1610	510	594
25	2020	1720	1100	2500	1800	7100	2960	1540	948	1350	409	556
26	1770	1920	1800	1800	2100	5000	2590	4840	975	1380	718	547
27	1310	2470	2300	1400	1900	6650	2560	9830	923	726	815	739
28	1010	9680	2300	1700	1800	15400	6330	7200	858	548	806	437
29	1420	15800	3200	1750	---	18000	15700	4280	507	956	794	348
30	1320	12800	6000	1800	---	12700	13500	7410	445	984	584	688
31	1570	---	6300	1900	---	8200	---	7740	---	953	396	---
TOTAL	98312	141907	111020	69950	64800	180190	242790	123850	42445	30101	26763	18077
MEAN	3171	4730	3581	2256	2314	5813	8093	3995	1415	971	863	603
MAX	11900	15800	7830	3600	4890	18000	19500	9830	4780	1610	1600	988
MIN	550	787	1100	1200	830	1800	2560	1230	445	514	396	303
MEAN+	3179	4740	3589	2262	2321	5823	8105	4005	1419	980	871	611
CFSM+	1.32	1.98	1.50	.94	.97	2.43	3.38	1.67	.59	.41	.36	.25
IN.+	1.53	2.20	1.72	1.09	1.01	2.80	3.77	1.92	.66	.47	.42	.28

CAL YR 1990	TOTAL	811582	MEAN	2224	MAX	17800	MIN	348	MEAN+	2231	CFSM+	.93	IN+	12.62
WTR YR 1991	TOTAL	1150205	MEAN	3151	MAX	19500	MIN	303	MEAN+	3159	CFSM+	1.32	IN+	17.87

+ Adjusted for diversion; records furnished by Dow Chemical Co.

## STREAMS TRIBUTARY TO LAKE HURON

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI  
(National stream quality accounting network station)

LOCATION.--Lat 43°34'07", long 84°11'37", in SW1/4 SE1/4 sec.35, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201; at bridge on Gordonville Road, 3.0 mi downstream from gaging station 04156000, and 20 mi upstream from mouth.

DRAINAGE AREA.--2,450 mi<sup>2</sup>.

PERIOD OF RECORD.--Water years 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. All flow except for high-water is regulated by powerplant at Sanford.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED SATUR- ATION (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 03...	1135	451	1040	8.44	14.0	3.3	10.9	109	56	K40
DEC 19...	1300	2690	651	8.04	2.5	5.3	12.3	92	210	210
FEB 12...	1330	2470	630	7.97	0.0	3.6	11.2	78	120	160
APR 16...	1215	19800	286	7.85	8.0	65	10.2	88	K2100	--
JUN 19...	1130	881	622	8.27	25.5	4.7	8.0	100	320	K80
SEP 24...	1100	455	988	8.37	14.5	4.0	9.2	92	55	150

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD (MG/L AS HCO3 (00453)	CAR- BONATE WATER DIS IT FIELD (MG/L AS CO3 (00452)	ALKA- LITY WAT DIS TOT IT FIELD (MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)
OCT 03...	260	89	74	18	100	2.7	200	4	170	34
DEC 19...	240	81	68	17	33	2.9	194	--	159	37
FEB 12...	270	79	77	18	31	3.3	229	--	188	31
APR 16...	130	26	37	8.5	7.3	2.4	124	--	102	12
JUN 19...	230	--	69	15	39	2.9	--	--	--	30
SEP 24...	270	100	75	19	100	2.5	200	--	164	34

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
OCT 03...	210	<0.1	5.5	570	0.78	694	0.01	0.01	0.10	0.20
DEC 19...	79	0.1	7.1	380	0.52	2760	0.01	0.01	1.4	1.4
FEB 12...	79	0.2	8.2	377	0.51	2510	<0.01	0.02	0.96	0.97
APR 16...	15	0.2	4.9	177	0.24	9460	0.07	<0.01	0.82	0.79
JUN 19...	90	0.3	4.8	366	0.50	871	0.04	0.04	0.49	0.50
SEP 24...	200	0.2	6.4	558	0.76	686	0.04	0.03	0.20	0.22

## STREAMS TRIBUTARY TO LAKE HURON

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04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
OCT 03...	0.24	0.22	0.7	0.02	0.04	0.01	<0.01	10	<1	34
DEC 19...	0.12	0.12	0.6	0.03	<0.01	0.01	<0.01	--	--	--
FEB 12...	0.22	0.22	0.6	0.04	0.02	0.01	0.02	<10	<1	34
APR 16...	0.15	0.04	0.8	0.19	0.04	0.10	<0.01	70	<1	20
JUN 19...	0.07	0.07	1.1	0.08	<0.01	<0.01	<0.01	--	--	--
SEP 24...	0.25	0.23	0.9	0.08	0.02	0.04	0.02	10	1	30

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
OCT 03...	<0.5	<1	<1	<3	2	10	1	11	12	<0.1
DEC 19...	--	--	--	--	--	--	--	--	--	--
FEB 12...	<0.5	<1	<1	<3	1	66	<1	13	23	<0.1
APR 16...	<0.5	<1	<1	<3	<1	150	1	<4	13	<0.1
JUN 19...	--	--	--	--	--	--	--	--	--	--
SEP 24...	0.7	1	<1	<3	1	11	<1	10	11	0.2

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, DIS- SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 03...	<10	4	<1	<1	440	<6	4	14	17	80
DEC 19...	--	--	--	--	--	--	--	10	73	74
FEB 12...	<10	1	<1	<1	480	<6	7	20	133	89
APR 16...	<10	1	<1	<1	120	<6	15	248	13300	37
JUN 19...	--	--	--	--	--	--	--	17	40	83
SEP 24...	<10	3	<1	<1	400	<6	11	16	20	80



## STREAMS TRIBUTARY TO LAKE HURON

04157000 SAGINAW RIVER AT SAGINAW, MI

LOCATION.--Lat 43°24'46", long 83°57'47", in NW1/4 SE1/4 sec.26, T.12 N., R.4 E., Saginaw County, Hydrologic Unit 04080206, on right bank 1,000 ft downstream from bridge on Rust Avenue in Saginaw, 1.9 mi downstream from Tittabawassee River, and 20.3 mi upstream from mouth.

DRAINAGE AREA.--6,060 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--1904, 1908-9, 1912-13, 1916, 1918-19, 1929-30, and 1942 (flood discharge for certain periods only) in WSP 1084; December 1942 to current year (high-water periods only); no high water 1944, 1949, 1953, 1955, 1958, 1961, 1963, 1964, 1966. Gage-height records for flood seasons collected in this vicinity 1910-20, and for entire years since 1921 are contained in reports of National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 565.11 ft, International Great Lakes datum. Prior to Oct. 1, 1972, nonrecording gage at site 1.9 mi downstream at same datum. Auxiliary water-stage recorder on right bank at Essexville.

REMARKS.--No estimated daily discharges. Water-discharge records good. Only daily discharges greater than 10,000 ft<sup>3</sup>/s are published. Considerable diversion through metropolitan area of Saginaw. National Weather Service gage-height telemeter at station.

COOPERATION.--Gage-height record, Dec. 31 to Jan. 11, was provided by National Weather Service.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 68,000 ft<sup>3</sup>/s, Mar. 30, 1904, gage height, 24.9 ft, site then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 29,200 ft<sup>3</sup>/s, Apr. 11; maximum daily gage height, 18.61 ft, Apr. 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	23300	16800		---	21600	24400	12900			
2	---	---	19700	16500			17400	19600	10400			
3	---	---	15200	14200		18500	13700	14900	---			
4	---	---	13800	11600		21800	11700	11900	---			
5	---	---	12200	10000		19700	10100	10000	---			
6	---	18600	---	---		15800	---	---	---			
7	---	23000	---	---		16000	---	---	---			
8	---	25800	---	---		15700	---	---	---			
9	---	23500	---	---		13700	15300	---	---			
10	12400	18800	---	---		12900	24300	---	---			
11	14600	14400	---	---		12300	29200	---	---			
12	19400	13200	---	---		11500	29100	---	---			
13	19900	11400	---	---		10700	26700	---	---			
14	16100	---	---	---		11000	22700	---	---			
15	13400	---	---	---		---	19000	---	---			
16	13200	---	---	---		---	21200	---	---			
17	11900	---	---	---		---	25900	---	---			
18	---	---	---	---		---	26600	---	---			
19	10800	---	---	---		---	21900	---	---			
20	10800	---	---	---		10500	19800	---	---			
21	---	---	---	---		10400	19700	---	---			
22	---	---	---	---		10800	18700	---	---			
23	---	---	---	---		---	16400	---	---			
24	---	---	---	---		10000	14600	---	---			
25	---	---	---	---		12400	13900	---	---			
26	---	---	---	---		11400	12800	---	---			
27	---	---	---	---		10600	11000	12000	---			
28	---	12300	---	---		14900	13200	15500	---			
29	---	21600	---	---		24800	21200	14700	---			
30	---	25100	---	---		28500	25500	12400	---			
31	---	---	17900	---		26300	---	13700	---			

## STREAMS TRIBUTARY TO LAKE HURON

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04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1975-86, 1989 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: November 1974 to September 1981.

WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 6, 1976 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at Rust Ave. bridge. Water-discharge measurements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975, 1977, 1979): Maximum recorded (more than 20 percent missing record), 1,230 microsiemens, Jan. 5, 1977; minimum recorded (more than 20 percent missing record), 224 microsiemens, Mar. 13, 1977.

WATER TEMPERATURES (water years 1975-77, 1979): Maximum, 30.0°C, July 10, 14, 20, 1977; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 17...	1200	12400	574	7.95	12.0	20	9.0	86	1000	1100
FEB 14...	1000	4480	671	8.03	0.0	5.0	15.7	113	80	K38
APR 10...	1030	23900	360	7.92	8.0	34	9.8	85	3500	3900
SEP 05...	1100	2830	752	8.23	21.5	20	8.9	103	510	K33

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARE DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)
OCT 17...	260	74	71	19	16	4.4	222	182	40	40
FEB 14...	290	77	79	22	32	2.7	257	211	47	63
APR 10...	170	36	48	12	13	2.5	163	134	21	24
SEP 05...	240	65	64	20	61	3.1	217	178	45	120

DATE	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 17...	0.1	7.7	367	0.50	12300	0.04	0.03	3.6	3.4	0.04
FEB 14...	0.2	7.1	383	0.52	4630	0.03	0.02	1.6	1.2	0.10
APR 10...	0.2	5.0	236	0.32	15200	0.05	0.02	0.89	0.89	0.09
SEP 05...	0.3	4.1	428	0.58	3270	0.02	0.02	0.55	0.46	0.01

STREAMS TRIBUTARY TO LAKE HURON  
04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
OCT 17...	0.04	1.1	0.10	0.04	0.03	0.01	<10	1	45	<0.5
FEB 14...	0.10	0.6	0.04	0.02	0.03	<0.01	<10	<1	40	<0.5
APR 10...	0.07	1.4	0.22	0.03	0.05	0.01	40	<1	27	<0.5
SEP 05...	0.01	1.2	0.13	0.01	<0.01	<0.01	<10	2	42	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 17...	<1	<1	<3	7	45	2	8	8	<0.1	<10
FEB 14...	1	<1	<3	4	41	<1	7	25	<0.1	<10
APR 10...	<1	<1	<3	4	110	2	<4	16	<0.1	<10
SEP 05...	<1	<1	<3	2	6	<1	10	2	--	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)	
OCT 17...	3	<1	<1	250	<6	12	45	1510	92	
FEB 14...	1	<1	<1	240	<6	7	7	85	88	
APR 10...	2	<1	<1	160	<6	7	176	11400	70	
SEP 05...	1	<1	<1	340	<6	52	58	443	98	

## STREAMS TRIBUTARY TO LAKE HURON

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04159010 PIGEON RIVER NEAR CASEVILLE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 43°56'22", long 83°14'30", in SW1/4 NW1/4 sec.31, T.18 N., R.11 E., Huron County,  
Hydrologic Unit 04080103, on left bank at upstream side of bridge on Kinde Road, 1.5 mi east of  
Caseville, and 3.1 mi upstream from mouth.

DRAINAGE AREA.--125 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Datum of gage 578.43 ft above National Geodetic Vertical Datum of 1929.  
Prior to June 10, 1987, nonrecording gage at same datum.

REMARKS.--Estimated daily discharges: Oct. 5 to Nov. 26, Dec. 24 to Mar. 14, Mar. 18-21, Mar. 26 to  
Apr. 9, and Aug. 12-26. Water-discharge records fair except for estimated daily discharges, which  
are poor. Some diversions at low flows for agricultural irrigation.

AVERAGE DISCHARGE.--5 years, 96.2 ft<sup>3</sup>/s, 10.45 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,260 ft<sup>3</sup>/s, Mar. 28, 1991, gage height, 13.20 ft,  
from floodmark; maximum gage height, 14.75 ft, Mar. 13, 1990, from graph based on gage readings; no flow  
at times most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in September 1986 reached a stage of 18.2 ft, from floodmark,  
and discharge of 2,900 ft<sup>3</sup>/s, from indirect computation of discharge.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,260 ft<sup>3</sup>/s, Mar. 28, gage height, 13.20 ft, from  
floodmark; no flow Aug. 28-30, Sept. 3-25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	54	361	250	29	90	250	430	207	8.1	.06	.07
2	25	48	215	150	28	300	190	245	109	8.0	.37	.10
3	25	43	154	100	31	950	160	163	78	7.4	12	.00
4	99	40	148	80	70	600	134	120	61	8.1	11	.00
5	120	200	173	64	150	400	122	98	50	9.6	12	.00
6	200	1800	159	56	320	600	135	98	42	9.9	8.0	.00
7	170	1300	138	50	260	860	140	114	36	9.9	5.4	.00
8	140	900	126	47	220	450	130	101	33	7.3	4.1	.00
9	90	600	127	45	180	330	480	89	30	5.0	3.4	.00
10	300	400	206	44	150	400	1360	89	28	4.0	2.8	.00
11	1600	300	249	43	125	350	1120	90	27	2.8	3.1	.00
12	1300	250	236	42	100	270	497	82	29	2.8	2.6	.00
13	1000	200	202	41	86	200	283	75	39	7.4	2.0	.00
14	700	170	171	42	72	170	198	73	34	13	1.5	.00
15	450	140	131	44	62	136	279	68	38	11	1.0	.00
16	320	120	104	48	54	122	449	60	256	7.1	4.0	.00
17	360	105	94	54	56	122	522	81	99	4.7	5.0	.00
18	450	95	102	60	60	200	276	85	53	2.9	5.0	.00
19	400	85	136	66	90	370	176	75	39	1.3	7.0	.00
20	350	75	139	71	160	260	184	62	32	.50	9.0	.00
21	280	66	109	76	250	220	372	55	28	1.6	7.0	.00
22	210	60	112	82	280	199	392	51	25	5.3	5.0	.00
23	180	54	139	76	230	192	261	47	23	3.8	4.0	.00
24	150	51	110	64	170	217	187	42	21	5.4	3.0	.00
25	130	48	80	56	120	223	173	42	18	4.5	2.0	.00
26	110	46	64	54	95	400	172	267	15	2.0	1.6	2.1
27	95	83	58	48	80	1000	135	528	14	1.0	.45	3.0
28	85	785	56	40	75	2100	326	369	11	.57	.00	2.2
29	75	1150	150	36	---	1500	1250	255	9.7	.33	.00	1.8
30	66	759	250	31	---	800	948	865	7.8	.66	.00	1.3
31	60	---	697	30	---	400	---	630	---	.71	.02	---
TOTAL	9565	10027	5196	1990	3603	14431	11301	5449	1492.5	156.67	122.40	10.57
MEAN	309	334	168	64.2	129	466	377	176	49.8	5.05	3.95	.35
MAX	1600	1800	697	250	320	2100	1360	865	256	13	12	3.0
MIN	25	40	56	30	28	90	122	42	7.8	.33	.00	.00
CFSM	2.47	2.67	1.34	.51	1.03	3.73	3.02	1.41	.40	.04	.03	.003
IN.	2.85	2.98	1.55	.59	1.07	4.29	3.36	1.62	.44	.05	.04	.00
CAL YR 1990	TOTAL	51459.19	MEAN	141	MAX	2040	MIN	.20	CFSM	1.13	IN	15.31
WTR YR 1991	TOTAL	63344.14	MEAN	174	MAX	2100	MIN	.00	CFSM	1.39	IN	18.85



## STREAMS TRIBUTARY TO LAKE HURON

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: April 1978 to September 1981.

WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1980): Maximum daily recorded (more than 20 percent missing record), 2,000 microsiemens, Oct. 20, 1979; minimum daily recorded (more than 20 percent missing record), 175 microsiemens, Mar. 6, 1979.

WATER TEMPERATURE (water year 1978): Maximum daily recorded (more than 20 percent missing record), 27.5°C, July 7, 1978; minimum daily recorded (more than 20 percent missing record), 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED SATUR-ATION (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
OCT 16...	1500	332	889	8.17	12.5	7.0	7.5	72	230	720
FEB 13...	1100	87.0	789	7.84	0.0	1.8	11.5	81	200	K150
APR 09...	1400	673	--	7.74	7.5	210	9.2	--	610	K89000
SEP 04...	1300	0.01	758	7.97	18.0	2.0	5.8	63	920	380

DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD HCO3 (00453)	ALKA-LINITY WAT DIS TOT IT FIELD CACO3 (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
OCT 16...	450	160	130	31	11	4.9	358	294	77	47
FEB 13...	420	140	120	29	12	3.3	335	275	61	43
APR 09...	250	--	71	18	7.7	3.8	--	--	42	26
SEP 04...	360	150	93	31	24	5.3	262	215	140	51

DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)
OCT 16...	0.1	8.5	591	0.80	530	0.04	0.04	11.0	11.0	<0.01
FEB 13...	0.2	6.2	479	0.65	113	0.04	0.03	5.7	5.6	0.04
APR 09...	0.2	4.6	320	0.44	581	0.14	0.04	6.6	5.1	0.25
SEP 04...	0.3	1.8	464	0.63	0.01	<0.01	<0.01	--	0.38	0.05

## STREAMS TRIBUTARY TO LAKE HURON

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)
OCT 16...	0.02	1.5	0.09	0.07	0.05	0.04	<10	<1	49	<0.5
FEB 13...	0.04	0.9	0.05	0.04	0.03	0.03	<10	<1	40	<0.5
APR 09...	0.17	1.9	0.53	0.19	0.37	0.17	60	<1	23	<0.5
SEP 04...	0.04	1.6	0.18	0.12	0.06	0.07	<10	2	41	<0.5
DATE	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 16...	<1	<1	<3	5	16	<1	11	6	<0.1	<10
FEB 13...	<1	<1	<3	1	13	<1	7	18	<0.1	<10
APR 09...	<1	<1	<3	4	55	<1	4	12	0.3	<10
SEP 04...	<1	<1	<3	2	19	<1	11	130	0.1	<10
DATE	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. & FINER THAN .062 MM (70331)	
OCT 16...	4	1	<1	260	<6	10	8	7.2	97	
FEB 13...	1	<1	<1	250	<6	9	68	16	61	
APR 09...	2	<1	<1	150	<6	<3	295	536	96	
SEP 04...	2	<1	<1	470	<6	38	24	0.01	31	

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

04159130 ST. CLAIR RIVER AT PORT HURON, MI  
(National stream quality accounting network station)

LOCATION.--Lat 42°59'19", long 82°25'29", in SE1/4 sec.3, T.6 N., R.17 E., St. Clair County, Hydrologic Unit 04090001, at Port Huron municipal water-treatment plant in Port Huron.

DRAINAGE AREA.--222,400 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--Water years 1970-73, 1978 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: April 1978 to September 1981.

WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly samples were collected near the Port Huron municipal water-treatment plant.

COOPERATION.--Discharges are provisional daily means provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 260 microsiemens, Dec. 18, 1980; minimum daily, 194 microsiemens, Jan. 27, 28, 1980.

WATER TEMPERATURE (water years 1979-81): Maximum daily, 24.0°C, Aug. 14-16, 1980; minimum daily, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 164 microsiemens was measured July 3, 1972.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND (00060)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, KF AGAR (COLS. PER 100 ML) (31673)
NOV 15...	1130	177000	209	8.4	8.0	0.6	11.8	101	<1	K1
DEC 11...	1230	179000	209	8.3	4.5	1.7	12.9	102	K2	K2
APR 24...	1210	186000	219	8.3	5.5	2.0	12.7	103	<1	K2
MAY 29...	1120	191000	213	8.4	13.5	4.6	11.3	110	K14	36
JUN 18...	1215	194000	215	8.4	19.0	0.7	10.2	112	<1	K6
SEP 10...	1245	192000	206	8.4	20.5	0.6	8.8	100	K1	28
DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD HCO3 (MG/L AS) (00453)	CAR-BONATE WATER DIS IT FIELD CO3 (MG/L AS) (00452)	ALKA-LINITY WAT IT TOT IT FIELD CACO3 (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
NOV 15...	100	17	28	7.4	3.6	0.8	98	2	84	18
DEC 11...	97	18	27	7.2	3.5	2.0	97	--	79	18
APR 24...	110	23	30	7.6	3.6	1.0	102	--	84	16
MAY 29...	100	16	29	7.5	3.8	1.0	104	1	87	17
JUN 18...	100	20	29	7.4	3.8	0.9	99	1	82	13
SEP 10...	110	24	30	7.6	3.7	1.0	98	1	82	18
DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
NOV 15...	7.0	<0.1	1.2	114	0.16	54500	<0.01	<0.01	0.30	0.30
DEC 11...	6.9	<0.1	1.3	108	0.15	52200	0.02	<0.01	0.30	0.30
APR 24...	7.4	0.1	1.0	118	0.16	59300	<0.01	<0.01	0.46	0.46
MAY 29...	7.2	0.2	0.58	119	0.16	61400	<0.01	<0.01	0.39	0.36
JUN 18...	7.1	0.1	0.6	116	0.16	60800	<0.01	<0.01	0.31	0.33
SEP 10...	7.5	0.1	1.1	114	0.16	59100	<0.01	<0.01	0.27	0.24

STREAMS TRIBUTARY TO ST. CLAIR RIVER  
04159130 ST. CLAIR RIVER AT PORT HURON, MI

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WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)
NOV 15...	0.02	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	<10	<1
DEC 11...	0.02	0.02	0.3	<0.01	<0.01	<0.01	<0.01	--	--
APR 24...	<0.01	<0.01	0.4	0.02	<0.01	0.01	<0.01	<10	<1
MAY 29...	<0.01	0.02	0.5	0.03	<0.01	<0.01	<0.01	<10	<1
JUN 18...	<0.01	<0.01	<0.2	<0.01	<0.01	<0.01	<0.01	--	--
SEP 10...	0.01	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	10	<1

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)
NOV 15...	16	<0.5	<1	<1	<3	1	6	<1	<4
DEC 11...	--	--	--	--	--	--	--	--	--
APR 24...	15	<0.5	<1	<1	<3	1	6	<1	<4
MAY 29...	15	<0.5	<1	2	<3	1	5	1	<4
JUN 18...	--	--	--	--	--	--	--	--	--
SEP 10...	15	<0.5	<1	<1	<3	1	<3	<1	<4

DATE	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV 15...	<1	<0.1	<10	1	<1	<1	97	<6	23
DEC 11...	--	--	--	--	--	--	--	--	--
APR 24...	<1	<0.1	<10	1	<1	<1	99	<6	<3
MAY 29...	<1	<0.1	<10	<1	<1	<1	100	<6	8
JUN 18...	--	--	--	--	--	--	--	--	--
SEP 10...	<1	<0.1	<10	1	<1	<1	100	<6	17



## STREAMS TRIBUTARY TO ST. CLAIR RIVER

04159500 BLACK RIVER NEAR FARGO, MI

LOCATION.--Lat 43°05'32", long 82°37'05", in NW1/4 sec.32, T.8 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, on left bank 20 ft downstream from bridge on Norman Road, 2.1 mi east of Fargo, 5.3 mi upstream from Mill Creek, and 12 mi northwest of Port Huron.

DRAINAGE AREA.--480 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1944 to current year.

REVISED RECORDS.--WSP 1307: 1950(M). WSP 1627: 1956-58. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 613.75 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 25-29, Jan. 4 to Mar. 20, May 30 to July 9, and July 14 to Sept. 30. Records good except for estimated daily discharges, Dec. 25-29 and Jan. 4 to Mar. 20, which are fair, and estimated daily discharges, May 30 to July 9 and July 14 to Sept. 30, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 298 ft<sup>3</sup>/s, 8.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,400 ft<sup>3</sup>/s, Apr. 5, 1947, gage height, 16.06 ft, from floodmark, from rating curve extended above 9,500 ft<sup>3</sup>/s; maximum gage height observed, 18.05 ft, Feb. 20, 1951, backwater from ice; minimum discharge observed, 1.8 ft<sup>3</sup>/s, Sept. 18, 19, 1946.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 6	2000	4,520	10.92	Apr. 10	1000	4,280	10.64
Dec. 30	2100	5,630	12.03	May 27	0700	*6,910	*13.11
Mar. 28	2300	6,550	12.87				

Minimum daily discharge, 15 ft<sup>3</sup>/s, Aug. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	85	510	3070	160	300	652	466	2600	40	30	20
2	21	83	382	1920	150	800	539	349	1500	40	27	25
3	19	83	314	1250	180	1800	432	282	600	45	30	33
4	24	85	344	700	250	1600	357	237	250	60	32	40
5	30	307	510	560	600	1200	339	207	130	62	30	30
6	51	3640	503	400	1800	1400	400	208	110	54	28	25
7	58	3230	443	340	1500	2500	435	258	95	50	26	20
8	49	1340	369	300	1100	1600	394	242	86	56	24	20
9	76	761	334	260	960	1100	2330	215	78	60	34	20
10	552	555	599	230	830	1000	4090	209	75	59	37	20
11	2500	430	887	210	550	900	2070	204	85	47	31	19
12	2380	344	661	200	400	750	958	184	100	40	28	21
13	985	282	658	200	330	580	631	166	95	42	26	24
14	576	232	605	210	300	480	478	179	86	39	24	24
15	404	202	387	220	270	460	658	189	150	38	24	23
16	359	185	316	230	260	430	2920	164	350	37	26	19
17	328	177	306	320	250	420	1340	140	250	36	30	18
18	642	162	396	370	240	580	704	140	150	35	35	18
19	700	149	575	520	360	1000	499	135	120	33	37	18
20	448	141	438	700	1000	910	799	113	94	32	40	18
21	313	133	317	900	1300	627	2600	100	80	30	34	17
22	245	134	417	750	1400	556	1990	93	72	29	29	17
23	220	157	646	500	900	496	1120	89	69	32	25	17
24	186	178	496	380	650	673	716	89	66	25	22	18
25	160	176	310	320	540	613	596	92	60	23	21	20
26	136	158	270	250	430	471	460	2880	54	22	20	20
27	119	186	250	210	370	688	370	6000	51	21	18	19
28	110	951	230	200	330	5220	413	1980	47	22	18	18
29	104	1670	900	180	---	4470	1180	2070	43	23	17	16
30	94	865	4360	170	---	1540	665	2230	41	29	16	17
31	88	---	3720	160	---	898	---	2400	---	34	15	---
TOTAL	11999	17081	21453	16230	17410	36062	31135	22310	7587	1195	834	634
MEAN	387	569	692	524	622	1163	1038	720	253	38.5	26.9	21.1
MAX	2500	3640	4360	3070	1800	5220	4090	6000	2600	62	40	40
MIN	19	83	230	160	150	300	339	89	41	21	15	16
CFSM	.81	1.19	1.44	1.09	1.30	2.42	2.16	1.50	.53	.08	.06	.04
IN.	.93	1.32	1.66	1.26	1.35	2.79	2.41	1.73	.59	.09	.06	.05
CAL YR 1990	TOTAL	126314	MEAN	346	MAX	4360	MIN	19	CFSM	.72	IN	9.79
WTR YR 1991	TOTAL	183930	MEAN	504	MAX	6000	MIN	15	CFSM	1.05	IN	14.25

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

195

04159900 MILL CREEK NEAR AVOCA, MI

LOCATION.--Lat 43°03'16", long 82°44'05", in NW1/4 sec.8, T.7 N., R.15 E., St. Clair County, Hydrologic Unit 04090001, on left bank at downstream side of bridge on Bricker Road, 0.2 mi upstream from Gleason Drain, and 2.3 mi west of Avoca.

DRAINAGE AREA.--169 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1963 to September 1975, October 1975 to September 1979 (operated as a crest-stage partial-record station), October 1987 to current year. Also operated as a low-flow partial-record station in water year 1979.

GAGE.--Water-stage recorder. Datum of gage is 711.31 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 25 to Mar. 2 and Mar. 31 to Apr. 30. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--16 years (water years 1964-75, 1988-91), 93.9 ft<sup>3</sup>/s, 7.55 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,570 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 8.87 ft; minimum, 0.8 ft<sup>3</sup>/s, Aug. 9, 10, 11, 1964; minimum gage height, 0.56 ft, July 28, 1965.

EXTREMES FOR CURRENT YEAR.-- Peak discharges greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	2300	*902	*5.82	No other peak greater than base discharge.			
Minimum discharge, 2.8 ft <sup>3</sup> /s, Sept. 12, gage height, 0.75 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.1	29	180	500	53	100	250	132	160	15	10	5.2
2	8.6	28	146	350	52	200	200	117	210	16	8.7	6.1
3	8.4	26	128	210	52	575	170	106	154	16	13	5.8
4	11	25	152	190	75	410	160	95	107	20	14	5.6
5	12	104	170	160	300	344	150	88	81	20	13	5.6
6	14	474	160	140	600	512	130	92	63	18	8.7	5.2
7	15	523	143	110	450	748	140	98	50	17	7.1	4.7
8	14	342	123	96	380	542	190	89	41	26	7.1	4.4
9	25	245	119	88	340	375	300	82	35	23	7.3	4.1
10	71	198	174	80	280	328	660	81	30	19	6.5	3.8
11	227	164	199	74	200	283	450	76	33	16	6.2	3.5
12	246	132	169	70	140	232	250	68	33	13	6.0	3.5
13	183	108	162	69	110	186	170	61	35	28	5.5	4.5
14	142	91	140	70	100	159	200	56	33	29	6.0	4.7
15	120	81	112	72	95	143	350	51	26	22	5.3	4.7
16	104	74	104	80	90	133	580	46	39	16	5.9	5.1
17	94	68	104	100	86	127	400	42	47	13	12	4.6
18	97	62	144	150	84	171	270	39	41	11	11	4.1
19	96	57	176	190	130	287	230	36	33	11	11	4.2
20	87	53	152	240	350	249	280	34	27	9.6	9.5	4.2
21	76	49	132	320	460	199	750	32	22	9.5	8.2	4.5
22	65	53	174	270	430	173	600	29	22	9.8	7.7	4.9
23	59	56	209	190	350	163	500	26	22	10	7.2	4.9
24	53	55	168	140	200	176	520	25	22	10	6.5	4.8
25	45	53	110	110	150	173	650	31	20	9.2	5.9	4.9
26	40	49	96	90	130	152	400	522	18	8.2	5.7	5.7
27	37	64	86	80	120	202	290	631	17	7.6	5.4	5.8
28	34	226	82	72	110	813	200	392	16	7.2	5.6	6.0
29	33	346	100	64	---	784	160	263	15	8.1	5.2	5.5
30	32	254	700	59	---	502	150	266	15	11	5.0	5.9
31	30	---	660	56	---	360	---	190	---	11	4.8	---
TOTAL	2088.1	4089	5474	4490	5917	9801	9750	3896	1467	460.2	241.0	146.5
MEAN	67.4	136	177	145	211	316	325	126	48.9	14.8	7.77	4.88
MAX	246	523	700	500	600	813	750	631	210	29	14	6.1
MIN	8.4	25	82	56	52	100	130	25	15	7.2	4.8	3.5
CFSM	.40	.81	1.05	.86	1.25	1.87	1.92	.75	.29	.09	.05	.03
IN.	.46	.90	1.20	.99	1.30	2.16	2.15	.86	.32	.10	.05	.03

CAL YR 1990	TOTAL	39854.4	MEAN	109	MAX	962	MIN	3.6	CFSM	.65	IN	8.77
WTR YR 1991	TOTAL	47819.8	MEAN	131	MAX	813	MIN	3.5	CFSM	.78	IN	10.53

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

04160570 NORTH BRANCH BELLE RIVER AT IMLAY CITY, MI

LOCATION.--Lat 43°01'49", long 83°04'02", in SW1/4 NW1/4 sec.16, T.7 N., R.12 E., Lapeer County, Hydrologic Unit 04090001, on left bank 12 ft upstream from bridge on State Highway 21, 0.6 mi northeast of Imlay City.

DRAINAGE AREA.--18.0 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1965 to current year.

GAGE.--Water-stage recorder. Concrete control Aug. 20, 1965, to Nov. 2, 1981. Datum of gage is 789.69 ft above National Geodetic Vertical Datum of 1929 (levels by Boldt, McLeod, and Johnson, Inc.). Prior to Feb. 24, 1985, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 6-14, Dec. 23-28, Dec. 31 to Feb. 3, Feb. 8-18, Feb. 25 to Mar. 1, and Sept. 4-30. Records fair except for estimated daily discharges, which are poor. Some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 12.1 ft<sup>3</sup>/s, 9.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 354 ft<sup>3</sup>/s, June 12, 1986, gage height, 6.66 ft, from rating curve extended above 100 ft<sup>3</sup>/s; maximum gage height, 9.33 ft, Apr. 19, 1975, datum then in use; no flow part of each day June 27, 28, 1977, June 26-28, 1979, June 30, 1988, caused by irrigation pumpage.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 190 ft<sup>3</sup>/s, Mar. 28, gage height, 4.92 ft; minimum daily, 0.65 ft<sup>3</sup>/s, Sept. 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.7	5.8	15	27	4.6	10	26	13	44	2.6	2.1	1.3
2	1.4	5.8	12	21	5.0	46	24	12	19	2.6	2.0	1.1
3	1.2	5.3	12	18	7.0	53	21	10	11	3.1	3.6	1.2
4	15	5.9	23	14	27	29	19	9.6	7.6	6.1	2.9	1.6
5	9.6	78	19	12	45	26	18	10	5.6	4.0	2.4	1.3
6	5.6	120	15	10	36	53	16	19	4.8	3.0	2.3	1.2
7	3.8	95	13	8.5	29	43	14	14	4.3	3.3	2.1	1.2
8	3.3	60	11	7.5	23	26	15	12	3.9	5.3	2.7	1.2
9	38	32	14	7.0	20	24	39	12	3.6	3.3	3.5	1.2
10	104	25	29	6.5	16	23	62	11	4.3	2.7	3.0	1.4
11	108	17	21	6.2	12	20	31	9.8	9.1	2.6	3.1	1.6
12	74	13	16	6.1	9.5	16	24	11	8.2	2.5	2.2	1.1
13	47	11	15	6.2	8.5	13	20	15	5.2	3.2	2.4	1.1
14	28	9.6	9.9	6.6	8.0	12	17	9.5	4.7	2.6	2.4	1.2
15	22	9.2	9.3	7.0	7.8	12	74	8.0	7.8	2.3	2.3	1.1
16	17	9.4	12	9.5	7.4	11	46	7.5	23	2.2	2.3	.86
17	25	9.1	12	12	7.2	11	28	7.3	8.8	2.2	2.8	.90
18	28	7.1	30	16	8.2	28	23	6.5	6.5	2.1	3.3	.82
19	22	6.7	20	20	45	25	20	6.2	5.4	1.9	6.8	.70
20	16	6.3	13	27	42	22	52	5.5	4.5	1.8	4.3	.80
21	12	6.0	14	22	34	18	79	5.2	3.9	1.9	3.3	.72
22	10	7.9	26	18	34	17	50	4.8	4.3	2.3	3.2	.66
23	9.4	7.9	17	14	24	19	33	4.8	4.7	2.4	2.8	.88
24	8.3	6.8	15	9.5	18	21	35	4.8	3.9	1.9	2.6	1.0
25	7.4	6.0	13	8.5	13	19	27	6.0	3.8	1.7	2.0	1.1
26	6.8	5.5	10	7.0	11	15	25	40	3.6	1.6	1.9	1.0
27	6.4	18	9.0	6.5	9.8	47	19	23	3.4	1.6	1.6	.85
28	6.2	77	8.7	5.9	9.5	117	17	12	3.1	1.3	1.6	.70
29	5.9	45	56	5.5	---	50	18	26	2.8	2.2	1.5	.65
30	6.1	23	98	5.2	---	35	15	14	2.5	3.5	1.6	.70
31	5.8	---	40	4.8	---	28	---	17	---	2.5	1.7	---
TOTAL	654.9	734.3	627.9	355.0	521.5	889	907	366.5	227.3	82.3	82.3	31.14
MEAN	21.1	24.5	20.3	11.5	18.6	28.7	30.2	11.8	7.58	2.65	2.65	1.04
MAX	108	120	98	27	45	117	79	40	44	6.1	6.8	1.6
MIN	1.2	5.3	8.7	4.8	4.6	10	14	4.8	2.5	1.3	1.5	.65
CFSM	1.17	1.36	1.13	.64	1.03	1.59	1.68	.66	.42	.15	.15	.06
IN.	1.35	1.52	1.30	.73	1.08	1.84	1.87	.76	.47	.17	.17	.06
CAL YR 1990	TOTAL	6199.95	MEAN	17.0	MAX	120	MIN	.68	CFSM	.94	IN	12.81
WTR YR 1991	TOTAL	5479.14	MEAN	15.0	MAX	120	MIN	.65	CFSM	.83	IN	11.32

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

197

04160600 BELLE RIVER AT MEMPHIS, MI

LOCATION.--Lat 42°54'03", long 82°46'09", in NW1/4 SE1/4 sec.35, T.6 N., R.14 E., St. Clair County, Hydrologic Unit 04090001, on right downstream side of bridge on State Highway 19 at Memphis.

DRAINAGE AREA.--151 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1962 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 705.41 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation bench mark).

REMARKS.--Estimated daily discharges: Dec. 25-31, Jan. 3 to Feb. 23, and Feb. 27, 28. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 91.5 ft<sup>3</sup>/s, 8.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,520 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 8.96 ft; minimum, 2.3 ft<sup>3</sup>/s, Sept. 6, 10, 1978; minimum gage height, 1.17 ft, Sept. 6, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1947 reached a stage of about 9 ft, from information by local residents.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 6	2100	788	5.21	Mar. 28	2300	800	5.25
Dec. 30	2200	959	5.74	Apr. 21	2300	635	4.71
Mar. 7	1400	620	4.66	May 27	0700	*1,000	*5.86

Minimum daily discharge, 6.3 ft<sup>3</sup>/s, Aug. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	23	121	468	42	81	170	117	432	17	13	8.3
2	12	22	94	320	41	211	141	98	311	17	11	8.2
3	12	21	81	170	40	496	119	87	133	17	12	8.2
4	13	23	124	140	60	361	102	78	84	19	14	13
5	26	179	189	120	200	239	98	74	61	28	13	9.8
6	28	662	152	100	500	338	99	85	49	24	12	8.6
7	22	614	123	90	420	558	96	106	42	22	11	8.4
8	19	326	102	78	290	351	87	94	38	22	10	8.5
9	25	198	97	67	270	231	163	85	35	26	11	8.6
10	125	140	179	62	260	226	495	86	32	22	14	8.4
11	387	107	203	55	150	194	391	83	34	19	11	8.3
12	365	86	152	54	100	158	212	85	44	17	9.5	8.3
13	182	72	135	54	86	126	146	133	46	18	9.2	10
14	104	63	110	54	78	109	119	102	39	21	8.1	9.6
15	72	57	82	55	75	99	209	75	36	19	8.2	10
16	58	54	78	62	70	94	482	63	128	17	8.8	7.8
17	49	51	83	80	66	91	360	58	155	16	9.8	7.3
18	69	49	122	110	64	111	223	55	81	16	11	7.7
19	76	46	168	150	100	186	163	52	56	14	15	7.5
20	57	43	124	180	220	162	167	49	44	13	17	7.5
21	46	41	97	240	350	132	479	46	36	13	16	7.2
22	39	41	150	210	370	119	561	42	32	12	12	7.5
23	37	45	187	140	290	113	365	37	31	14	11	7.5
24	34	46	132	100	192	125	345	35	30	13	10	7.3
25	30	46	85	90	139	127	497	40	27	9.9	9.1	8.4
26	28	44	74	70	116	110	287	503	24	10	8.3	8.8
27	26	42	68	60	95	105	191	851	23	9.4	8.3	8.2
28	24	124	65	55	90	518	154	446	21	9.5	7.6	7.6
29	23	279	80	50	---	609	149	255	19	9.3	6.9	6.8
30	22	192	400	47	---	338	138	207	18	11	6.6	7.1
31	22	---	770	44	---	225	---	151	---	15	6.3	---
TOTAL	2044	3736	4627	3575	4774	6943	7208	4278	2141	510.1	330.7	250.4
MEAN	65.9	125	149	115	171	224	240	138	71.4	16.5	10.7	8.35
MAX	387	662	770	468	500	609	561	851	432	28	17	13
MIN	12	21	65	44	40	81	87	35	18	9.3	6.3	6.8
CFSM	.44	.83	.99	.76	1.13	1.48	1.59	.91	.47	.11	.07	.06
IN.	.50	.92	1.14	.88	1.18	1.71	1.78	1.05	.53	.13	.08	.06

CAL YR 1990	TOTAL	41733.0	MEAN	114	MAX	978	MIN	8.2	CFSM	.76	IN	10.28
WTR YR 1991	TOTAL	40417.2	MEAN	111	MAX	851	MIN	6.3	CFSM	.74	IN	9.96



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04160800 SASHABAW CREEK NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°43'12", long 83°21'13", in SE1/4 sec.26, T.4 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of culverts on Maybee Road, 1.1 mi upstream from mouth, and 2.5 mi northeast of Drayton Plains.

DRAINAGE AREA.--20.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 30, 1961, to Mar. 6, 1968. Elevation of gage is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 20 to Jan. 31 and Feb. 11, 12, 15-17, 23, 27. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 13.0 ft<sup>3</sup>/s, 8.45 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 181 ft<sup>3</sup>/s, Oct. 1, 1981, gage height, 4.53 ft; minimum, 0.03 ft<sup>3</sup>/s, July 9, 16, 1988; minimum gage height, 1.59 ft, Aug. 1, 2, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 55 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	2300	*68	*3.50	Dec. 30	unknown	56	unknown
Nov. 6	0200	66	3.47				

Minimum discharge, 0.28 ft<sup>3</sup>/s, Sept. 20, gage height, 1.82 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.8	10	22	31	13	15	21	22	18	2.7	3.0	1.0
2	3.5	10	19	29	13	28	19	21	18	2.7	2.8	.79
3	3.3	9.8	19	27	13	33	18	20	17	2.8	3.9	.73
4	11	10	24	25	15	27	17	19	15	4.1	4.1	1.3
5	9.2	35	22	24	22	26	18	21	14	4.3	3.5	1.1
6	6.8	54	21	23	23	29	17	33	13	3.6	3.0	.97
7	6.3	41	20	22	23	31	16	28	12	5.2	2.7	.85
8	7.6	35	19	21	22	26	16	24	12	7.7	3.3	.75
9	29	30	19	20	22	25	24	23	11	5.9	5.1	.73
10	54	26	20	19	20	24	42	22	10	4.6	3.9	.76
11	58	22	20	21	17	23	33	21	12	3.7	3.0	.67
12	43	20	20	20	16	25	28	21	14	3.0	2.4	.58
13	35	18	21	20	13	24	24	27	12	3.6	2.0	.59
14	29	18	18	19	13	21	23	22	11	3.4	1.7	.62
15	26	18	18	19	13	19	34	20	9.6	2.7	1.6	.56
16	23	19	18	20	12	18	38	18	10	2.3	2.3	.45
17	20	20	18	21	11	18	33	18	9.5	2.0	2.5	.40
18	22	18	21	22	12	21	29	16	8.3	1.7	4.5	.40
19	21	18	20	23	19	21	27	15	7.4	1.4	7.2	.33
20	19	17	19	22	25	21	43	14	6.7	1.4	6.7	.32
21	18	16	17	21	27	21	47	13	6.1	1.6	4.7	.32
22	17	18	21	19	30	20	42	12	6.3	3.0	3.7	.35
23	17	18	20	18	26	22	35	12	7.5	5.5	3.2	.49
24	16	17	18	16	22	23	34	12	6.1	4.1	2.5	.80
25	15	16	16	15	19	22	31	13	5.4	5.6	2.2	.59
26	14	15	15	15	17	20	28	26	4.7	4.7	2.0	.60
27	14	19	14	14	15	21	26	21	3.8	4.5	1.9	.51
28	13	31	15	14	14	31	25	18	3.4	4.0	1.8	.46
29	12	27	30	13	---	31	24	17	3.1	4.4	1.6	.46
30	11	24	48	13	---	26	23	16	2.9	5.6	1.3	.49
31	11	---	40	13	---	23	---	22	---	3.7	1.3	---
TOTAL	588.5	649.8	652	619	507	735	835	607	289.8	115.5	95.4	18.97
MEAN	19.0	21.7	21.0	20.0	18.1	23.7	27.8	19.6	9.66	3.73	3.08	.63
MAX	58	54	48	31	30	33	47	33	18	7.7	7.2	1.3
MIN	3.3	9.8	14	13	11	15	16	12	2.9	1.4	1.3	.32
CFSM	.91	1.04	1.01	.96	.87	1.13	1.33	.94	.46	.18	.15	.03
IN.	1.05	1.16	1.16	1.10	.90	1.31	1.49	1.08	.52	.21	.17	.03
CAL YR 1990	TOTAL	7291.41	MEAN	20.0	MAX	71	MIN	.83	CFSM	.96	IN	12.98
WTR YR 1991	TOTAL	5712.97	MEAN	15.7	MAX	58	MIN	.32	CFSM	.75	IN	10.17

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

199

04160900 CLINTON RIVER NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°39'37", long 83°23'25", in NE1/4 sec.21, T.3 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on State Highway 59, 1.0 mi downstream from State fish hatchery, and 2.0 mi south of Drayton Plains.

DRAINAGE AREA.--79.2 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 940 ft above National Geodetic Vertical Datum of 1929, from topographic map. Jan. 29 to July 9, 1964, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Some regulation and occasional diversion for lake-level control at many lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 51.5 ft<sup>3</sup>/s, 8.83 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 276 ft<sup>3</sup>/s, Mar. 12, 1974, gage height, 4.95 ft; minimum, 2.4 ft<sup>3</sup>/s, May 31, 1961; minimum gage height, 1.23 ft, Jan. 4, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 159 ft<sup>3</sup>/s, Nov. 8, gage height, 4.04 ft; minimum, 6.3 ft<sup>3</sup>/s, Sept. 30, gage height, 2.06 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	12	86	100	55	72	61	101	99	14	9.7	9.2
2	25	12	85	101	53	78	60	100	93	14	9.5	8.7
3	25	14	91	102	51	81	60	69	89	12	13	8.2
4	35	20	89	101	52	82	60	41	84	12	9.5	8.0
5	47	64	87	99	55	82	52	56	60	12	9.5	7.6
6	52	113	85	98	57	84	39	56	40	11	9.4	7.6
7	55	148	83	96	59	84	25	69	38	14	9.5	7.5
8	76	158	81	94	60	85	24	86	37	14	11	7.6
9	111	153	80	91	62	86	12	85	35	13	12	7.6
10	128	136	79	89	62	86	83	84	35	13	15	7.7
11	128	117	80	89	62	84	89	82	36	11	14	7.5
12	130	106	81	89	61	84	90	81	28	12	14	7.3
13	133	97	81	88	61	83	90	80	16	12	15	7.3
14	134	89	81	85	63	83	90	78	15	11	14	7.2
15	133	83	81	84	64	75	95	76	16	13	15	7.1
16	131	80	80	85	64	72	98	73	16	13	15	7.0
17	128	81	79	85	63	68	100	75	19	10	16	7.3
18	129	81	80	84	64	68	102	71	19	9.2	16	6.9
19	125	79	78	83	70	69	98	68	21	8.4	40	7.6
20	118	78	77	83	68	71	108	65	19	8.3	90	8.2
21	110	73	76	83	69	71	108	48	19	8.6	63	8.1
22	103	79	75	82	70	71	107	33	20	11	20	7.9
23	97	84	76	80	70	70	107	33	20	9.6	20	9.6
24	90	80	76	79	73	70	110	35	18	11	20	11
25	84	79	80	78	73	69	109	37	18	12	20	10
26	79	81	78	75	73	68	108	75	18	11	20	11
27	73	83	77	73	72	67	109	101	17	14	20	8.7
28	68	88	72	71	72	63	109	103	16	15	20	6.6
29	61	86	87	68	---	60	108	104	14	12	17	6.6
30	35	86	91	62	---	60	103	104	15	9.3	9.5	6.5
31	13	---	96	57	---	61	---	104	---	10	9.5	---
TOTAL	2681	2540	2528	2634	1778	2307	2514	2273	990	360.4	596.1	239.1
MEAN	86.5	84.7	81.5	85.0	63.5	74.4	83.8	73.3	33.0	11.6	19.2	7.97
MAX	134	158	96	102	73	86	110	104	99	15	90	11
MIN	13	12	72	57	51	60	12	33	14	8.3	9.4	6.5
CFSM	1.09	1.07	1.03	1.07	.80	.94	1.06	.93	.42	.15	.24	.10
IN.	1.26	1.19	1.19	1.24	.84	1.08	1.18	1.07	.46	.17	.28	.11
CAL YR 1990	TOTAL	26585.0	MEAN	72.8	MAX	158	MIN	11	CFSM	.92	IN	12.49
WTR YR 1991	TOTAL	21440.6	MEAN	58.7	MAX	158	MIN	6.5	CFSM	.74	IN	10.07

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161100 GALLOWAY CREEK NEAR AUBURN HEIGHTS, MI

LOCATION.--Lat 42°40'02", long 83°12'02", in SE1/4 sec.18, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank 12 ft downstream from wooden bridge on Oakland University property, 2.7 mi northeast of Auburn Heights.

DRAINAGE AREA.--17.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1959 to September 1991 (discontinued).

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Concrete control Aug. 20, 1960 to Aug. 25, 1991. Datum of gage is 820.78 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Oct. 4-8, 13-31, Jan. 9-13, Jan. 24 to Feb. 6, and Aug. 25 to Sept. 30. Records fair except for estimated daily discharges, Oct. 4-8, 13-31, and Aug. 25 to Sept. 30, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 11.2 ft<sup>3</sup>/s, 8.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 536 ft<sup>3</sup>/s, Aug. 24, 1985, gage height, 5.62 ft; maximum gage height, 6.27 ft, June 25, 1968; minimum discharge, 0.01 ft<sup>3</sup>/s, on many days during July and August, 1964; minimum gage height, 0.82 ft, Aug. 1, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 147 ft<sup>3</sup>/s, May 26; minimum daily, 1.2 ft<sup>3</sup>/s, Feb. 17, May 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.2	4.3	13	32	6.8	7.6	18	14	22	3.4	6.2	7.0
2	2.6	4.3	11	25	8.2	43	16	11	23	5.1	4.1	4.7
3	2.1	4.3	22	19	11	56	13	8.4	19	4.0	23	6.0
4	10	5.2	33	15	15	36	12	7.2	14	7.4	9.3	11
5	5.2	89	21	14	20	29	22	14	11	9.9	5.1	9.0
6	3.8	90	17	13	25	35	17	34	8.7	3.3	3.6	5.6
7	3.4	47	14	12	24	34	14	21	7.0	16	3.0	4.0
8	7.5	29	13	11	21	26	9.5	14	6.1	27	17	3.4
9	66	21	15	10	22	25	26	17	5.1	7.9	23	3.0
10	111	17	17	9.6	21	23	31	13	5.1	4.1	8.4	2.7
11	78	14	15	9.6	17	21	19	9.9	14	3.1	4.8	2.4
12	50	12	14	9.6	7.5	19	13	11	17	2.6	3.5	2.4
13	18	11	14	9.7	3.4	18	10	16	15	3.7	3.0	2.3
14	12	9.8	12	14	3.5	17	13	9.8	14	2.9	2.7	2.3
15	11	9.3	12	19	1.9	16	40	6.5	14	2.5	4.0	2.3
16	10	9.1	13	34	1.3	15	37	4.6	19	2.2	4.7	2.3
17	9.0	9.4	12	41	1.2	15	22	23	11	2.1	8.4	2.2
18	20	8.5	17	34	3.0	24	17	11	9.6	2.0	11	2.2
19	43	8.4	15	33	36	21	16	4.9	8.5	2.0	51	2.2
20	22	7.8	12	40	41	19	52	2.9	7.4	2.0	31	2.2
21	9.0	7.7	15	33	30	18	53	2.0	6.1	3.0	10	2.3
22	7.0	13	19	19	31	18	36	1.5	14	32	5.3	2.6
23	7.5	12	17	14	21	21	26	1.2	14	47	4.0	3.0
24	6.0	10	14	11	17	23	31	2.4	8.3	20	3.5	3.3
25	5.5	9.1	13	7.4	13	20	23	11	6.3	8.1	3.3	4.0
26	5.0	8.3	13	6.2	9.8	18	18	147	5.3	4.7	3.2	3.8
27	4.8	18	18	6.1	6.6	18	16	85	4.5	3.6	3.1	3.3
28	4.6	30	11	6.0	6.1	33	21	46	4.0	3.0	3.1	2.8
29	4.4	21	93	6.0	---	30	16	32	3.9	12	3.0	2.5
30	4.3	15	104	6.0	---	24	14	26	3.7	29	6.0	2.8
31	4.3	---	53	6.0	---	20	---	33	---	11	13	---
TOTAL	550.2	554.5	682	525.2	424.3	742.6	671.5	640.3	320.6	286.6	284.3	109.6
MEAN	17.7	18.5	22.0	16.9	15.2	24.0	22.4	20.7	10.7	9.25	9.17	3.65
MAX	111	90	104	41	41	56	53	147	23	47	51	11
MIN	2.1	4.3	11	6.0	1.2	7.6	9.5	1.2	3.7	2.0	2.7	2.2
CFSM	.99	1.03	1.23	.94	.85	1.34	1.25	1.16	.60	.52	.51	.20
IN.	1.14	1.15	1.42	1.09	.88	1.54	1.40	1.33	.67	.60	.59	.23
CAL YR 1990	TOTAL	6655.4	MEAN	18.2	MAX	116	MIN	1.5	CFSM	1.02	IN	13.83
WTR YR 1991	TOTAL	5791.7	MEAN	15.9	MAX	147	MIN	1.2	CFSM	.89	IN	12.04

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

201

04161500 PAINT CREEK NEAR LAKE ORION, MI

LOCATION.--Lat 42°46'03", long 83°13'12", in NE1/4 sec.13, T.4 N., R.10 E., Oakland County, Hydrologic Unit 04090003, on left bank 100 ft upstream from railroad bridge, 1.6 mi southeast of Lake Orion, and 2.8 mi upstream from Trout Creek.

DRAINAGE AREA.--38.5 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1955 to September 1975, October 1975 to September 1988 (operated as a crest-stage partial-record station), October 1988 to September 1991 (discontinued).

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 929.80 ft above National Geodetic Vertical Datum of 1929 (levels by Giffels and Webster Engineering, Inc.).

REMARKS.--Estimated daily discharges: Dec. 24-28. Records good. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years (water years 1956-75, 1989-91), 25.5 ft<sup>3</sup>/s, 8.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 428 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 4.26 ft, from floodmark; maximum gage height, 4.43 ft, Sept. 22, 1971, result of construction downstream; minimum discharge, 1.2 ft<sup>3</sup>/s, June 28, July 13, 14, 15, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 82 ft<sup>3</sup>/s, May 31, gage height, 2.75 ft, from graph based on gage readings, no peak discharge above base discharge of 90 ft<sup>3</sup>/s; maximum gage height, 3.38 ft, Dec. 27, backwater from ice; minimum daily discharge, 3.2 ft<sup>3</sup>/s, Sept. 7, 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	27	29	51	27	37	45	41	32	6.6	4.4	6.4
2	9.6	25	29	52	27	41	43	34	30	4.6	3.9	6.0
3	9.0	23	34	52	27	42	41	39	29	4.4	5.5	6.0
4	15	22	37	50	27	43	42	38	31	7.6	5.3	5.8
5	13	42	36	49	23	43	44	35	25	4.5	5.1	3.3
6	13	37	37	48	23	45	36	33	12	4.4	5.0	3.4
7	13	35	39	46	25	45	33	22	12	5.7	4.8	3.2
8	14	37	39	43	29	45	31	24	11	6.1	6.0	3.2
9	35	40	39	41	31	46	40	27	11	5.0	6.3	8.6
10	58	42	38	39	33	45	41	29	12	4.8	5.8	26
11	61	43	37	39	34	44	39	30	20	4.7	5.3	30
12	61	42	37	40	34	42	43	31	19	4.6	6.1	35
13	56	39	38	38	34	41	42	30	19	5.2	7.2	34
14	50	36	37	37	35	39	42	29	22	6.5	6.8	38
15	47	34	39	35	35	38	56	27	18	14	7.1	35
16	41	33	39	36	33	37	56	25	16	7.0	6.6	36
17	36	32	38	35	32	36	49	26	15	5.9	7.2	41
18	37	30	39	34	32	37	45	20	11	4.4	11	43
19	32	29	38	34	36	36	45	18	8.2	7.0	13	41
20	29	25	36	34	33	33	58	17	7.9	5.4	11	40
21	30	24	37	34	34	29	61	17	7.3	5.4	11	40
22	31	26	37	34	37	25	63	16	7.3	8.2	12	38
23	32	25	38	34	40	18	63	15	7.3	7.2	11	37
24	33	23	38	34	42	23	69	17	8.9	7.2	9.6	37
25	38	22	37	33	42	27	72	21	11	8.4	8.5	35
26	32	21	36	32	41	29	68	46	11	7.1	7.7	31
27	29	25	35	31	40	36	60	40	11	6.1	7.7	26
28	26	28	34	30	38	43	56	37	11	5.2	7.6	20
29	25	27	44	29	---	43	51	35	9.4	6.2	7.2	19
30	25	29	44	29	---	44	48	31	9.1	7.5	7.2	18
31	21	---	47	28	---	45	---	40	---	6.0	7.1	---
TOTAL	962.6	923	1162	1181	924	1177	1482	890	454.4	192.9	230.0	745.9
MEAN	31.1	30.8	37.5	38.1	33.0	38.0	49.4	28.7	15.1	6.22	7.42	24.9
MAX	61	43	47	52	42	46	72	46	32	14	13	43
MIN	9.0	21	29	28	23	18	31	15	7.3	4.4	3.9	3.2
CFSM	.81	.80	.97	.99	.86	.99	1.28	.75	.39	.16	.19	.65
IN.	.93	.89	1.12	1.14	.89	1.14	1.43	.86	.44	.19	.22	.72

CAL YR 1990 TOTAL 11082.5 MEAN 30.4 MAX 112 MIN 4.2 CFSM .79 IN 10.71  
WTR YR 1991 TOTAL 10324.8 MEAN 28.3 MAX 72 MIN 3.2 CFSM .74 IN 9.98



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161540 PAINT CREEK AT ROCHESTER, MI

LOCATION.--Lat 42°41'18", long 83°08'35", in NW1/4 SE1/4 sec.10, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on Ludlow Street in Rochester, 1.5 mi upstream from mouth.

DRAINAGE AREA.--70.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.11 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 24-31, Jan. 4-9, Jan. 22 to Feb. 1, and Feb. 15-17. Records good except for estimated daily discharges, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 52.6 ft<sup>3</sup>/s, 10.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 918 ft<sup>3</sup>/s, Feb. 1, 1968; maximum gage height, 5.95 ft, Feb. 10, 1965, backwater from ice; minimum discharge, 1.2 ft<sup>3</sup>/s, Aug. 19, 1974, caused by regulation due to bridge construction; minimum gage height, 1.26 ft, Sept. 16, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 5	1900	321	3.35	May 26	1300	*389	*3.57

Minimum discharge, 11 ft<sup>3</sup>/s, Aug. 7, gage height, 1.50 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	50	57	111	50	65	77	80	82	20	16	17
2	23	50	55	99	50	106	74	71	69	17	14	16
3	22	48	69	91	53	125	70	68	60	16	21	18
4	45	49	94	85	62	95	69	73	54	20	18	24
5	34	190	75	80	76	89	80	73	51	18	16	16
6	29	176	70	75	68	103	71	95	35	15	14	14
7	34	101	67	72	65	105	64	64	31	24	13	13
8	40	88	67	69	64	90	62	60	30	29	20	12
9	132	81	69	67	68	88	85	64	29	19	25	12
10	209	75	76	65	67	86	101	63	27	17	18	30
11	164	71	70	65	62	82	78	60	44	17	15	35
12	113	68	68	67	60	76	76	67	46	18	14	40
13	96	66	70	67	58	74	74	71	36	18	16	40
14	82	62	64	64	60	71	78	59	39	18	15	43
15	73	60	65	64	58	69	124	50	36	24	15	42
16	67	58	68	74	56	67	118	47	36	21	18	39
17	66	57	67	81	55	66	95	60	32	17	20	44
18	76	55	75	71	57	77	82	46	29	14	33	46
19	63	54	70	69	100	73	81	41	23	15	134	51
20	55	50	64	77	99	69	135	38	21	14	42	47
21	54	48	67	73	82	62	141	36	20	14	30	61
22	55	55	76	70	87	62	119	34	23	52	28	51
23	57	53	71	65	74	54	107	32	26	32	25	59
24	57	51	68	62	74	59	126	42	21	20	23	52
25	62	48	65	58	73	60	118	44	24	19	21	47
26	58	46	63	55	69	59	111	287	24	18	20	43
27	58	57	62	53	66	65	101	132	23	16	18	39
28	52	83	61	52	64	93	102	96	22	15	18	34
29	47	65	170	51	---	89	93	76	21	20	18	32
30	51	58	190	50	---	82	87	64	20	30	17	31
31	42	---	120	50	---	79	---	127	---	20	19	---
TOTAL	2040	2073	2393	2152	1877	2440	2799	2220	1034	627	734	1048
MEAN	65.8	69.1	77.2	69.4	67.0	78.7	93.3	71.6	34.5	20.2	23.7	34.9
MAX	209	190	190	111	100	125	141	287	82	52	134	61
MIN	22	46	55	50	50	54	62	32	20	14	13	12
CFSM	.93	.98	1.09	.98	.95	1.11	1.32	1.01	.49	.29	.33	.49
IN.	1.07	1.09	1.26	1.13	.98	1.28	1.47	1.16	.54	.33	.39	.55
CAL YR 1990	TOTAL	24171	MEAN	66.2	MAX	233	MIN	13	CFSM	.93	IN	12.68
WTR YR 1991	TOTAL	21437	MEAN	58.7	MAX	287	MIN	12	CFSM	.83	IN	11.25

STREAMS TRIBUTARY TO LAKE ST. CLAIR

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04161580 STONY CREEK NEAR ROMEO, MI

LOCATION.--Lat 42°48'03", long 83°05'25", in SW1/4 sec.31, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of culvert on Romeo Road, 4.0 mi west of Romeo.

DRAINAGE AREA.--25.6 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 861.64 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 24-28, Dec. 31 to Feb. 3, Feb. 10-16, and Feb. 23 to Mar. 1. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 17.4 ft<sup>3</sup>/s, 9.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 290 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 5.19 ft; minimum, 0.92 ft<sup>3</sup>/s, Oct. 5, 9, 1967; minimum gage height, 1.28 ft, July 27, 28, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 89 ft<sup>3</sup>/s, May 26, gage height, 3.16 ft, from graph based on gage readings, no peak discharge above base discharge of 100 ft<sup>3</sup>/s; minimum 1.7 ft<sup>3</sup>/s, July 27, Aug. 14, 15, gage height, 1.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.3	6.2	23	33	10	17	26	30	32	4.1	2.5	2.7
2	5.5	6.6	22	30	11	34	23	27	25	4.1	2.1	2.6
3	5.4	9.9	23	26	14	39	21	24	21	4.0	5.5	2.9
4	12	12	30	24	18	31	20	20	19	11	4.8	5.4
5	8.3	44	29	22	24	28	20	20	16	11	3.3	3.6
6	6.3	52	28	21	26	34	20	27	14	8.9	2.8	3.1
7	6.2	36	27	20	26	36	18	25	10	9.3	2.5	2.9
8	8.1	33	24	19	24	28	17	22	8.1	12	2.8	3.0
9	26	31	24	18	26	27	28	20	6.8	15	4.3	3.0
10	39	29	26	17	22	26	42	16	7.4	13	3.1	3.1
11	46	24	24	18	18	24	37	13	16	11	2.6	3.0
12	37	20	23	18	15	21	30	12	17	8.3	2.2	2.9
13	32	18	24	17	14	21	27	12	13	7.1	2.1	3.0
14	30	20	19	16	14	20	27	11	11	9.3	2.0	3.2
15	28	20	19	16	13	18	37	9.3	11	5.5	1.9	3.4
16	24	19	21	17	14	17	42	8.5	13	4.6	2.4	3.3
17	22	17	20	18	15	15	35	11	12	10	2.8	2.9
18	24	14	23	19	16	19	30	10	10	11	5.9	2.9
19	21	13	22	19	26	18	27	8.6	9.9	11	12	2.9
20	20	13	19	19	30	17	41	7.9	7.8	5.7	8.3	2.9
21	19	12	20	18	31	17	49	7.3	6.8	3.5	5.2	2.8
22	18	15	24	16	34	25	44	6.8	8.5	4.4	4.4	2.8
23	15	15	22	15	24	28	38	6.3	9.2	4.6	6.8	3.4
24	13	19	19	14	21	28	46	8.7	7.4	3.1	7.9	3.1
25	11	19	17	12	19	26	45	15	7.4	2.6	4.0	3.1
26	8.8	15	16	12	18	23	39	70	7.5	2.3	3.2	3.5
27	6.6	18	15	12	17	25	36	63	6.5	2.1	3.0	3.3
28	6.2	28	16	11	16	37	42	48	5.2	3.1	3.0	3.2
29	5.8	27	35	11	---	36	38	42	4.6	4.1	2.9	3.2
30	5.8	25	55	11	---	31	34	34	4.3	5.4	2.8	3.3
31	5.8	---	40	10	---	27	---	41	---	3.2	2.8	---
TOTAL	521.1	630.7	749	549	556	793	979	676.4	347.4	214.3	121.9	94.4
MEAN	16.8	21.0	24.2	17.7	19.9	25.6	32.6	21.8	11.6	6.91	3.93	3.15
MAX	46	52	55	33	34	39	49	70	32	15	12	5.4
MIN	5.3	6.2	15	10	10	15	17	6.3	4.3	2.1	1.9	2.6
CFSM	.66	.82	.95	.69	.78	1.00	1.27	.85	.45	.27	.15	.12
IN.	.76	.92	1.09	.80	.81	1.15	1.42	.98	.50	.31	.18	.14
CAL YR 1990	TOTAL	7540.7	MEAN	20.7	MAX	103	MIN	2.9	CFSM	.81	IN	10.96
WTR YR 1991	TOTAL	6232.2	MEAN	17.1	MAX	70	MIN	1.9	CFSM	.67	IN	9.06

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161790 STONY LAKE NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'58", long 83°05'58", in SE1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank 1,000 ft east of bridge over dam on Stony Creek, 2.7 mi west of Washington.

DRAINAGE AREA.--68.0 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1963 to current year.

REVISED RECORDS.--WDR MI-77-1: 1976.

GAGE.--Water-stage recorder. Datum of gage is 790.00 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority); gage readings have been converted to elevations NGVD.

REMARKS.--Reservoir is formed by an earthfill dam with concrete spillway completed in 1962. The spillway section includes a drum gate with minimum crest elevation of 796 ft, maximum of 802 ft; and 2 sluices, one on each side, with valve controls capable of draining lake. Total capacity (new capacity table put into use Oct. 1, 1973), 4,649 acre-ft at elevation of 802 ft. The reservoir began filling February 1963. Lake is used for recreational purposes.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 5,495 acre-ft, May 17, 18, 1974, Apr. 20, 1975, elevation, 803.6 ft; minimum recorded, 1,758 acre-ft, Nov. 21, 1967, elevation, 794.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,166 acre-ft, Apr. 24, elevation, 802.99 ft; minimum, 4,153 acre-ft, Nov. 26, elevation, 801.00 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre- feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 . . . . .	802.14	4,722	--	--
Oct. 31 . . . . .	802.21	4,758	+36	+0.6
Nov. 30 . . . . .	801.09	4,196	-562	-9.4
Dec. 31 . . . . .	801.50	4,399	+203	+3.3
CAL YR 1990 . . . . .	--	--	+942	+1.3
Jan. 31 . . . . .	801.02	4,163	-236	-3.8
Feb. 28 . . . . .	801.14	4,220	+57	+1.0
Mar. 31 . . . . .	802.08	4,691	+471	+7.7
Apr. 30 . . . . .	802.57	4,945	+254	+4.3
May 31 . . . . .	802.58	4,951	+6	+0.1
June 30 . . . . .	802.10	4,701	-250	-4.2
July 31 . . . . .	802.16	4,732	+31	+0.5
Aug. 31 . . . . .	802.06	4,680	-52	-0.8
Sept. 30 . . . . .	802.04	4,670	-10	-0.2
WTR YR 1991 . . . . .	--	--	-52	-0.1

STREAMS TRIBUTARY TO LAKE ST. CLAIR

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04161800 STONY CREEK NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'55", long 83°05'31", in SW1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Mt. Vernon Road, 500 ft downstream from Stony Lake Dam, and 2.9 mi west of Washington.

DRAINAGE AREA.--68.2 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 772.59 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority).

REMARKS.--No estimated daily discharges. Records good. Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963; occasional regulation by Stony Lake since (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 43.0 ft<sup>3</sup>/s, 8.56 in/yr, adjusted for storage since 1963.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 552 ft<sup>3</sup>/s, June 10, 1988, gage height, 6.44 ft, from rating curve extended above 380 ft<sup>3</sup>/s, caused by momentary release of water from Stony Lake; maximum gage height, 6.71 ft, Mar. 6, 1959, backwater from ice; minimum discharge, 0.9 ft<sup>3</sup>/s, July 10, 1963; minimum gage height, 1.79 ft, Apr. 6, 1979; minimum daily discharge, 1.3 ft<sup>3</sup>/s, July 31, Aug. 1, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 178 ft<sup>3</sup>/s, May 27, gage height, 4.13 ft; minimum daily, 4.4 ft<sup>3</sup>/s, Sept. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	24	53	111	36	47	49	79	107	10	22	8.5
2	12	23	52	100	35	59	35	72	91	11	20	6.0
3	11	22	61	88	35	79	45	64	80	11	22	5.0
4	20	24	66	75	38	79	38	61	65	11	18	9.3
5	20	54	64	70	48	78	39	59	52	11	14	7.5
6	19	106	64	66	56	82	47	67	43	12	13	7.8
7	22	121	62	62	62	84	50	66	38	15	12	7.9
8	29	105	60	58	63	81	51	64	34	22	14	8.0
9	46	87	57	55	64	78	58	63	29	19	19	8.0
10	70	77	57	54	63	74	67	60	25	18	15	8.5
11	108	68	56	55	58	69	74	55	29	19	13	8.6
12	105	62	55	57	52	65	75	49	37	18	11	6.0
13	87	55	56	54	48	62	71	46	36	20	11	6.1
14	76	70	51	51	48	56	68	42	34	17	10	6.8
15	68	97	51	50	46	50	75	38	32	15	8.9	7.1
16	62	93	50	54	40	48	83	35	32	14	8.4	7.1
17	58	67	48	59	41	48	87	48	30	12	9.5	6.7
18	63	53	51	60	41	31	84	41	28	12	15	6.3
19	59	80	51	61	47	19	83	33	25	12	47	5.4
20	53	93	49	63	61	35	91	29	23	13	49	5.9
21	49	83	50	61	70	35	101	28	22	13	41	4.4
22	47	65	52	57	78	29	107	27	23	17	32	4.7
23	44	49	58	54	74	36	105	26	21	18	27	7.0
24	41	43	55	51	70	50	116	30	17	14	22	7.4
25	39	40	52	47	65	56	111	38	16	12	19	6.4
26	35	40	49	44	59	36	104	115	16	10	17	8.1
27	32	44	46	41	52	37	95	169	15	8.5	16	6.8
28	31	50	45	40	48	56	91	168	14	7.9	15	6.6
29	27	53	64	39	---	69	88	133	14	9.8	13	8.1
30	25	53	109	39	---	73	84	105	15	14	13	6.6
31	25	---	119	38	---	72	---	111	---	19	18	---
TOTAL	1396	1901	1813	1814	1498	1773	2272	2021	1043	435.2	584.8	208.6
MEAN	45.0	63.4	58.5	58.5	53.5	57.2	75.7	65.2	34.8	14.0	18.9	6.95
MAX	108	121	119	111	78	84	116	169	107	22	49	9.3
MIN	11	22	45	38	35	19	35	26	14	7.9	8.4	4.4
MEAN+	45.6	54.0	61.8	54.7	54.5	64.9	80.0	65.3	30.6	14.5	18.1	6.75
CFSM+	.67	.79	.91	.80	.80	.95	1.17	.96	.45	.21	.27	.10
IN.+	.77	.88	1.04	.92	.83	1.10	1.31	1.10	.50	.25	.31	.11

CAL YR 1990 TOTAL 18784.0 MEAN 51.5 MAX 160 MIN 5.4 MEAN+ 52.8 CFSM+ .77 IN+ 10.51  
WTR YR 1991 TOTAL 16759.6 MEAN 45.9 MAX 169 MIN 4.4 MEAN+ 45.8 CFSM+ .67 IN+ 9.12

+ Adjusted for change in contents in Stony Lake.



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04163400 PLUM BROOK AT UTICA, MI

LOCATION.--Lat 42°36'05", long 83°04'27", in SE1/4 NE1/4 sec.7, T.2 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at upstream side of bridge on Ryan Road, 1.0 mi southwest of Utica.

DRAINAGE AREA.--16.5 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1965 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 619.79 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Jan. 2-15, 21-31, Feb. 12-17, 26-28, and Aug. 31 to Sept. 10. Records good except for estimated daily discharges, Aug. 31 to Sept. 10, which are poor. Occasional diversion for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 13.5 ft<sup>3</sup>/s, 11.11 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft<sup>3</sup>/s, June 26, 1968, gage height, 10.36 ft; no flow part of each day July 19, 28, 1966, Aug. 22-28, Sept. 3, 11, 1969.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 5	2400	310	7.46	May 26	1200	*389	*8.04
Dec. 29	1800	349	7.78	Aug. 19	1600	219	6.34

Minimum discharge, 0.45 ft<sup>3</sup>/s, July 29, gage height, 1.75 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.2	5.0	11	32	7.1	9.8	11	11	13	2.8	1.0	5.0
2	4.3	5.2	9.3	27	7.5	54	9.9	11	15	3.1	.62	1.2
3	3.8	5.0	24	22	10	87	12	8.8	14	4.7	7.1	1.0
4	17	4.6	75	19	21	32	14	8.1	8.5	6.1	4.8	15
5	10	129	31	16	26	29	11	12	7.2	7.8	2.0	8.0
6	5.8	157	27	13	21	34	10	49	5.9	5.1	1.1	4.5
7	5.4	46	23	12	18	29	8.7	21	5.1	9.7	.83	3.0
8	24	28	16	11	17	20	9.7	12	4.2	23	4.5	2.4
9	114	20	18	10	16	18	34	12	4.1	7.7	18	1.9
10	181	16	26	9.0	14	18	40	11	5.6	4.0	3.7	1.7
11	120	12	20	8.2	11	17	17	8.9	14	2.8	1.2	1.4
12	36	12	18	7.7	9.4	14	12	9.8	14	2.5	.93	1.1
13	23	15	15	7.6	9.0	14	11	31	7.4	4.2	.98	1.3
14	15	11	12	8.3	8.9	12	13	16	4.7	3.4	.77	1.1
15	15	9.7	12	11	8.8	12	42	9.2	5.0	2.8	.65	1.3
16	13	9.1	15	33	9.0	10	31	7.0	14	1.3	1.4	1.4
17	12	8.7	15	46	9.2	9.9	16	76	7.8	1.2	3.4	1.1
18	61	8.0	27	27	9.6	19	12	25	5.2	1.2	15	1.1
19	25	10	20	25	42	16	13	13	3.5	.85	105	.99
20	14	9.7	14	40	43	12	50	11	2.8	.59	43	1.0
21	11	8.4	17	30	33	11	50	10	2.6	.92	15	1.2
22	10	15	27	23	32	12	33	7.7	4.1	8.9	9.2	1.3
23	9.8	13	20	16	18	15	24	5.8	8.2	19	9.2	4.0
24	11	11	19	13	14	16	59	12	5.5	3.6	6.9	2.7
25	8.9	9.4	14	10	13	13	34	19	3.8	1.5	3.4	2.1
26	7.6	10	12	6.8	11	11	23	244	3.0	1.2	3.2	2.2
27	6.3	17	11	6.6	9.5	12	16	82	3.1	.94	3.2	1.8
28	5.7	33	14	6.9	9.0	36	16	37	2.5	.70	3.2	1.4
29	5.9	18	187	6.8	---	20	14	24	2.6	3.1	1.8	1.4
30	5.9	12	212	6.8	---	13	13	17	2.5	11	1.5	1.5
31	5.2	---	64	7.0	---	11	---	29	---	2.4	16	---
TOTAL	790.8	667.8	1025.3	517.7	457.0	636.7	659.3	850.3	198.9	148.10	288.58	75.09
MEAN	25.5	22.3	33.1	16.7	16.3	20.5	22.0	27.4	6.63	4.78	9.31	2.50
MAX	181	157	212	46	43	87	59	244	15	23	105	15
MIN	3.8	4.6	9.3	6.6	7.1	9.8	8.7	5.8	2.5	.59	.62	.99
CFSM	1.55	1.35	2.01	1.01	.99	1.24	1.33	1.66	.40	.29	.56	.15
IN.	1.78	1.51	2.31	1.17	1.03	1.44	1.49	1.92	.45	.33	.65	.17

CAL YR 1990	TOTAL	7566.52	MEAN	20.7	MAX	212	MIN	.80	CFSM	1.26	IN	17.06
WTR YR 1991	TOTAL	6315.57	MEAN	17.3	MAX	244	MIN	.59	CFSM	1.05	IN	14.24

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164000 CLINTON RIVER NEAR FRASER, MI

LOCATION.--Lat 42°34'38", long 82°57'05", in SE1/4 NE1/4 sec.19, T.2 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank 50 ft downstream from bridge on Garfield Road, 2.8 mi north of Fraser, and 4.0 mi upstream from North Branch.

DRAINAGE AREA.--444 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 577.71 ft above National Geodetic Vertical Datum of 1929 (Macomb County bench mark). Prior to Nov. 17, 1949, and from May 29 to July 31, 1990, nonrecording gage at same site and datum. Nov. 17, 1949 to Apr. 5, 1990, water-stage recorder at site 800 ft downstream at same datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--44 years, 385 ft<sup>3</sup>/s, 11.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,840 ft<sup>3</sup>/s, Oct. 1, 1981, gage height, 19.56 ft; minimum, 47 ft<sup>3</sup>/s, Sept. 6, 1955; minimum gage height, 4.29 ft, Sept. 7, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20 ft, from floodmark, and discharge of about 9,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,000 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	2100	4,350	16.10	Mar. 2	2315	2,430	13.78
Nov. 5	2130	3,430	15.11	May 26	1015	*5,490	*17.15
Dec. 30	0200	4,100	15.85				

Minimum discharge, 99 ft<sup>3</sup>/s, July 28, gage height, 4.87 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	146	193	390	889	301	380	319	563	698	136	135	167
2	141	191	373	746	313	940	278	483	621	156	127	127
3	135	183	637	687	348	1530	271	397	544	172	227	124
4	351	179	1150	570	412	723	271	327	427	182	170	367
5	320	1520	700	585	509	621	332	346	374	174	129	175
6	267	2180	578	566	468	675	273	778	297	134	125	139
7	268	1330	538	519	445	712	251	548	248	440	115	119
8	538	856	492	472	423	579	258	447	212	591	292	116
9	1520	722	469	480	436	550	482	431	193	196	583	121
10	2580	660	522	437	423	532	713	405	249	163	202	133
11	2580	567	470	428	387	489	484	372	513	154	151	135
12	1250	511	443	500	357	467	433	361	425	152	128	135
13	757	482	426	428	343	433	415	613	278	157	127	142
14	631	450	398	463	360	415	490	441	218	143	125	138
15	590	474	401	527	370	404	758	353	223	131	124	131
16	552	495	469	711	311	385	796	311	418	139	190	130
17	531	475	393	853	330	374	638	664	217	128	240	135
18	1160	427	570	629	348	511	540	454	207	122	478	133
19	733	412	482	579	830	405	477	298	197	125	918	136
20	510	377	412	719	857	380	1040	264	187	123	912	137
21	427	364	516	620	633	377	1130	230	181	120	413	143
22	399	588	644	447	646	344	778	195	216	206	318	142
23	388	462	526	446	558	368	690	172	286	428	218	183
24	375	401	495	420	486	375	903	360	190	191	238	164
25	369	351	400	363	458	370	805	463	178	149	182	148
26	362	336	380	360	415	353	701	3410	168	137	160	156
27	351	503	344	353	387	314	592	2290	159	120	159	131
28	333	695	401	360	377	692	552	1200	160	109	173	138
29	324	545	2290	336	---	440	514	761	162	121	144	119
30	315	421	3520	347	---	373	555	674	143	289	239	120
31	241	---	1740	346	---	328	---	657	---	161	653	---
TOTAL	19444	17350	21569	16186	12531	15839	16739	19268	8589	5749	8395	4384
MEAN	627	578	696	522	448	511	558	622	286	185	271	146
MAX	2580	2180	3520	889	857	1530	1130	3410	698	591	918	367
MIN	135	179	344	336	301	314	251	172	143	109	115	116
CFSM	1.41	1.30	1.57	1.18	1.01	1.15	1.26	1.40	.64	.42	.61	.33
IN.	1.63	1.45	1.81	1.36	1.05	1.33	1.40	1.61	.72	.48	.70	.37

CAL YR 1990	TOTAL	200224	MEAN	549	MAX	3820	MIN	103	CFSM	1.24	IN	16.78
WTR YR 1991	TOTAL	166043	MEAN	455	MAX	3520	MIN	109	CFSM	1.03	IN	13.91

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164100 EAST POND CREEK AT ROMEO, MI

LOCATION.--Lat 42°49'21", long 83°01'13", in NE1/4 SE1/4 sec.27, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on State Highway 53, 1.4 mi north of Romeo.

DRAINAGE AREA.--21.8 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 780 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-31, Dec. 24-27, Dec. 31 to Jan. 14, Jan. 20 to Feb. 2, and Feb. 15-17. Records good except for estimated daily discharges, which are fair. Occasional regulation by lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 16.3 ft<sup>3</sup>/s, 10.15 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 358 ft<sup>3</sup>/s, Feb. 10, 1965, gage height, 4.48 ft; maximum gage height, 4.56 ft, Mar. 12, 1962, backwater from ice; minimum discharge, 0.8 ft<sup>3</sup>/s, July 30, 31, 1964, Aug. 6, 7, 1965; minimum gage height, 0.71 ft, July 21, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 80 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
May 26	1100	*94	*2.52	No other peak greater than base discharge.			

Minimum daily discharge, 2.4 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.6	11	17	35	14	19	22	29	21	3.8	4.7	3.2
2	7.5	13	17	32	15	28	20	29	19	6.1	3.6	3.5
3	8.5	11	21	29	15	33	22	24	17	5.2	6.7	3.4
4	13	11	26	26	17	29	20	17	16	6.1	7.1	5.5
5	10	38	24	24	19	27	18	27	15	7.4	5.2	5.8
6	9.5	52	22	21	19	34	18	29	13	7.1	4.6	5.2
7	10	41	29	19	20	38	18	24	12	8.1	4.2	4.8
8	12	35	19	18	21	31	18	19	12	9.4	4.3	4.4
9	15	32	19	17	23	28	22	18	11	8.1	6.3	4.0
10	23	29	19	16	23	21	32	18	10	7.7	5.5	4.3
11	48	26	19	16	20	23	35	18	14	8.0	4.4	4.9
12	45	24	19	16	18	21	24	17	15	6.0	3.6	5.5
13	40	21	19	17	18	20	22	18	14	6.3	3.4	5.2
14	36	19	18	17	18	19	23	16	12	6.4	2.8	10
15	32	19	18	18	18	19	33	10	11	5.4	2.8	6.4
16	29	17	18	19	17	18	34	13	13	5.8	3.0	4.0
17	26	16	18	21	16	17	35	15	12	5.2	3.7	4.1
18	28	17	19	20	16	18	26	14	12	4.5	6.0	4.6
19	27	17	19	19	25	18	30	13	11	4.3	11	5.5
20	25	16	18	18	28	18	38	13	10	3.8	11	5.8
21	22	17	18	17	26	18	43	12	9.6	3.8	9.1	6.1
22	21	18	19	16	29	18	42	12	9.9	3.3	7.6	6.1
23	19	18	19	16	27	19	41	12	11	5.3	6.1	7.0
24	18	17	20	15	25	19	45	12	9.5	4.9	5.0	6.9
25	16	16	19	15	24	21	43	14	8.5	5.5	4.5	7.3
26	15	16	17	14	22	19	39	69	7.8	4.4	8.4	7.6
27	14	17	17	14	19	19	36	59	6.4	3.7	7.6	7.3
28	13	25	18	14	19	24	38	36	6.4	2.4	4.6	7.1
29	12	25	34	14	---	25	33	31	6.4	2.8	3.7	7.0
30	11	18	46	14	---	24	32	25	4.6	5.4	2.9	6.7
31	10	---	40	14	---	23	---	27	---	5.4	2.8	---
TOTAL	623.1	652	665	581	571	708	902	690	350.1	171.6	166.2	169.2
MEAN	20.1	21.7	21.5	18.7	20.4	22.8	30.1	22.3	11.7	5.54	5.36	5.64
MAX	48	52	46	35	29	38	45	69	21	9.4	11	10
MIN	7.5	11	17	14	14	17	18	10	4.6	2.4	2.8	3.2
CFSM	.92	1.00	.99	.86	.94	1.05	1.38	1.02	.54	.25	.25	.26
IN.	1.06	1.11	1.13	.99	.97	1.21	1.54	1.18	.60	.29	.28	.29
CAL YR 1990	TOTAL	7594.5	MEAN	20.8	MAX	70	MIN	3.7	CFSM	.95	IN	12.96
WTR YR 1991	TOTAL	6249.2	MEAN	17.1	MAX	69	MIN	2.4	CFSM	.78	IN	10.66

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

209

04164300 EAST BRANCH COON CREEK AT ARMADA, MI

LOCATION.--Lat 42°50'45", long 82°53'06", in NE1/4 sec.23, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank at downstream side of bridge on Prospect Street in Armada.

DRAINAGE AREA.--13.0 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1958 to current year.

REVISED RECORDS.--WDR MI-83: 1982.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 735 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 1-28, and Feb. 4 to Mar. 2. Records good except for estimated daily discharges and daily discharges below 0.5 ft<sup>3</sup>/s, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 7.20 ft<sup>3</sup>/s, 7.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 910 ft<sup>3</sup>/s, Apr. 19, 1975, gage height, 6.69 ft; no flow Jan. 25 to Feb. 9, 1961, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0600	122	3.06	Apr. 10	0200	164	3.39
Nov. 6	0100	242	3.93	Apr. 24	1700	110	2.96
Dec. 29	2400	220	3.78	May 26	1400	*255	*4.01
Mar. 3	0300	111	2.97				

Minimum daily discharge, 0.01 ft<sup>3</sup>/s, Sept. 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.76	.91	4.9	23	.35	3.0	6.5	5.6	4.6	.17	.12	.35
2	.75	1.0	4.3	9.0	.46	40	5.5	4.7	3.4	.21	.19	.29
3	.75	1.0	4.8	7.0	.99	69	4.6	3.9	2.8	.19	.53	.38
4	.94	1.2	14	6.0	3.5	22	4.1	3.4	2.3	1.1	.13	.29
5	.39	53	18	5.2	11	15	4.9	3.6	1.8	.51	.14	.11
6	.32	143	13	4.3	9.0	47	4.9	5.6	1.5	.37	.17	.11
7	.54	43	8.7	3.5	7.0	53	4.7	4.9	1.3	.42	.17	.14
8	1.7	22	6.9	3.1	5.7	17	4.3	3.9	1.1	.39	.38	.10
9	3.9	12	7.8	2.7	5.0	13	25	3.9	.95	.19	.21	.15
10	23	8.3	22	2.5	4.0	15	97	3.6	.90	.19	.14	.06
11	79	6.3	18	2.4	3.0	12	33	3.1	2.1	.20	.17	.06
12	22	4.8	12	2.3	2.7	8.9	13	2.8	1.9	.10	.16	.05
13	10	3.9	11	2.3	2.6	6.6	8.3	3.2	1.2	.66	.11	.11
14	6.0	3.3	7.5	2.3	2.5	5.6	7.3	3.4	.89	.59	.09	.09
15	4.2	3.4	5.3	2.4	2.4	5.1	34	2.4	1.4	.24	.08	.09
16	3.1	3.4	5.3	3.0	2.2	4.6	40	1.8	7.9	.12	.05	.09
17	2.5	3.0	5.2	4.0	2.3	4.4	14	1.6	5.2	.10	.09	.13
18	12	2.5	12	5.5	2.4	7.1	8.5	1.6	2.4	.13	.13	.10
19	14	2.2	13	8.0	2.5	8.6	6.7	1.5	1.6	.14	.57	.03
20	4.9	2.0	7.7	12	12	6.9	15	1.3	1.1	.11	.13	.01
21	3.3	1.9	6.6	9.5	10	5.8	52	1.1	.86	.12	.08	.08
22	2.6	2.6	14	7.0	8.0	5.4	30	1.1	.83	.20	.11	.22
23	2.0	2.6	13	5.5	6.5	5.5	14	1.0	.77	.18	.15	.23
24	1.6	2.4	8.9	4.4	5.2	5.9	64	1.1	.59	.17	.13	.38
25	1.5	2.2	8.0	3.9	4.5	5.2	54	2.2	.50	.20	.11	.37
26	1.4	2.3	7.0	3.6	3.3	4.3	20	155	.40	.24	.11	.35
27	1.1	2.6	5.7	3.5	2.7	5.2	11	89	.33	.29	.13	.37
28	1.2	6.4	4.7	2.5	2.6	42	9.4	39	.26	.32	.18	.36
29	1.1	13	75	1.0	---	25	8.4	22	.20	.68	.20	.41
30	.88	7.8	163	.18	---	13	7.1	13	.19	.39	.25	.77
31	.88	---	66	.40	---	8.0	---	7.9	---	.13	.39	---
TOTAL	208.31	364.01	573.3	151.98	124.40	489.1	611.2	398.2	51.27	9.05	5.60	6.28
MEAN	6.72	12.1	18.5	4.90	4.44	15.8	20.4	12.8	1.71	.29	.18	.21
MAX	79	143	163	23	12	69	97	155	7.9	1.1	.57	.77
MIN	.32	.91	4.3	.18	.35	3.0	4.1	1.0	.19	.10	.05	.01
CFSM	.52	.93	1.42	.38	.34	1.22	1.57	.99	.13	.02	.01	.02
IN.	.60	1.04	1.64	.43	.36	1.40	1.75	1.14	.15	.03	.02	.02
CAL YR 1990	TOTAL	3574.78	MEAN	9.79	MAX	163	MIN	.05	CFSM	.75	IN	10.23
WTR YR 1991	TOTAL	2992.70	MEAN	8.20	MAX	163	MIN	.01	CFSM	.63	IN	8.56



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164500 NORTH BRANCH CLINTON RIVER NEAR MOUNT CLEMENS, MI

LOCATION.--Lat 42°37'45", long 82°53'25", in SW1/4 sec.35, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 30 ft upstream from bridge on State Highway 59, 2 mi north of Mount Clemens, and 3.6 mi upstream from mouth.

DRAINAGE AREA.--199 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 1437: 1948. WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since September 1961. Datum of gage is 576.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 15, 1949, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 8 to Dec. 10, Dec. 25-29, Jan. 4-19, Jan. 23 to Feb. 3, and Feb. 13-19, 28. Records good except for estimated daily discharges, which are fair. Some regulation at times by mill upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--44 years, 128 ft<sup>3</sup>/s, 8.73 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft<sup>3</sup>/s, Feb. 2, 1968, gage height, 18.62 ft; minimum, 0.08 ft<sup>3</sup>/s, part of each day July 4-10, 14, 15, 1988; minimum gage height, 3.12 ft, Sept. 13, 14, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20.0 ft, from floodmark.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Nov. 7	1500	1,410	12.20	May 27	1500	2,580	14.17
Dec. 30	2400	*2,610	*14.21				

Minimum discharge, 0.51 ft<sup>3</sup>/s, Sept. 20, 21, gage height, 3.82 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	36	260	1400	68	125	154	166	245	13	9.9	4.5
2	15	35	200	683	66	218	131	139	144	10	7.1	4.7
3	14	37	150	432	75	651	114	121	101	9.4	7.2	3.7
4	13	38	130	280	139	686	103	105	82	11	11	5.0
5	17	101	320	230	280	491	103	89	67	18	13	5.0
6	22	577	270	190	384	339	108	113	56	25	10	9.5
7	21	1240	230	160	441	491	109	165	47	16	7.3	7.7
8	21	1300	180	130	423	568	101	141	40	16	5.5	4.9
9	44	800	160	110	368	335	115	108	36	18	6.8	4.3
10	182	360	155	100	375	249	325	97	33	14	12	4.4
11	443	240	228	93	367	235	453	93	36	12	11	3.9
12	507	170	210	90	215	203	406	85	61	11	8.2	3.0
13	477	140	168	89	150	170	208	80	77	11	4.8	3.8
14	241	120	139	89	120	145	155	82	54	12	1.8	3.0
15	142	105	101	92	95	128	208	72	42	14	1.2	3.4
16	101	95	84	100	88	117	462	55	42	12	1.3	6.5
17	81	90	88	150	87	109	515	60	77	8.3	1.8	4.6
18	123	86	106	200	88	112	315	80	69	6.4	3.8	2.5
19	208	82	174	290	110	144	201	65	46	5.5	34	1.5
20	202	78	172	341	394	155	201	55	35	3.7	46	.90
21	123	71	117	403	534	133	357	48	29	2.6	30	.66
22	85	70	168	362	549	121	499	43	26	6.6	21	.77
23	69	74	232	230	535	116	474	39	28	11	16	2.5
24	60	77	205	130	310	124	402	40	30	12	13	5.1
25	54	78	180	100	214	128	576	52	25	8.6	10	5.5
26	49	76	140	90	170	119	589	504	21	5.5	8.7	5.3
27	44	72	100	85	134	108	348	2060	17	4.5	7.5	5.7
28	40	100	80	80	130	170	228	1670	15	3.5	11	5.8
29	38	250	250	76	---	266	210	710	13	4.8	7.9	6.3
30	36	470	1610	72	---	281	198	279	13	6.1	5.6	5.6
31	37	---	2250	70	---	203	---	217	---	11	7.3	---
TOTAL	3524	7068	8857	6947	6909	7440	8368	7633	1607	322.5	341.7	130.03
MEAN	114	236	286	224	247	240	279	246	53.6	10.4	11.0	4.33
MAX	507	1300	2250	1400	549	686	589	2060	245	25	46	9.5
MIN	13	35	80	70	66	108	101	39	13	2.6	1.2	.66
CFSM	.57	1.19	1.44	1.13	1.24	1.21	1.40	1.24	.27	.05	.06	.02
IN.	.66	1.32	1.66	1.30	1.29	1.39	1.56	1.43	.30	.06	.06	.02

CAL YR 1990	TOTAL	67256.20	MEAN	184	MAX	2250	MIN	2.2	CFSM	.93	IN	12.57
WTR YR 1991	TOTAL	59147.23	MEAN	162	MAX	2250	MIN	.66	CFSM	.81	IN	11.06

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

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04165500 CLINTON RIVER AT MOUNT CLEMENS, MI  
(National stream quality accounting network station)

LOCATION.--Lat 42°35'45", long 82°54'35", Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Moravian Drive, 0.2 mi downstream from North Branch, and 0.5 mi west of Mount Clemens.

DRAINAGE AREA.--734 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1934 to current year.

REVISED RECORDS.--WSP 1084: 1943, 1945-46. WSP 1937: 1935, 1936(M), 1937-39, 1949(M), 1950. WSP 1557: Drainage area. WSP 1727: 1952(M), 1954(M).

GAGE.--Water-stage recorder. Datum of gage is 570.43 ft above National Geodetic Vertical Datum of 1929. May 10, 1934 to Jan. 11, 1939, nonrecording gage at same site and datum. Auxiliary gage is a water-stage recorder on right bank 2.0 mi downstream from base gage at same datum. Mar. 15, 1938 to Jan. 3, 1952, auxiliary nonrecording gage 1.6 mi downstream from base gage at same datum.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 8-13, Jan. 23 to Feb. 1, and Feb. 12-17. Water-discharge records good. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--57 years, 549 ft<sup>3</sup>/s, 10.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,200 ft<sup>3</sup>/s, Apr. 6, 1947, gage height, 23.55 ft, from floodmark; minimum not determined; minimum gage height, 2.72 ft, Nov. 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0200	4,810	11.30	Mar. 3	0400	3,300	9.60
Nov. 6	0300	3,990	10.41	May 26	1600	*6,460	*13.06
Dec. 30	1000	6,380	12.92				

Minimum daily discharge, 137 ft<sup>3</sup>/s, Sept. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	200	258	599	2310	410	655	549	769	1110	175	154	241
2	191	253	516	1560	425	1240	474	705	838	168	162	198
3	191	247	906	1160	480	2760	442	566	719	182	230	189
4	409	237	1760	864	627	1600	428	461	548	198	187	424
5	415	1650	1190	841	857	1310	528	429	460	195	161	220
6	328	3590	984	828	908	1220	446	999	373	173	161	191
7	312	2800	877	781	936	1380	401	803	311	412	148	173
8	690	1960	775	660	903	1280	389	657	268	597	272	170
9	1740	1320	733	640	878	1050	670	588	239	208	611	176
10	2910	995	795	590	854	923	1090	546	269	174	199	164
11	3830	828	822	570	767	870	979	489	582	161	166	148
12	2040	736	769	630	600	813	948	467	523	166	158	150
13	1390	704	679	590	550	755	724	726	362	171	153	157
14	1040	680	654	665	520	707	699	541	278	159	154	165
15	848	658	634	743	500	671	1100	429	273	156	153	153
16	795	648	676	936	450	642	1370	364	508	156	187	156
17	763	622	627	1260	450	622	1210	796	284	150	225	151
18	1520	597	792	1010	463	722	974	595	265	151	516	150
19	1140	547	778	985	1090	664	782	370	237	149	1160	145
20	843	504	726	1210	1490	664	1350	326	219	151	1140	140
21	696	493	742	1120	1260	648	1820	285	215	146	454	156
22	618	691	972	942	1300	599	1430	251	236	234	337	156
23	594	622	876	700	1150	606	1230	229	314	429	244	179
24	542	537	816	620	921	574	1630	445	219	202	247	166
25	488	469	650	520	781	596	1660	713	206	167	207	159
26	499	486	590	490	708	602	1390	4520	191	165	182	151
27	486	663	570	480	643	546	1020	5070	182	162	192	137
28	383	858	750	470	620	946	834	3340	180	148	222	148
29	434	786	2650	450	---	782	766	1800	182	153	204	140
30	407	703	6110	450	---	748	790	1140	172	284	308	139
31	333	---	4260	440	---	614	---	1090	---	186	900	---
TOTAL	27075	26142	35278	25515	21541	27809	28123	30509	10763	6328	9794	5192
MEAN	873	871	1138	823	769	897	937	984	359	204	316	173
MAX	3830	3590	6110	2310	1490	2760	1820	5070	1110	597	1160	424
MIN	191	237	516	440	410	546	389	229	172	146	148	137
CFSM	1.19	1.19	1.55	1.12	1.05	1.22	1.28	1.34	.49	.28	.43	.24
IN.	1.37	1.32	1.79	1.29	1.09	1.41	1.43	1.55	.55	.32	.50	.26

CAL YR 1990	TOTAL	304374	MEAN	834	MAX	7030	MIN	120	CFSM	1.14	IN	15.43
WTR YR 1991	TOTAL	254069	MEAN	696	MAX	6110	MIN	137	CFSM	.95	IN	12.88

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1969, 1973 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: October 1974 to September 1981.

WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Aug. 13, 1975 to Sept. 6, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1975-76, 1978-81): Maximum, 3,580 microsiemens, Jan. 26, 1978; minimum, 126 microsiemens, July 29, 1976.

WATER TEMPERATURE (water years 1975-81): Maximum, 29.5°C, Sept. 20, 1978; minimum, 0.0°C on many days during winter.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
DEC 12...	1200	765	818	8.4	3.5	6.4	12.5	97	2000	380
APR 25...	1030	1640	677	8.3	10.5	41	10.0	91	400	900
JUN 19...	1200	230	823	8.3	22.5	10	6.5	76	K180	270
SEP 11...	1130	133	894	8.3	20.5	4.6	7.0	79	560	470

DATE	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD HCO3 (MG/L AS) (00453)	CAR-BONATE WATER DIS IT FIELD CO3 (MG/L AS) (00452)	ALKA-LINITY WAT DIS TOT IT FIELD CACO3 (MG/L AS) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
DEC 12...	310	85	84	24	52	3.6	271	1	226	59
APR 25...	250	67	69	19	39	3.4	224	--	184	44
JUN 19...	270	67	73	21	61	5.0	246	--	202	45
SEP 11...	270	84	74	21	86	7.2	229	--	188	64

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
DEC 12...	98	0.4	5.6	454	0.62	938	0.03	0.01	2.1	2.0
APR 25...	82	0.2	4.2	369	0.50	1630	0.04	0.03	1.3	1.3
JUN 19...	100	0.4	5.1	463	0.63	288	0.05	0.05	2.6	2.6
SEP 11...	130	0.6	5.0	510	0.69	183	0.06	0.06	3.8	3.9

STREAMS TRIBUTARY TO LAKE ST. CLAIR  
04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
DEC 12...	0.15	0.14	1.2	0.13	0.07	0.09	0.08	<10	1	65
APR 25...	0.09	0.07	1.3	0.14	0.04	0.06	<0.01	10	<1	39
JUN 19...	0.08	0.04	1.0	0.11	0.08	0.09	0.10	20	2	53
SEP 11...	0.13	0.14	1.4	0.31	0.26	0.23	0.22	<10	2	58

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
DEC 12...	<0.5	<1	1	<3	2	32	1	10	31	<0.1
APR 25...	<0.5	<1	<1	<3	2	23	<1	5	25	<0.1
JUN 19...	<0.5	<1	<1	<3	2	12	<1	8	30	<0.1
SEP 11...	<0.5	<1	<1	<3	5	11	<1	11	38	<0.1

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
DEC 12...	<10	4	<1	<1	230	<6	9	--	--	--
APR 25...	10	2	<1	<1	190	<6	7	63	279	94
JUN 19...	<10	5	<1	<1	230	<6	4	22	14	91
SEP 11...	10	11	<1	<1	260	<6	12	16	5.7	88



## STREAMS TRIBUTARY TO DETROIT RIVER

04166000 RIVER ROUGE AT BIRMINGHAM, MI

LOCATION.--Lat 42°32'45", long 83°13'25", in NW1/4 sec.36, T.2 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on left bank 25 ft downstream from mouth of Quarton Lake outlet, 100 ft upstream from bridge on Maple Road at Birmingham.

DRAINAGE AREA.--33.3 mi<sup>2</sup>. Prior to water year 1971, drainage area was 36.9 mi<sup>2</sup>. An area of 3.6 mi<sup>2</sup> noncontributing since then.

PERIOD OF RECORD.--June 1950 to current year.

REVISED RECORDS.--WSP 1387: 1951-52(M). WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since July 27, 1962. Datum of gage is 715.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Jan. 26 to Feb. 2 and Feb. 16-18. Records good except for estimated daily discharges, which are fair. Occasional regulation by Quarton Lake upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--20 years (water years 1951-70), 15.3 ft<sup>3</sup>/s, 5.63 in/yr; 21 years (water years 1971-91), 23.8 ft<sup>3</sup>/s, 9.71 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft<sup>3</sup>/s, June 26, 1968, gage height, 8.70 ft; minimum, 0.10 ft<sup>3</sup>/s, Aug. 8, 9, 1963; minimum gage height, 1.02 ft, Oct. 12, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	2100	321	4.03	May 17	1000	336	4.11
Nov. 5	2300	373	4.30	May 26	1100	*664	*5.68
Dec. 29	1700	379	4.33	Aug. 19	1000	317	4.01
Mar. 2	2300	224	3.48				

Minimum discharge, 5.5 ft<sup>3</sup>/s, Aug. 8, Sept. 29, 30, gage height, 1.64 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	19	22	58	19	21	21	28	36	8.3	8.5	14
2	12	18	21	47	21	83	20	27	46	9.1	6.9	10
3	12	17	45	42	28	93	20	25	37	28	12	12
4	43	17	83	36	35	40	18	24	29	21	11	30
5	21	165	43	36	45	33	25	35	27	14	7.8	15
6	15	177	33	36	38	42	21	67	25	11	6.9	11
7	17	64	29	33	35	40	19	36	24	50	6.4	9.5
8	32	45	27	31	32	28	21	28	22	38	23	8.9
9	150	41	29	31	33	27	38	29	21	16	38	9.0
10	218	33	34	30	31	27	51	27	26	12	15	9.2
11	140	28	30	31	24	24	26	24	50	11	9.6	8.8
12	57	25	28	33	19	23	21	31	37	10	7.9	8.3
13	42	24	28	29	18	22	20	63	26	12	8.0	7.7
14	32	23	24	30	21	21	26	31	22	11	6.6	7.6
15	28	23	25	32	19	20	58	22	17	9.7	12	7.6
16	25	23	28	48	16	19	46	21	22	8.8	25	7.0
17	27	21	26	55	15	19	32	168	16	8.2	28	6.5
18	76	20	36	40	18	30	28	51	14	8.2	47	6.7
19	45	19	30	38	56	25	28	29	12	7.9	197	6.9
20	31	19	24	48	55	22	93	22	11	7.6	86	6.5
21	24	19	29	40	40	23	79	19	10	7.6	30	6.8
22	22	29	54	30	39	24	49	17	14	11	20	6.6
23	22	25	52	29	29	25	42	15	19	19	21	8.3
24	21	21	30	26	26	25	54	58	14	10	16	7.7
25	19	20	26	23	23	22	45	64	11	8.3	13	7.5
26	19	19	23	22	22	20	36	426	10	7.5	11	7.6
27	19	28	21	22	20	24	32	134	9.6	7.3	10	6.7
28	18	49	23	21	20	44	33	64	9.0	7.0	9.8	6.2
29	18	33	229	20	---	29	31	49	8.9	9.8	9.5	5.7
30	18	24	248	21	---	25	29	44	8.6	22	17	5.6
31	18	---	92	20	---	22	---	44	---	11	33	---
TOTAL	1254	1088	1472	1038	797	942	1062	1722	634.1	422.3	752.9	270.9
MEAN	40.5	36.3	47.5	33.5	28.5	30.4	35.4	55.5	21.1	13.6	24.3	9.03
MAX	218	177	248	58	56	93	93	426	50	50	197	30
MIN	12	17	21	20	15	18	15	15	8.6	7.0	6.4	5.6
CFSM	1.22	1.09	1.43	1.01	.86	.91	1.06	1.67	.63	.41	.73	.27
IN.	1.40	1.22	1.64	1.16	.89	1.05	1.19	1.92	.71	.47	.84	.30

CAL YR 1990	TOTAL	12574.5	MEAN	34.5	MAX	248	MIN	5.4	CFSM	1.04	IN	14.05
WTR YR 1991	TOTAL	11455.2	MEAN	31.4	MAX	426	MIN	5.6	CFSM	.94	IN	12.80

STREAMS TRIBUTARY TO DETROIT RIVER

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04166100 RIVER ROUGE AT SOUTHFIELD, MI

LOCATION.--Lat 42°26'52", long 83°17'52", in SW1/4 sec.32, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank at downstream side of bridge on Beech Road at Southfield, 4.2 mi east of Farmington.

DRAINAGE AREA.--87.9 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 609.62 ft, City of Southfield datum. Prior to Sept. 30, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 28 to Dec. 7, Dec. 24-28, and Jan. 21 to Mar. 1. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 65.4 ft<sup>3</sup>/s, 10.10 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,900 ft<sup>3</sup>/s, June 26, 1968, gage height, 19.04 ft; minimum, 0.1 ft<sup>3</sup>/s, Aug. 2, 1964, gage height, 1.15 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	2300	1,080	10.66	May 26	1400	*2,000	*13.23
Nov. 6	0300	1,150	10.89	June 1	0500	730	9.33
Dec. 29	2100	1,580	12.17	Aug. 19	1100	1,190	11.02
Mar. 3	0300	744	9.39				

Minimum discharge, 14 ft<sup>3</sup>/s, Aug. 7,8; minimum gage height, 3.28 ft, Aug. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	45	62	191	53	65	56	60	328	20	20	37
2	31	45	58	142	60	259	53	58	151	26	17	27
3	29	42	120	108	80	422	52	54	104	112	32	25
4	101	42	250	105	100	133	51	51	65	97	24	89
5	64	449	130	95	120	108	69	89	56	36	19	36
6	42	875	92	94	100	147	58	222	50	26	16	27
7	39	219	82	84	95	132	53	90	46	227	15	23
8	85	130	77	85	85	87	68	65	44	222	92	21
9	512	103	77	80	90	82	81	67	40	46	175	22
10	814	91	90	74	80	80	112	60	41	33	37	24
11	723	80	83	74	60	71	65	54	138	29	25	22
12	179	74	76	84	50	65	54	57	88	26	21	20
13	111	69	78	82	48	64	51	257	47	27	19	20
14	88	66	67	78	56	61	77	100	43	27	18	20
15	78	64	71	80	50	57	183	64	37	24	21	19
16	68	63	88	154	45	55	144	55	39	21	38	19
17	70	61	73	181	41	55	80	445	38	20	59	18
18	284	57	106	102	70	94	66	141	32	19	132	17
19	127	56	89	95	150	72	73	70	29	19	814	17
20	78	55	71	124	250	61	465	55	27	18	357	18
21	65	54	87	95	150	59	337	49	27	18	75	17
22	58	83	114	83	160	58	156	46	35	21	50	18
23	54	69	124	78	110	69	110	43	50	32	43	23
24	53	60	85	68	90	67	133	195	32	23	36	20
25	49	55	70	61	70	59	108	197	27	18	29	19
26	48	52	63	59	60	55	85	1430	26	17	26	20
27	49	75	58	58	57	62	74	814	24	16	24	18
28	47	130	65	57	55	169	75	213	23	15	23	18
29	46	100	812	56	---	89	67	133	22	26	22	17
30	45	70	1240	57	---	67	63	113	21	55	23	16
31	45	---	424	55	---	59	---	111	---	27	134	---
TOTAL	4115	3434	4982	2839	2435	2983	3119	5458	1730	1343	2436	707
MEAN	133	114	161	91.6	87.0	96.2	104	176	57.7	43.3	78.6	23.6
MAX	814	875	1240	191	250	422	465	1430	328	227	814	89
MIN	29	42	58	55	41	55	51	43	21	15	15	16
CFSM	1.51	1.30	1.83	1.04	.99	1.09	1.18	2.00	.66	.49	.89	.27
IN.	1.74	1.45	2.11	1.20	1.03	1.26	1.32	2.31	.73	.57	1.03	.30

CAL YR 1990 TOTAL 41388 MEAN 113 MAX 1280 MIN 14 CFSM 1.29 IN 17.52  
WTR YR 1991 TOTAL 35581 MEAN 97.5 MAX 1430 MIN 15 CFSM 1.11 IN 15.06

## STREAMS TRIBUTARY TO DETROIT RIVER

04166200 EVANS DITCH AT SOUTHFIELD, MI

LOCATION.--Lat 42°27'28", long 83°16'03", in SE1/4 sec.28, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank 70 ft upstream from bridge on Nine Mile Road at Southfield, 1.6 mi upstream from mouth, and 5.5 mi east of Farmington.

DRAINAGE AREA.--9.49 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Datum of gage is 615.07 ft, City of Southfield datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 8.64 ft<sup>3</sup>/s, 12.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,200 ft<sup>3</sup>/s, Oct. 1, 1981, gage height, 15.03 ft, from floodmark, from rating curve extended above 410 ft<sup>3</sup>/s; no flow June 13-15, 1986, caused by regulation of unknown source.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s, revised, and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	1815	415	9.65	June 1	0230	431	9.77
Mar. 2	2000	404	9.54	Aug. 8	2045	336	9.13
May 26	0715	*686	*11.38				

Minimum daily discharge, 0.93 ft<sup>3</sup>/s, Aug. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.3	2.5	3.2	13	3.1	6.1	4.3	5.7	85	1.8	1.1	1.3
2	2.2	2.7	2.9	11	4.9	98	3.9	3.9	27	4.2	1.0	1.1
3	2.1	2.8	43	8.7	6.6	34	3.8	3.5	8.4	15	5.8	6.2
4	16	3.0	26	6.8	7.9	14	3.9	3.3	5.6	15	1.1	13
5	2.4	136	8.1	6.2	9.9	11	9.6	32	4.5	2.2	.93	1.4
6	1.9	26	6.5	6.2	7.5	24	4.3	13	4.4	1.7	1.1	1.2
7	9.7	11	5.7	5.5	6.9	12	3.9	4.8	3.6	55	.99	1.1
8	9.4	6.6	5.8	5.0	6.5	8.5	12	4.1	3.1	38	76	1.1
9	124	5.4	6.5	5.0	6.7	9.2	8.5	5.2	2.8	2.2	11	1.7
10	159	4.8	7.2	4.8	5.9	7.6	4.4	3.6	8.9	1.8	2.0	1.5
11	21	4.3	5.6	5.7	4.7	6.9	3.5	3.2	34	1.6	1.6	1.2
12	8.3	4.0	5.1	8.8	3.8	6.4	3.4	25	5.4	1.4	1.5	1.1
13	7.4	3.7	5.1	5.3	4.0	6.2	3.3	22	3.5	1.7	1.5	1.3
14	5.3	3.6	3.9	8.3	7.1	5.7	11	5.3	3.1	1.4	1.4	1.2
15	5.3	3.5	7.5	9.4	4.5	5.6	27	5.2	3.4	1.2	7.2	1.2
16	4.2	3.5	9.0	36	3.7	5.0	7.1	3.6	5.1	1.2	2.3	1.3
17	5.3	3.2	6.0	22	4.3	5.2	4.8	27	2.6	1.2	37	1.3
18	79	3.0	14	10	6.5	15	4.3	4.1	2.4	1.3	9.5	1.3
19	8.1	3.0	6.8	13	46	6.4	11	3.3	2.3	1.3	65	1.2
20	5.1	2.9	4.8	17	17	5.6	88	3.1	2.2	1.2	6.0	1.2
21	4.4	2.9	14	8.9	14	5.4	25	2.9	2.0	1.4	2.3	1.2
22	3.9	14	9.2	5.9	13	4.9	13	2.7	16	2.8	4.4	1.7
23	3.6	4.3	7.8	5.1	7.0	9.1	9.4	4.5	4.4	2.8	2.4	4.4
24	3.5	3.3	7.3	4.7	6.2	6.8	13	36	2.2	1.1	1.5	1.0
25	3.2	2.9	5.5	3.9	5.7	4.9	7.8	68	2.0	1.2	1.4	1.0
26	3.1	3.3	4.5	3.7	5.1	4.9	6.8	284	2.0	1.0	1.4	1.6
27	2.9	11	4.2	3.5	4.5	8.5	6.4	21	2.0	1.1	1.4	1.0
28	2.9	15	5.1	3.9	5.4	20	5.8	15	1.9	1.0	1.4	1.0
29	2.7	4.3	232	3.5	---	6.9	4.7	7.8	1.9	15	1.4	1.0
30	2.7	3.4	118	4.1	---	4.8	4.3	7.4	1.7	3.7	6.2	1.1
31	2.7	---	23	3.6	---	4.5	---	13	---	1.1	6.5	---
TOTAL	513.6	299.9	613.3	258.5	228.4	373.1	318.2	643.2	253.4	182.6	264.32	56.9
MEAN	16.6	10.0	19.8	8.34	8.16	12.0	10.6	20.7	8.45	5.89	8.53	1.90
MAX	159	136	232	36	46	98	88	284	85	55	76	13
MIN	1.9	2.5	2.9	3.5	3.1	4.5	3.3	2.7	1.7	1.0	.93	1.0
CFSM	1.75	1.05	2.09	.88	.86	1.26	1.12	2.18	.89	.62	.90	.20
IN.	2.01	1.18	2.40	1.01	.90	1.46	1.25	2.52	.99	.72	1.04	.22
CAL YR 1990	TOTAL	4790.10	MEAN	13.1	MAX	260	MIN	1.2	CFSM	1.38	IN	18.77
WTR YR 1991	TOTAL	4005.42	MEAN	11.0	MAX	284	MIN	.93	CFSM	1.16	IN	15.70

## STREAMS TRIBUTARY TO DETROIT RIVER

04166300 UPPER RIVER ROUGE AT FARMINGTON, MI

LOCATION.--Lat 42°27'52", long 83°22'11", in NW1/4 sec.27, T.1 N., R.9 E., Oakland County, Hydrologic Unit 04090004, on left bank 800 ft downstream from bridge on Shiawassee Road at Farmington.

DRAINAGE AREA.--17.5 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1958 to current year.

REVISED RECORDS.--WSP 1912: 1959(M), 1960(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 690.4 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 27, 28, Jan. 1-6, Jan. 22 to Feb. 4, and Feb. 11-18. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 12.8 ft<sup>3</sup>/s, 9.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft<sup>3</sup>/s, June 25, 1968, gage height, 8.70 ft; minimum, 0.07 ft<sup>3</sup>/s, Aug. 30, 1966, result of regulation; minimum daily, 0.32 ft<sup>3</sup>/s, Aug. 10, 1964, Aug. 29, 1966.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 10	1900	183	4.41	May 26	0700	502	5.89
Nov. 5	2200	231	4.68	Aug. 19	0600	*614	*6.28
Dec. 29	2000	309	5.08	Aug. 31	0130	147	a4.20

a From graph based on gage readings.

Minimum discharge, 2.5 ft<sup>3</sup>/s, July 26, 27, gage height, 2.84 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.8	7.2	12	35	9.0	12	11	13	60	4.1	5.8	18
2	5.6	7.0	11	25	10	40	9.5	12	36	5.7	4.2	10
3	5.5	6.7	25	20	15	49	9.4	11	24	29	9.1	9.2
4	27	7.1	45	18	20	26	9.4	10	15	15	6.2	26
5	17	103	23	18	24	21	14	23	11	7.2	5.0	12
6	9.3	117	17	17	21	26	12	52	9.4	5.6	4.0	9.0
7	8.3	47	14	16	18	25	10	25	8.1	35	3.4	7.4
8	13	30	13	15	16	17	10	16	7.1	43	27	6.2
9	91	21	13	15	16	16	13	16	6.7	13	43	6.4
10	142	16	16	13	15	15	15	14	7.4	8.0	13	6.5
11	92	14	14	12	11	13	12	12	18	6.6	7.6	6.2
12	42	12	13	14	9.8	12	9.3	10	14	5.8	5.9	6.0
13	26	11	13	12	9.0	12	10	10	9.1	5.9	4.7	6.1
14	18	10	11	12	10	11	12	10	7.3	5.4	4.1	6.0
15	14	9.8	12	14	9.0	10	37	9.1	6.2	4.7	4.2	5.9
16	12	9.6	16	32	8.0	10	37	8.8	6.3	4.3	3.9	5.4
17	11	9.3	14	39	7.5	10	21	42	6.2	4.1	16	5.0
18	30	9.0	20	24	10	17	15	16	5.7	4.0	32	5.1
19	19	8.7	17	21	39	14	16	11	5.2	3.6	281	4.8
20	13	8.6	13	28	38	13	80	9.0	4.9	3.4	63	5.0
21	10	8.5	17	23	27	12	67	7.8	4.4	3.7	23	4.5
22	9.7	14	21	16	30	11	37	7.1	8.1	4.3	13	4.4
23	9.1	12	17	12	20	12	25	6.6	9.3	5.8	9.9	5.1
24	8.6	10	14	11	16	12	27	18	6.6	4.1	8.3	4.6
25	8.1	9.2	13	11	14	12	22	14	5.5	3.4	7.1	4.6
26	7.8	8.8	11	10	12	11	18	235	4.9	3.2	6.4	5.7
27	7.6	14	11	10	11	11	15	62	4.5	3.1	5.9	4.7
28	7.1	31	13	9.8	10	27	16	31	4.4	3.1	5.3	4.1
29	7.0	20	172	9.4	---	18	15	20	4.1	14	5.5	4.0
30	7.1	14	204	9.9	---	14	14	16	4.4	18	14	4.1
31	7.2	---	75	9.4	---	11	---	16	---	8.7	68	---
TOTAL	690.8	605.5	900	531.5	455.3	520	618.6	763.4	323.8	284.8	709.5	212.0
MEAN	22.3	20.2	29.0	17.1	16.3	16.8	20.6	24.6	10.8	9.19	22.9	7.07
MAX	142	117	204	39	39	49	80	235	60	43	281	26
MIN	5.5	6.7	11	9.4	7.5	10	9.3	6.6	4.1	3.1	3.4	4.0
CFSM	1.27	1.15	1.66	.98	.93	.96	1.18	1.41	.62	.53	1.31	.40
IN.	1.47	1.29	1.91	1.13	.97	1.11	1.31	1.62	.69	.61	1.51	.45

CAL YR 1990	TOTAL	8063.4	MEAN	22.1	MAX	216	MIN	3.4	CFSM	1.26	IN	17.14
WTR YR 1991	TOTAL	6615.2	MEAN	18.1	MAX	281	MIN	3.1	CFSM	1.03	IN	14.06



## STREAMS TRIBUTARY TO DETROIT RIVER

04166500 RIVER ROUGE AT DETROIT, MI

LOCATION.--Lat 42°22'20", long 83°15'20", in SW1/4 sec.27, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 500 ft upstream from bridge on Plymouth Road at Detroit, 4 mi upstream from Middle River Rouge.

DRAINAGE AREA.--187 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1034: 1933(M). WSP 1054: 1939, 1943, 1945(M). WSP 1437: 1931-32, 1934, 1936(M), 1937-38, 1944(M), 1945. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 584.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 16, 1948, nonrecording gage at site 1 mi downstream at datum 4.6 ft lower.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 5-10, and Feb. 13-18. Records good, except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--61 years, 120 ft<sup>3</sup>/s, 8.71 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,000 ft<sup>3</sup>/s, Apr. 5, 1947; maximum gage height, 23.0 ft, Apr. 6, 1947, from floodmark, site and datum then in use; minimum discharge, 1.8 ft<sup>3</sup>/s, Aug. 1, 2, 1964, gage height, 3.00 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	0500	1,660	13.11	May 26	2100	*3,740	*17.17
Nov. 6	1000	1,680	13.18	Aug. 19	2400	2,300	14.75
Dec. 30	1000	2,950	15.87				

Minimum daily discharge, 23 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	54	72	99	382	80	112	85	107	909	34	40	111
2	50	73	91	279	85	426	80	107	343	53	32	59
3	49	68	194	218	103	795	74	93	269	69	73	48
4	166	67	643	158	133	240	74	85	144	231	53	236
5	154	579	242	150	177	173	113	139	113	143	36	94
6	79	1550	155	145	174	201	99	502	98	53	29	58
7	71	614	127	135	146	232	82	194	85	183	26	45
8	162	253	111	115	131	141	83	129	77	528	101	39
9	756	185	108	115	136	120	150	161	70	129	556	46
10	1300	157	127	115	131	119	140	119	66	63	113	61
11	1450	133	119	124	109	106	110	98	213	51	55	42
12	453	116	106	166	83	97	82	117	218	45	41	37
13	223	105	105	119	80	90	72	390	94	41	35	36
14	164	99	92	136	90	86	108	174	75	44	33	36
15	144	95	93	158	80	81	283	113	75	39	36	35
16	120	92	144	296	70	77	293	95	121	36	82	33
17	114	90	107	450	65	75	146	443	69	32	83	32
18	524	82	169	226	85	139	108	326	62	30	327	32
19	314	82	153	184	305	118	116	128	50	28	1080	31
20	145	79	105	256	430	91	658	97	46	27	1500	31
21	116	76	123	206	244	83	761	85	43	27	243	30
22	104	151	221	128	252	82	304	77	74	30	117	30
23	94	128	185	140	182	97	202	81	161	45	117	49
24	89	101	149	117	142	101	223	277	66	43	74	40
25	85	85	115	106	127	88	186	497	51	30	58	34
26	83	78	100	93	115	77	148	2510	44	26	49	35
27	77	138	90	95	102	82	130	2390	42	24	45	35
28	74	231	105	91	103	260	129	579	38	23	42	31
29	71	194	866	89	---	152	119	240	36	25	40	30
30	70	119	2640	85	---	110	111	195	35	144	41	28
31	71	---	1390	90	---	91	---	204	---	61	254	---
TOTAL	7426	5892	9074	5167	3960	4742	5269	10752	3787	2337	5411	1484
MEAN	240	196	293	167	141	153	176	347	126	75.4	175	49.5
MAX	1450	1550	2640	450	430	795	761	2510	909	528	1500	236
MIN	49	67	90	85	65	75	72	77	35	23	26	28
CFSM	1.28	1.05	1.57	.89	.75	.82	.94	1.86	.67	.40	.94	.27
IN.	1.48	1.17	1.81	1.03	.79	.94	1.05	2.14	.75	.46	1.08	.30

CAL YR 1990 TOTAL 79348 MEAN 217 MAX 3290 MIN 27 CFSM 1.16 IN 15.78  
WTR YR 1991 TOTAL 65301 MEAN 179 MAX 2640 MIN 23 CFSM .96 IN 12.99

## STREAMS TRIBUTARY TO DETROIT RIVER

219

04167000 MIDDLE RIVER ROUGE NEAR GARDEN CITY, MI

LOCATION.--Lat 42°20'55", long 83°18'45", in SW1/4 NW1/4 sec.6, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 200 ft downstream from bridge on Inkster Road, 1.8 mi northeast of Garden City, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--99.9 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1930 to September 1933 (published as "at Detroit"), June 1947 to September 1977, October 1977 to September 1983 (operated as a crest-stage partial-record station), October 1983 to current year. Monthly discharge only for October, November, 1930, published in WSP 1307.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 600.95 ft above National Geodetic Vertical Datum of 1929. Nov. 21, 1930 to Sept. 30, 1933, nonrecording gage at site 4.8 mi downstream at datum 17.48 ft lower. June 6, 1947 to Oct. 18, 1948, nonrecording gage at site 200 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Jan. 25 to Feb. 1 and Feb. 12-18. Records good except for estimated daily discharges, which are fair. Occasional regulation by reservoirs upstream from station since 1956. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--41 years (water years 1931-33, 1948-77, 1984-91), 73.7 ft<sup>3</sup>/s, 10.02 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,330 ft<sup>3</sup>/s, June 26, 1968; maximum gage height, 10.50 ft, May 10, 1948; minimum discharge, 0.9 ft<sup>3</sup>/s, Aug. 16, 1956.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Dec. 30	1200	867	a*9.51	June 3	0300	702	7.89
May 26	0800	*1,010	8.78				

a Log jam.

Minimum discharge, 20 ft<sup>3</sup>/s, July 28, gage height, 1.78 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	54	82	294	66	82	69	83	209	31	33	73
2	38	51	75	175	67	228	66	75	390	50	27	44
3	36	47	155	128	76	256	64	63	458	68	60	39
4	83	46	233	101	90	156	64	60	222	92	40	108
5	81	297	135	102	107	120	84	116	124	55	29	61
6	70	479	107	106	112	125	73	290	86	37	25	42
7	61	285	97	101	106	125	68	143	70	53	24	36
8	77	170	90	95	100	106	67	96	62	105	122	33
9	282	125	87	92	99	93	94	105	55	64	209	58
10	453	104	89	89	99	89	75	81	51	40	76	85
11	453	95	90	100	89	84	63	69	102	33	43	47
12	235	89	86	122	70	79	58	63	96	30	32	36
13	141	83	85	98	63	76	57	60	62	32	28	33
14	101	80	78	100	70	74	95	58	50	33	29	33
15	92	78	82	109	63	72	172	54	58	28	25	33
16	83	73	91	185	57	68	163	56	74	27	27	34
17	79	65	84	222	54	65	107	160	49	27	74	33
18	232	59	99	155	72	93	82	96	43	26	152	31
19	124	56	98	128	192	83	106	60	40	26	302	29
20	92	54	85	138	216	76	408	50	38	25	520	27
21	82	53	103	135	154	73	342	48	36	27	143	28
22	78	98	124	113	147	69	235	45	91	29	82	29
23	73	85	116	97	129	75	160	43	132	34	74	46
24	71	76	103	87	107	79	163	109	57	26	52	32
25	67	69	88	80	98	75	139	145	42	24	45	31
26	61	65	81	75	87	69	117	877	37	22	41	31
27	59	103	72	71	79	75	100	476	35	22	38	30
28	61	127	71	69	79	127	97	179	34	21	35	28
29	56	113	432	67	---	102	89	109	32	35	34	29
30	55	94	810	66	---	86	85	99	32	75	33	29
31	56	---	611	66	---	75	---	101	---	51	73	---
TOTAL	3572	3273	4639	3566	2748	3055	3562	4069	2867	1248	2527	1228
MEAN	115	109	150	115	98.1	98.5	119	131	95.6	40.3	81.5	40.9
MAX	453	479	810	294	216	256	408	877	458	105	520	108
MIN	36	46	71	66	54	65	57	43	32	21	24	27
CFSM	1.15	1.09	1.50	1.15	.98	.99	1.19	1.31	.96	.40	.82	.41
IN.	1.33	1.22	1.73	1.33	1.02	1.14	1.33	1.52	1.07	.46	.94	.46

CAL YR 1990 TOTAL 45910 MEAN 126 MAX 1460 MIN 23 CFSM 1.26 IN 17.10  
WTR YR 1991 TOTAL 36354 MEAN 99.6 MAX 877 MIN 21 CFSM 1.00 IN 13.54

## STREAMS TRIBUTARY TO DETROIT RIVER

04168000 LOWER RIVER ROUGE AT INKSTER, MI

LOCATION.--Lat 42°18'00", long 83°18'00", in SW1/4 SE1/4 sec.19, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 10 ft downstream from bridge on John Daly Road, 0.6 mi northeast of Inkster, and 4.8 mi upstream from mouth.

DRAINAGE AREA.--83.2 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1947 to current year.

REVISED RECORDS.--WSP 1174: 1948(M). WSP 1437: 1949. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 593.14 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 20, 1948, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 2, 3, Nov. 15-17, Dec. 25-28, Jan. 4-8, Jan. 21 to Feb. 3, Feb. 12-18, June 26, 27, Aug. 13, 14, and Sept. 13, 14. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 53.6 ft<sup>3</sup>/s, 8.75 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,600 ft<sup>3</sup>/s, June 26, 1968, gage height, 13.62 ft; minimum, 0.2 ft<sup>3</sup>/s, Sept. 13, 1955, Jan. 23, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Dec. 30	2000	*1,850	*11.50	May 26	0900	927	9.21

Minimum discharge, 0.56 ft<sup>3</sup>/s, July 29, gage height, 2.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14	16	36	189	25	52	30	39	169	2.8	1.6	11
2	12	16	32	119	26	164	28	32	340	13	2.0	6.1
3	11	15	108	81	34	361	25	27	364	18	18	6.2
4	34	16	307	66	60	132	24	24	102	30	6.9	10
5	20	209	134	51	87	101	36	65	53	13	4.5	6.6
6	14	558	81	45	82	106	31	211	37	5.8	3.2	6.3
7	18	192	66	39	75	126	27	96	27	5.9	2.7	4.0
8	31	113	56	37	64	71	25	56	21	24	44	3.5
9	235	82	55	36	72	59	74	43	17	5.8	68	13
10	520	64	62	33	73	53	71	36	17	3.8	15	15
11	533	51	56	50	51	47	40	30	31	2.4	5.8	8.3
12	174	42	49	76	40	40	28	26	29	1.7	4.3	5.6
13	99	35	46	56	35	37	28	43	16	1.7	4.0	4.6
14	70	32	38	55	32	35	49	35	12	1.6	3.5	3.9
15	54	30	44	59	29	32	102	23	20	1.6	7.5	3.2
16	43	29	72	156	28	29	106	24	20	2.0	17	3.2
17	36	27	63	250	28	29	60	82	11	1.8	12	5.6
18	181	25	81	129	30	48	44	36	9.7	1.7	27	3.8
19	132	24	88	92	135	46	61	20	7.9	1.7	76	3.5
20	67	22	61	135	280	39	454	15	7.0	1.1	131	3.9
21	49	22	83	105	176	35	414	13	6.1	1.1	31	3.7
22	41	45	146	65	187	33	179	11	16	1.9	14	4.0
23	34	39	105	54	111	40	106	19	25	12	12	9.2
24	30	34	87	43	76	39	105	71	10	4.3	10	4.4
25	27	31	75	38	63	33	100	27	7.0	1.4	7.7	3.8
26	23	26	62	34	53	30	70	693	6.0	3.2	7.4	4.2
27	21	48	54	30	43	34	53	286	5.3	1.9	6.9	3.4
28	19	77	45	28	38	91	50	95	4.6	.94	6.0	3.4
29	17	71	465	25	---	54	43	52	3.6	1.2	5.1	3.2
30	17	45	1460	25	---	39	40	83	2.9	8.3	4.4	2.8
31	16	---	940	25	---	31	---	40	---	3.4	15	---
TOTAL	2592	2036	5057	2226	2033	2066	2503	2353	1397.1	179.04	573.5	169.4
MEAN	83.6	67.9	163	71.8	72.6	66.6	83.4	75.9	46.6	5.78	18.5	5.65
MAX	533	558	1460	250	280	361	454	693	364	30	131	15
MIN	11	15	32	25	25	29	24	11	2.9	.94	1.6	2.8
CFSM	1.01	.82	1.96	.86	.87	.80	1.00	.91	.56	.07	.22	.07
IN.	1.16	.91	2.26	1.00	.91	.92	1.12	1.05	.62	.08	.26	.08

CAL YR 1990	TOTAL	32535.90	MEAN	89.1	MAX	1720	MIN	1.4	CFSM	1.07	IN	14.55
WTR YR 1991	TOTAL	23185.04	MEAN	63.5	MAX	1460	MIN	.94	CFSM	.76	IN	10.37

## STREAMS TRIBUTARY TO LAKE ERIE

221

04170000 HURON RIVER AT MILFORD, MI

LOCATION.--Lat 42°34'44", long 83°37'36", in NE1/4 sec.16, T.2 N., R.7 E., Oakland County, Hydrologic Unit 04090005, on left bank 40 ft downstream from bridge on General Motors Road, 0.5 mi downstream from Sherwood Creek, and 0.5 mi west of Milford.

DRAINAGE AREA.--132 mi<sup>2</sup>.

PERIOD OF RECORD.--September 1948 to current year.

REVISED RECORDS.--WSP 1337: 1952(m). WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 880.00 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1970, at site 240 ft upstream at same datum.

REMARKS.--No estimated daily discharges. Records good. Flow below about 300 ft<sup>3</sup>/s regulated by powerplant 1.5 mi upstream from station prior to May 20, 1957; occasional regulation for lake level control since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--43 years, 98.4 ft<sup>3</sup>/s, 10.12 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 648 ft<sup>3</sup>/s, Oct. 3, 1981, gage height, 7.87 ft; maximum gage height, 8.26 ft, June 28, 1968; minimum daily discharge, 5.2 ft<sup>3</sup>/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 298 ft<sup>3</sup>/s, Oct. 12, gage height, 6.66 ft; minimum daily, 19 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	90	119	177	264	129	135	136	154	111	33	33	47
2	85	126	171	238	128	163	127	149	112	30	29	37
3	89	122	179	213	130	196	122	146	114	29	34	35
4	138	126	187	194	137	185	119	131	114	27	38	48
5	140	175	191	187	149	177	122	118	106	25	37	45
6	130	222	186	182	154	175	122	139	103	25	36	39
7	121	230	181	177	153	178	114	141	99	51	35	36
8	126	215	176	172	151	173	109	133	93	75	50	34
9	177	197	173	168	153	166	120	130	87	62	79	35
10	246	182	172	165	150	164	134	126	85	53	64	35
11	286	171	170	164	144	162	134	119	94	50	48	33
12	296	165	165	165	137	158	128	114	95	48	42	33
13	279	162	163	160	133	154	123	114	87	48	42	32
14	249	159	160	156	133	150	123	111	80	48	40	33
15	229	158	154	153	132	147	140	109	75	43	36	33
16	216	157	154	157	131	146	150	104	73	37	35	33
17	208	160	152	166	130	145	147	107	66	35	39	32
18	208	159	151	165	130	153	144	103	56	33	56	33
19	209	158	152	162	146	156	139	90	47	30	79	32
20	201	156	150	163	161	158	170	80	47	27	98	36
21	187	154	151	161	162	155	197	74	48	26	88	43
22	174	157	164	155	167	158	200	70	54	30	72	42
23	164	159	171	149	165	156	193	69	65	30	61	45
24	153	158	167	146	156	156	186	82	60	26	53	51
25	146	154	162	141	151	152	182	90	58	22	44	57
26	140	153	156	139	146	145	173	125	55	21	40	58
27	134	160	152	136	139	141	166	135	53	20	38	57
28	127	184	150	135	135	159	162	137	50	19	38	57
29	124	193	193	134	---	169	167	130	48	23	37	56
30	119	185	259	133	---	157	164	122	42	44	36	49
31	116	---	282	131	---	145	---	116	---	41	51	---
TOTAL	5307	4976	5371	5131	4032	4934	4413	3568	2277	1111	1508	1236
MEAN	171	166	173	166	144	159	147	115	75.9	35.8	48.6	41.2
MAX	296	230	282	264	167	196	200	154	114	75	98	58
MIN	85	119	150	131	128	135	109	69	42	19	29	32
CFSM	1.30	1.26	1.31	1.26	1.09	1.21	1.11	.87	.58	.27	.37	.31
IN.	1.50	1.40	1.51	1.45	1.14	1.39	1.24	1.01	.64	.31	.42	.35
CAL YR 1990	TOTAL	47829	MEAN	131	MAX	296	MIN	28	CFSM	.99	IN	13.48
WTR YR 1991	TOTAL	43864	MEAN	120	MAX	296	MIN	19	CFSM	.91	IN	12.36



## STREAMS TRIBUTARY TO LAKE ERIE

04170490 KENT LAKE NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'34", in sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, at Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--The inlet and outlet is the Huron River which enters the northeast end of the lake and leaves the southwest end of the lake. Streamflow records are currently collected on the Huron River at sites about 1 mi upstream (04170000) and 150 ft downstream (04170500) from Kent Lake. Maximum depth, 38 ft, surface area, 1,200 acres. A concrete dam with steel drum spillway is used to control the lake level.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 16.68 ft, Apr. 6, 1950; minimum, 11.60 ft, Mar. 7, 8, 1968.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 16.28 ft, Oct. 12-14; minimum not determined, occurred sometime during period Jan. 26 to Feb. 7.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.81	14.17	12.82	13.00	---	12.64	13.76	15.57	15.54	15.17	15.16	15.22
2	15.80	14.05	12.81	13.00	---	12.69	13.76	15.56	15.53	15.16	15.16	15.20
3	15.80	13.99	12.82	13.00	---	12.76	13.88	15.56	15.52	15.14	15.18	15.20
4	15.92	13.98	12.80	13.00	---	12.78	13.95	15.54	15.48	15.13	15.18	15.24
5	15.94	14.07	12.80	12.98	---	12.79	14.02	15.51	15.44	15.12	15.18	15.24
6	15.94	14.16	12.81	12.96	---	12.85	14.03	15.51	15.42	15.11	15.17	15.23
7	15.95	14.14	12.80	12.93	12.35	12.86	14.05	15.52	---	15.20	15.17	15.22
8	15.95	14.00	12.79	12.91	12.50	12.87	14.06	15.53	---	15.27	15.22	15.21
9	16.05	13.90	12.78	12.90	12.60	12.86	14.12	15.52	---	15.26	15.30	15.21
10	16.17	13.84	12.78	12.88	12.64	12.85	14.27	15.50	---	15.24	15.30	15.21
11	16.24	13.78	12.77	12.88	12.66	12.84	14.41	15.48	---	15.23	15.28	15.20
12	16.28	13.76	12.76	12.88	12.64	12.83	14.45	15.48	---	15.21	15.26	15.19
13	16.28	13.71	12.75	12.87	12.64	12.82	14.47	15.48	---	15.21	15.25	15.19
14	16.26	13.57	12.75	12.85	12.65	12.80	14.48	15.48	---	15.20	15.23	15.19
15	16.22	13.35	12.74	12.84	12.64	12.78	14.52	15.46	---	15.19	15.22	15.18
16	16.19	13.17	12.73	12.85	12.62	12.77	14.61	15.44	---	15.18	15.21	15.18
17	16.15	13.01	12.73	12.85	12.62	12.77	14.78	15.47	---	15.16	15.23	15.17
18	16.14	12.92	12.72	12.83	12.62	12.81	14.86	15.45	---	15.16	15.27	15.17
19	16.14	12.87	12.72	12.82	12.65	12.84	14.92	15.41	---	15.15	15.32	15.16
20	16.12	12.81	12.71	12.82	12.68	12.90	15.01	15.37	---	15.14	15.35	15.16
21	16.10	12.77	12.72	12.82	12.70	12.98	15.05	15.35	---	15.14	15.35	15.17
22	16.00	12.77	12.73	12.82	12.72	13.05	15.13	15.33	---	15.15	15.34	15.19
23	15.67	12.76	12.77	12.82	12.72	13.05	15.37	15.32	---	15.16	15.32	15.19
24	15.49	12.76	12.75	12.71	12.72	13.11	15.53	15.35	---	15.14	15.29	15.20
25	15.39	12.75	12.76	12.43	12.70	13.19	15.57	15.43	---	15.13	15.26	15.21
26	15.33	12.75	12.77	---	12.68	13.41	15.58	15.51	---	15.12	15.24	15.22
27	15.29	12.75	12.77	---	12.67	13.55	15.58	15.52	---	15.10	15.23	15.23
28	15.27	12.81	12.82	---	12.66	13.66	15.57	15.53	---	15.10	15.23	15.23
29	15.15	12.84	12.83	---	---	13.78	15.57	15.52	---	15.11	15.22	15.23
30	14.70	12.82	12.94	---	---	13.78	15.54	15.51	---	15.14	15.22	15.21
31	14.43	---	12.99	---	---	13.76	---	15.49	---	15.15	15.23	---
MEAN	15.81	13.37	12.78	---	---	13.01	14.70	15.47	---	15.16	15.24	15.20
MAX	16.28	14.17	12.99	---	---	13.78	15.58	15.57	---	15.27	15.35	15.24
MIN	14.43	12.75	12.71	---	---	12.64	13.76	15.32	---	15.10	15.16	15.16

CAL YR 1990 MEAN 14.43 MAX 16.28 MIN 12.54

## STREAMS TRIBUTARY TO LAKE ERIE

223

04170500 HURON RIVER NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'35", in NE1/4 sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, on right bank 150 ft downstream from Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1948 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--No estimated daily discharges. Records fair. Occasional regulation by Kent Lake (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--43 years, 112 ft<sup>3</sup>/s, 10.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 ft<sup>3</sup>/s, Dec. 29, 1950, gage height, 5.05 ft, from rating curve extended above 600 ft<sup>3</sup>/s; minimum, 2.6 ft<sup>3</sup>/s, May 27, 1963, gage height, 0.53 ft; minimum daily, 6.4 ft<sup>3</sup>/s, May 7, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 446 ft<sup>3</sup>/s, Oct. 29, gage height, 3.69 ft; minimum daily, 27 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	97	224	202	273	162	152	146	166	160	48	40	59
2	91	177	201	260	157	164	102	164	154	46	39	55
3	86	159	208	242	156	183	64	167	150	42	42	54
4	152	153	204	228	157	189	88	158	137	39	41	67
5	158	181	205	218	161	176	108	151	126	34	40	65
6	155	214	207	210	166	172	114	155	118	33	39	64
7	157	277	203	203	121	180	119	157	111	65	37	60
8	158	284	200	197	120	180	123	160	108	88	49	61
9	203	245	196	193	145	177	73	157	100	81	76	59
10	256	221	194	189	157	174	61	153	94	72	76	60
11	285	201	192	189	160	171	101	143	108	67	69	57
12	297	192	188	191	158	168	117	140	117	60	61	53
13	295	209	187	187	156	165	122	140	109	61	58	52
14	281	245	185	182	158	158	127	140	97	58	54	52
15	262	261	183	178	156	152	136	134	90	54	50	51
16	244	255	180	181	152	150	95	127	94	50	48	49
17	226	234	178	186	152	150	90	133	87	45	52	49
18	221	204	177	188	150	144	119	123	78	44	65	47
19	218	199	177	185	156	141	139	113	67	42	83	44
20	209	194	174	186	164	130	169	102	60	39	101	42
21	206	184	175	182	171	122	181	94	56	38	102	43
22	298	184	180	177	177	140	105	86	55	41	99	44
23	318	181	191	173	178	138	98	83	65	43	91	47
24	230	181	187	198	175	148	151	91	62	35	79	49
25	191	179	187	211	170	76	169	122	63	32	70	51
26	169	178	181	191	166	46	174	144	60	29	61	56
27	153	181	176	177	161	83	172	149	58	28	57	56
28	147	193	173	163	156	116	172	151	58	27	56	56
29	265	204	200	169	---	150	169	151	57	29	55	58
30	321	204	245	181	---	152	162	145	59	36	57	54
31	262	---	267	170	---	147	---	141	---	38	63	---
TOTAL	6611	6198	6003	6058	4418	4594	3766	4240	2758	1444	1910	1614
MEAN	213	207	194	195	158	148	126	137	91.9	46.6	61.6	53.8
MAX	321	284	267	273	178	189	181	167	160	88	102	67
MIN	86	153	173	163	120	46	61	83	55	27	37	42
CAL YR 1990	TOTAL	5412	MEAN	148	MAX	321	MIN	11	CFSM	1.00	IN	13.6
WTR YR 1991	TOTAL	4964	MEAN	136	MAX	321	MIN	27	CFSM	.92	IN	12.4

## STREAMS TRIBUTARY TO LAKE ERIE

04172000 HURON RIVER NEAR HAMBURG, MI

LOCATION.--Lat 42°27'55", long 83°48'00", in sec.24, T.1 N., R.5 E., Livingston County, Hydrologic Unit 04090005, on right bank at downstream side of bridge on Hamburg Road, 1.1 mi north of Hamburg, and 3 mi upstream from Strawberry Lake.

DRAINAGE AREA.--308 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 850.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 12, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 25 to Jan. 10, Jan. 22-28, and Feb. 16. Records good except for estimated daily discharges, which are fair. Occasional regulation by Kent Lake (station 04170490), 11 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 215 ft<sup>3</sup>/s, 9.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,560 ft<sup>3</sup>/s, May 15, 1956, gage height, 8.35 ft; maximum gage height, 8.46 ft, June 30, 1968; minimum discharge, 26 ft<sup>3</sup>/s, July 15, 16, 1988; minimum gage height, 3.16 ft, Aug. 1-3, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 612 ft<sup>3</sup>/s, Oct. 13, gage height, 6.03 ft; maximum gage height, 6.42 ft, Jan. 2, backwater from ice; minimum daily discharge, 59 ft<sup>3</sup>/s, July 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	153	399	329	500	313	320	305	311	309	104	73	110
2	148	372	328	580	290	341	302	296	339	99	73	105
3	146	324	330	550	278	375	268	281	380	93	80	103
4	188	278	342	510	279	389	238	269	386	87	81	115
5	231	284	350	470	293	399	238	258	376	82	77	121
6	249	330	352	440	305	403	243	264	355	76	74	118
7	250	369	348	410	314	402	245	264	327	79	72	113
8	252	415	344	390	292	398	246	258	301	100	76	109
9	298	467	337	380	290	392	259	255	277	118	102	108
10	378	472	332	370	304	385	247	255	250	120	127	109
11	478	444	325	369	311	371	240	250	235	114	132	106
12	555	409	319	365	310	355	248	239	243	107	129	101
13	599	373	313	357	306	340	258	229	243	105	121	96
14	606	347	292	355	307	328	267	229	234	103	112	93
15	590	346	281	344	307	315	289	230	220	98	107	90
16	557	366	277	341	300	302	317	227	211	92	116	88
17	518	379	274	352	293	295	298	228	201	86	120	85
18	484	374	275	359	285	301	276	229	186	81	141	82
19	447	352	277	361	297	297	278	224	169	77	155	78
20	417	330	278	364	318	289	325	217	151	74	188	76
21	400	315	281	364	337	275	362	206	136	72	206	75
22	385	307	293	355	361	271	384	196	126	72	202	76
23	381	298	306	350	372	283	371	183	128	76	192	79
24	421	292	313	345	377	291	349	177	125	74	177	81
25	431	286	320	340	374	293	355	209	120	72	160	83
26	393	279	315	350	361	245	363	279	117	69	145	86
27	345	283	310	370	345	222	362	317	114	65	132	87
28	309	303	305	360	331	248	355	330	112	60	122	87
29	281	317	300	332	---	277	344	330	110	59	118	89
30	293	323	300	312	---	298	328	322	108	66	114	89
31	371	---	340	305	---	305	---	313	---	71	116	---
TOTAL	11554	10433	9686	11950	8850	10005	8960	7875	6589	2651	3840	2838
MEAN	373	348	312	385	316	323	299	254	220	85.5	124	94.6
MAX	606	472	352	580	377	403	384	330	386	120	206	121
MIN	146	278	274	305	278	222	238	177	108	59	72	75
CFSM	1.21	1.13	1.01	1.25	1.03	1.05	.97	.83	.71	.28	.40	.31
IN.	1.40	1.26	1.17	1.44	1.07	1.21	1.08	.95	.80	.32	.46	.34

CAL YR 1990 TOTAL 105548 MEAN 289 MAX 786 MIN 75 CFSM .94 IN 12.75  
WTR YR 1991 TOTAL 95231 MEAN 261 MAX 606 MIN 59 CFSM .85 IN 11.50

## STREAMS TRIBUTARY TO LAKE ERIE

04174050 HURON RIVER AT DELHI MILLS, MI

LOCATION.--Lat 42°20'01", long 83°48'34", in SE1/4 sec.2, T.2 S., R.5 E., Washtenaw County, Hydrologic Unit 04090005, at bridge on East Delhi Road, 5.0 mi northwest of Ann Arbor, 5.2 mi downstream from Mill Creek, 5.1 mi upstream from Barton Dam, and 60.0 mi upstream from mouth.

DRAINAGE AREA.--699 mi<sup>2</sup>.

PERIOD OF RECORD.--Water years 1971-81, 1983 to current year.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	TEMPER- ATURE WATER (DEG C) (00010)	CARBON, ORGANIC TOTAL (MG/L AS C) (00680)	PCB, TOTAL (UG/L) (39516)	ALDRIN, TOTAL (UG/L) (39330)	CHLOR- DANE, TOTAL (UG/L) (39350)	CHLOR- PYRIFOS TOTAL RECOVER (UG/L) (38932)	DEF TOTAL (UG/L) (39040)	DDD, TOTAL (UG/L) (39360)
NOV 01...	1350	617	11.5	8.4	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
DEC 13...	1850	625	4.0	9.0	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
APR 26...	1645	600	14.0	8.7	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
JUN 20...	1905	622	27.5	8.4	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
JUL 24...	1455	632	25.5	7.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
SEP 12...	1500	634	20.0	6.7	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
23...	1015	668	14.5	5.5	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01

DATE	DDE, TOTAL (UG/L) (39365)	DDT, TOTAL (UG/L) (39370)	DI- AZINON, TOTAL (UG/L) (39570)	DI- SYSTON TOTAL (UG/L) (39011)	DI- ELDRIN TOTAL (UG/L) (39380)	ENDO- SULFAN, TOTAL (UG/L) (39388)	ENDRIN, TOTAL (UG/L) (39390)	ETHION, TOTAL (UG/L) (39398)	FONOFOS (DY- FONATE) WATER WHOLE TOT.REC (UG/L) (82614)
NOV 01...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
DEC 13...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
APR 26...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
JUN 20...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
JUL 24...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SEP 12...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
23...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

DATE	HEPTA- CHLOR, TOTAL (UG/L) (39410)	HEPTA- CHLOR EPOXIDE TOTAL (UG/L) (39420)	LINDANE TOTAL (UG/L) (39340)	MALA- THION, TOTAL (UG/L) (39530)	METH- OXY- CHLOR, TOTAL (UG/L) (39480)	METHYL PARA- THION, TOTAL (UG/L) (39600)	METHYL TRI- THION, TOTAL (UG/L) (39790)	MIREX, TOTAL (UG/L) (39755)	NAPH- THA- LENES, POLY- CHLOR. TOTAL (UG/L) (39250)
NOV 01...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.1
DEC 13...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1
APR 26...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1
JUN 20...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1
JUL 24...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.1
SEP 12...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.1
23...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.1



## STREAMS TRIBUTARY TO LAKE ERIE

04174050 HURON RIVER AT DELHI MILLS, MI--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	PARA- THION, TOTAL (UG/L) (39540)	PER- THANE TOTAL (UG/L) (39034)	PHORATE TOTAL (UG/L) (39023)	TOX- APHENE, TOTAL (UG/L) (39400)	TOTAL TRI- THION (UG/L) (39786)	2,4-D, TOTAL (UG/L) (39730)	2, 4-DP TOTAL (UG/L) (82183)	2,4,5-T TOTAL (UG/L) (39740)	SILVEX, TOTAL (UG/L) (39760)
NOV									
01...	<0.01	<0.1	<0.01	<1	<0.01	--	--	--	--
DEC									
13...	<0.01	<0.1	<0.01	<1	<0.01	--	--	--	--
APR									
26...	<0.01	<0.1	<0.01	<1	<0.01	0.04	<0.01	<0.01	<0.01
JUN									
20...	<0.01	<0.1	<0.01	<1	<0.01	0.09	0.01	<0.01	<0.01
JUL									
24...	<0.01	<0.1	<0.01	<1	<0.01	<0.01	<0.01	<0.01	<0.01
SEP									
12...	<0.01	<0.1	<0.01	<1	<0.01	0.08	<0.01	<0.01	<0.01
23...	<0.01	<0.1	<0.01	<1	<0.01	0.07	<0.01	<0.01	<0.01

## STREAMS TRIBUTARY TO LAKE ERIE

227

04174500 HURON RIVER AT ANN ARBOR, MI

LOCATION.--Lat 42°17'10", long 83°44'00", in NW1/4 sec.28, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 100 ft upstream from bridge on Wall Street in Ann Arbor, 0.7 mi downstream from Argo Dam, and 4.2 mi upstream from Geddes Dam.

DRAINAGE AREA.--729 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1904 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at Geddes" February 1904 to December 1914 and as "at Barton" January 1914 to September 1940.

REVISED RECORDS.--WSP 874: 1938. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 744.81 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1904 to December 1914 at Geddes Dam, 4.2 mi downstream, and January 1914 to September 1947 at Barton Dam, 2.6 mi upstream, flow computed from records of operation of powerplants and records of depth of flow over dam and/or flow through undersluices.

REMARKS.--Estimated daily discharges: Jan. 24 and 25. Records good. Diversion upstream from station for Ann Arbor municipal supply had negligible effect on natural flow prior to 1955, figures of runoff adjusted since. Flow regulated by powerplants prior to May 1962. From June 1962 to 1975 occasional regulation for lake level control operations upstream from station. Since 1975 extensive regulation of flow exists due to automation of gates at dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--87 years, 463 ft<sup>3</sup>/s, 8.62 in/yr, adjusted for diversion since 1955.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 5,840 ft<sup>3</sup>/s, Mar. 14, 1918; minimum daily, 4 ft<sup>3</sup>/s, Aug. 2, Sept. 11, 1931, plant leakage, but may be doubtful due to change in leakage.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,660 ft<sup>3</sup>/s, Dec. 30, gage height, 15.10 ft; minimum daily, 82 ft<sup>3</sup>/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	316	596	690	1700	576	845	679	860	549	148	96	146
2	286	612	691	1530	574	985	651	747	600	149	82	165
3	219	796	738	1500	546	1120	656	804	662	173	130	206
4	396	766	831	1410	588	1010	654	733	694	152	122	170
5	466	1010	815	1320	612	977	647	765	752	160	112	158
6	420	1260	890	1260	644	1010	641	784	559	179	105	138
7	452	1160	766	1110	686	1050	476	701	532	148	92	137
8	460	971	790	1060	751	971	483	724	506	169	200	137
9	817	903	735	959	803	934	664	706	411	136	199	156
10	1490	946	766	928	744	893	677	551	411	150	219	159
11	2010	1000	766	909	691	763	407	559	355	141	161	172
12	1650	946	713	869	675	771	212	645	422	143	124	159
13	1460	850	735	843	635	880	256	630	434	173	124	125
14	1340	804	693	799	645	869	549	555	399	164	140	125
15	1220	768	666	785	604	790	806	533	264	147	146	126
16	1200	733	656	865	615	632	901	483	296	135	155	118
17	1040	717	599	999	623	505	846	482	320	124	206	112
18	1240	691	624	941	612	571	766	467	312	103	280	114
19	1060	630	641	913	726	738	792	440	327	107	356	108
20	508	639	633	938	946	796	1160	408	288	104	377	104
21	741	637	713	953	950	755	1320	310	217	107	305	104
22	907	655	784	774	1040	677	1270	315	172	126	244	101
23	847	649	772	777	1010	710	1200	316	305	145	244	100
24	600	629	732	740	908	696	1260	378	241	120	240	100
25	758	597	657	700	895	687	1250	448	160	97	230	99
26	765	585	658	689	862	664	1140	633	169	93	219	100
27	677	609	592	689	786	733	1110	601	167	91	201	102
28	659	711	631	645	781	736	1050	589	167	86	149	98
29	608	732	1180	649	---	746	1000	564	193	109	140	97
30	455	737	2120	643	---	701	950	583	172	117	232	100
31	522	---	2090	595	---	649	---	601	---	108	157	---
TOTAL	25589	23339	25367	29492	20528	24864	24473	17915	11056	4104	5787	3836
MEAN	825	778	818	951	733	802	816	578	369	132	187	128
MAX	2010	1260	2120	1700	1040	1120	1320	860	752	179	377	206
MIN	219	585	592	595	546	505	212	310	160	86	82	97
MEAN+	845	795	833	966	749	818	835	601	397	165	217	153
CFSM+	1.16	1.09	1.14	1.33	1.03	1.12	1.15	.82	.54	.23	.30	.21
IN.+	1.34	1.22	1.32	1.53	1.07	1.29	1.28	.95	.61	.26	.34	.23

CAL YR 1990 TOTAL 254216 MEAN 696 MAX 2370 MIN 96 MEAN+ 716 CFSM+ .98 IN+ 13.33  
WTR YR 1991 TOTAL 216350 MEAN 593 MAX 2120 MIN 82 MEAN+ 614 CFSM+ .84 IN+ 11.43

+ Adjusted for diversion for municipal supply; record furnished by City of Ann Arbor.

## STREAMS TRIBUTARY TO LAKE ERIE

04174800 HURON RIVER AT YPSILANTI, MI

LOCATION.--Lat 42°14'57", long 83°36'45", in SW1/4 sec.4, T.3 S., R.7 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 30 ft downstream from bridge on Forest Avenue in Ypsilanti, 4.9 mi downstream from Geddes Dam, 5.6 mi upstream from Ford Dam, and at mile 42.8.

DRAINAGE AREA.--807 mi<sup>2</sup>.

PERIOD OF RECORD.--June 1974 to September 1984, October 1989 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Extensive regulation caused by many dams upstream from station; storage capacity is small. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--12 years, 608 ft<sup>3</sup>/s, 10.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft<sup>3</sup>/s, May 2, 1983, gage height, 12.64 ft; minimum daily, 62 ft<sup>3</sup>/s, June 28, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,620 ft<sup>3</sup>/s, Dec. 30, gage height, 11.99 ft; minimum daily, 124 ft<sup>3</sup>/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	417	745	879	1950	692	1030	861	1010	693	214	159	252
2	399	748	838	1810	761	1300	824	890	862	251	149	215
3	322	915	991	1690	727	1470	839	937	844	307	216	318
4	566	895	1080	1580	784	1270	825	883	850	231	189	316
5	614	1470	1010	1540	832	1160	830	990	910	232	165	238
6	567	1670	1060	1440	867	1280	823	977	696	262	164	227
7	578	1450	984	1320	869	1250	650	887	649	235	168	202
8	606	1280	924	1240	945	1180	637	885	638	308	349	220
9	1150	1060	929	1130	1000	1170	821	883	545	218	342	258
10	2020	1140	941	1100	961	1100	826	740	554	216	304	265
11	2420	1160	962	1110	884	919	581	711	526	215	226	268
12	2030	1130	901	1060	850	948	335	805	556	217	185	227
13	1720	1030	914	1010	819	1080	344	818	595	264	178	218
14	1600	977	860	994	831	1020	686	719	550	245	199	201
15	1460	946	842	955	804	988	965	687	398	215	218	211
16	1370	880	836	1150	730	833	1090	644	460	200	213	195
17	1240	897	773	1250	801	674	1010	716	456	194	341	157
18	1480	851	805	1160	790	777	899	620	463	157	376	183
19	1330	786	819	1120	1060	920	928	591	478	153	540	178
20	667	793	810	1170	1260	962	1610	551	440	154	636	179
21	864	800	924	1170	1230	973	1580	465	314	165	429	152
22	1070	847	991	891	1350	853	1520	431	308	190	345	184
23	1040	815	980	957	1240	921	1370	445	433	245	343	158
24	759	789	914	896	1140	879	1530	523	394	177	310	177
25	888	760	760	835	1090	862	1440	552	258	158	322	167
26	897	745	810	844	1040	867	1360	1080	239	126	304	170
27	843	785	691	843	978	870	1270	837	246	154	268	157
28	794	913	806	803	956	1000	1190	782	241	124	236	181
29	782	925	1800	833	---	951	1170	711	265	204	220	146
30	613	904	3150	815	---	887	1100	718	256	188	368	183
31	637	---	2650	779	---	836	---	749	---	159	312	---
TOTAL	31743	29106	32634	35445	26291	31230	29914	23237	15117	6378	8774	6203
MEAN	1024	970	1053	1143	939	1007	997	750	504	206	283	207
MAX	2420	1670	3150	1950	1350	1470	1610	1080	910	308	636	318
MIN	322	745	691	779	692	674	335	431	239	124	149	146
CAL YR 1990	TOTAL	324876	MEAN	890	MAX	3360	MIN	144				
WTR YR 1991	TOTAL	276072	MEAN	756	MAX	3150	MIN	124				

## STREAMS TRIBUTARY TO LAKE ERIE

04174950 WILLOW RUN NEAR RAWSONVILLE, MI

LOCATION.--Lat 42°13'09", long 83°32'13", in SW1/4 sec.18, T.3 S., R.8 E., Wayne County, Hydrologic Unit 04090005, on right bank 30 ft upstream from culverts on North I-94 Service Road, 0.7 mi upstream from mouth, and 0.8 mi northeast of Rawsonville.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--April 1986 to current year (seasonal records only, April to September).

GAGE.--Water-stage recorder. Elevation of gage is 670 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Actual surface drainage area is 6.28 mi<sup>2</sup>. Flow contains effluent from sewage-treatment plant about 1 mi upstream from station. Some of this flow originates from ground-water sources and other sources outside the basin. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge during period April to September, 142 ft<sup>3</sup>/s, Aug. 19, 1990; minimum daily, 20 ft<sup>3</sup>/s, Sept. 30, 1991.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							25	33	37	27	23	25
2							29	31	43	33	25	21
3							27	31	33	31	34	23
4							29	29	32	37	27	29
5							34	47	33	26	24	25
6							29	34	33	24	28	25
7							26	33	33	27	27	26
8							32	31	33	28	56	23
9							45	30	31	26	36	30
10							31	32	36	26	27	29
11							28	29	40	25	25	25
12							28	30	34	27	25	25
13							30	31	30	24	25	26
14							36	32	33	25	29	26
15							37	32	33	24	28	24
16							31	30	32	27	26	28
17							31	39	32	25	37	24
18							30	27	33	27	27	23
19							46	26	30	25	54	22
20							64	31	34	26	44	25
21							41	29	32	28	25	23
22							37	30	34	25	26	22
23							36	30	30	30	28	23
24							38	37	27	28	26	23
25							35	31	31	26	22	25
26							34	90	32	25	24	24
27							34	32	31	27	26	23
28							30	31	31	21	26	24
29							29	33	32	27	27	23
30							34	33	27	29	29	20
31							---	43	---	24	27	---
TOTAL							1016	1057	982	830	913	734
MEAN							33.9	34.1	32.7	26.8	29.5	24.5
MAX							64	90	43	37	56	30
MIN							25	26	27	21	22	20



## STREAMS TRIBUTARY TO LAKE ERIE

## 04175600 RIVER RAISIN NEAR MANCHESTER, MI

LOCATION.--Lat 42°10'05", long 84°04'34", in NE1/4 SE1/4 sec.33, T.3 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, on left bank at downstream side of bridge on Sharon Valley Road, 2.5 mi northwest of Manchester.

DRAINAGE AREA.--132 mi<sup>2</sup>.

PERIOD OF RECORD.--January 1970 to September 1981, January 1985 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 30, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 4 to Feb. 3, and Feb. 14-18. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by many dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--17 years (water years 1971-81, 1986-91), 105 ft<sup>3</sup>/s, 10.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 869 ft<sup>3</sup>/s, Feb. 24, 1985, gage height, 7.21 ft; minimum, 4.5 ft<sup>3</sup>/s, Nov. 29, 1971; minimum gage height, 1.16 ft, Oct. 12, Nov. 4, 1978.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 280 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 11	1000	372	5.20	Jan. 1	0300	*478	*5.72
Nov. 6	1400	315	4.88	Apr. 20	2400	324	4.93

Minimum daily discharge, 12 ft<sup>3</sup>/s, July 28; minimum gage height, 1.40 ft, Sept. 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	64	88	151	434	120	152	145	207	114	24	18	30
2	61	87	134	370	120	203	140	192	145	28	15	28
3	57	85	129	323	130	258	128	175	176	35	16	27
4	97	84	160	300	140	233	125	159	145	34	18	32
5	113	134	165	275	163	217	133	152	134	32	17	32
6	100	287	156	250	168	212	135	174	118	28	16	29
7	90	280	143	240	160	211	133	175	103	29	14	27
8	85	247	141	220	155	192	126	160	95	41	19	26
9	135	212	136	210	159	181	128	147	90	40	45	27
10	271	192	139	200	158	171	134	138	84	34	38	32
11	361	174	138	195	146	163	119	129	90	28	30	32
12	321	163	135	190	134	155	112	134	94	26	25	28
13	273	154	138	190	128	148	106	193	86	27	22	28
14	234	147	128	195	115	140	110	194	77	30	21	27
15	213	145	123	195	115	137	148	151	71	25	21	27
16	198	144	127	200	110	136	188	126	73	24	22	27
17	185	140	131	205	110	129	173	125	68	21	22	26
18	196	132	137	210	130	146	159	114	62	20	27	24
19	205	126	140	215	156	157	152	107	56	19	35	23
20	187	124	134	215	206	150	264	98	51	19	87	21
21	176	121	134	205	210	145	319	91	47	15	86	21
22	167	125	156	190	221	141	295	87	45	19	68	21
23	155	127	159	180	204	144	263	83	43	20	58	16
24	146	130	158	170	182	154	274	85	40	18	50	19
25	137	116	125	160	170	142	273	99	38	16	44	19
26	125	111	120	150	161	135	260	116	37	14	41	21
27	117	118	120	145	154	146	241	120	33	13	38	21
28	114	157	130	140	148	177	229	114	30	12	38	20
29	102	172	207	135	---	170	221	104	28	15	34	22
30	96	158	442	130	---	160	220	96	26	18	34	15
31	91	---	430	125	---	151	---	96	---	19	32	---
TOTAL	4872	4480	4966	6562	4273	5156	5453	4141	2299	743	1051	748
MEAN	157	149	160	212	153	166	182	134	76.6	24.0	33.9	24.9
MAX	361	287	442	434	221	258	319	207	176	41	87	32
MIN	57	84	120	125	110	129	106	83	26	12	14	15
CFSM	1.19	1.13	1.21	1.61	1.16	1.26	1.38	1.02	.58	.18	.26	.19
IN.	1.37	1.26	1.40	1.85	1.20	1.45	1.54	1.17	.65	.21	.30	.21
CAL YR 1990	TOTAL	53540	MEAN	147	MAX	475	MIN	28	CFSM	1.11	IN	15.09
WTR YR 1991	TOTAL	44744	MEAN	123	MAX	442	MIN	12	CFSM	.93	IN	12.61

## STREAMS TRIBUTARY TO LAKE ERIE

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## 04176000 RIVER RAISIN NEAR ADRIAN, MI

LOCATION.--Lat 41°54'15", long 83°58'50", in NW1/4 sec.5, T.7 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, on right bank at downstream side of bridge on Academy Road, 1.7 mi east of Adrian, and 2.6 mi downstream from South Branch.

DRAINAGE AREA.--463 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1953 to September 1978, October 1978 to September 1984 (operated as a crest-stage partial-record station only), October 1984 to current year. Records for October 1930 to August 1931 and October 1932 to April 1938, published as "Raisin River" in WSP 714, 744, 759, 784, 804, 824, and 854, have been found to be unreliable and should not be used.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 693.2 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 26-28, Jan. 1-6, 9, 10, Jan. 22 to Feb. 2, and Feb. 13-18. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplant at Tecumseh, 11 mi upstream from station, prior to June 27, 1968. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--32 years (water years 1954-78, 1985-91), 332 ft<sup>3</sup>/s, 9.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft<sup>3</sup>/s, Mar. 15, 1982, gage height, 15.77 ft; minimum, 18 ft<sup>3</sup>/s, Aug. 10, 1964, gage height, 1.33 ft; minimum daily, 25 ft<sup>3</sup>/s, Oct. 26, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Oct. 12	0500	2,090	11.50	Dec. 31	0900	*4,070	*13.81
Nov. 7	1900	1,560	10.62	Apr. 22	0100	1,760	10.98

Minimum discharge, 52 ft<sup>3</sup>/s, July 28, 29, gage height, 2.39 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	197	289	415	3450	370	466	444	558	490	92	60	86
2	195	302	390	2360	360	591	424	541	691	164	57	82
3	196	277	454	1800	396	989	403	503	831	138	58	79
4	270	271	796	1300	446	1160	387	468	737	161	59	103
5	284	449	946	1050	506	919	386	455	515	137	57	90
6	278	1050	761	900	547	758	378	516	384	119	57	87
7	299	1440	568	749	532	748	392	510	284	105	55	82
8	296	1340	494	640	497	696	404	490	294	116	69	77
9	455	977	452	600	492	607	388	456	264	112	103	99
10	972	736	437	590	493	562	372	424	246	111	96	113
11	1740	611	430	604	471	529	415	395	259	104	101	92
12	2040	534	420	626	424	495	401	373	283	97	91	90
13	1560	475	406	636	400	472	371	362	251	90	79	89
14	1130	442	390	603	370	451	398	493	237	89	71	86
15	889	391	393	600	340	427	550	448	217	86	64	83
16	685	405	394	740	320	413	851	411	232	85	73	80
17	548	396	404	1050	310	404	901	431	220	77	71	77
18	580	382	424	1130	360	441	681	346	203	73	77	74
19	589	369	493	892	571	474	583	335	187	69	102	73
20	578	359	479	781	981	486	916	311	160	64	351	70
21	504	335	466	764	1190	467	1490	271	155	63	244	69
22	458	343	612	600	1090	436	1600	265	149	66	225	68
23	423	343	743	550	984	456	1230	249	151	64	191	72
24	396	343	622	510	777	471	1070	245	141	61	163	71
25	371	336	531	480	643	469	1140	240	133	59	141	69
26	334	326	490	460	544	457	1030	373	126	56	125	73
27	343	327	460	440	507	455	841	353	114	55	113	71
28	331	355	540	420	477	500	734	333	104	53	104	70
29	315	425	714	410	---	560	648	298	100	54	97	70
30	305	443	2340	390	---	522	606	272	94	65	94	70
31	296	---	3970	380	---	472	---	316	---	60	90	---
TOTAL	17857	15071	21434	26505	15398	17353	20434	12041	8252	2745	3338	2415
MEAN	576	502	691	855	550	560	681	388	275	88.5	108	80.5
MAX	2040	1440	3970	3450	1190	1160	1600	558	831	164	351	113
MIN	195	271	390	380	310	404	371	240	94	53	55	68
CFSM	1.24	1.08	1.49	1.85	1.19	1.21	1.47	.84	.59	.19	.23	.17
IN.	1.43	1.21	1.72	2.13	1.24	1.39	1.64	.97	.66	.22	.27	.19

CAL YR 1990 TOTAL 193556 MEAN 530 MAX 3970 MIN 93 CFSM 1.15 IN 15.55  
WTR YR 1991 TOTAL 162843 MEAN 446 MAX 3970 MIN 53 CFSM .96 IN 13.08

## STREAMS TRIBUTARY TO LAKE ERIE

04176500 RIVER RAISIN NEAR MONROE, MI  
(National stream quality accounting network station)

LOCATION.--Lat 41°57'38", long 83°31'52", Monroe County, Hydrologic Unit 04100002, on left bank 0.8 mi downstream from bridge on Ida Maybee Road, 5.0 mi downstream from Saline River, and 7.5 mi west of Monroe.

DRAINAGE AREA.--1,042 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1937 to current year. Published as "Raisin River at Monroe" 1937-52 and as "River Raisin at Monroe" 1952-53.

REVISED RECORDS.--WSP 954: 1938-40(M), 1941. WSP 1437: 1939, 1948. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 616.26 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1953, at site 9 mi downstream at datum 46.26 ft lower.

REMARKS.--Estimated daily discharges: Dec. 25-28, Dec. 31 to Jan. 2, Jan. 7-10, Jan. 22 to Feb. 2, and Feb. 13-17. Water-discharge records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplants upstream from station prior to June 27, 1968. At times, flow is affected by irrigation pumpage.

AVERAGE DISCHARGE.--54 years, 736 ft<sup>3</sup>/s, 9.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,300 ft<sup>3</sup>/s, Mar. 16, 1982, gage height, 10.4 ft; maximum gage height, 11.16 ft, Mar. 15, 1982, backwater from ice; minimum discharge, about 2 ft<sup>3</sup>/s, Sept. 4, 1938, Sept. 19, 20, 1941, site then in use.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Jan. 1	unknown	*8,000	unknown	June 3	0900	4,080	6.63

Minimum discharge, 70 ft<sup>3</sup>/s, Aug. 1, gage height, 1.94 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	236	408	658	7800	590	857	771	997	1000	148	75	124
2	230	389	644	7300	560	983	707	909	1850	224	81	119
3	228	370	770	5530	593	1600	661	835	3710	204	77	118
4	229	372	2060	3970	654	1690	623	775	2280	207	76	129
5	228	582	2020	3000	795	1840	610	748	1670	217	80	118
6	270	2460	1990	2240	892	1750	607	906	1220	208	78	126
7	292	2260	1810	1500	946	1590	600	933	902	191	77	122
8	282	2290	1380	1200	935	1330	607	880	712	180	90	116
9	448	2210	1050	1100	892	1180	643	811	595	180	104	139
10	1420	1980	902	1000	867	1060	715	748	541	173	121	150
11	2520	1580	826	982	836	951	724	691	514	160	123	160
12	2210	1180	785	1090	787	878	664	649	535	153	129	180
13	2430	960	744	1080	720	826	646	627	520	145	130	173
14	2400	820	692	1050	660	775	644	1010	498	141	127	158
15	2150	739	668	1060	550	734	805	871	453	140	120	158
16	1760	671	663	1560	500	686	1120	778	422	136	115	151
17	1270	620	688	2370	520	654	1280	780	400	128	100	147
18	1180	595	731	2250	619	671	1340	727	369	118	98	150
19	1320	572	853	2170	864	713	1270	670	345	113	130	143
20	1150	550	911	2130	1710	738	2070	586	308	103	249	140
21	1020	526	985	1920	2150	743	2840	536	281	98	338	126
22	895	529	1410	1500	2680	738	2880	498	253	100	414	109
23	772	529	1550	1150	2470	725	2900	450	247	100	327	103
24	683	534	1610	920	2150	714	2780	430	232	93	278	102
25	618	522	1350	850	1730	724	2450	413	223	90	236	104
26	555	503	860	800	1330	717	2010	1500	216	86	203	102
27	515	507	800	760	1060	721	1780	2160	197	79	186	100
28	465	527	860	730	920	740	1570	1830	186	75	169	94
29	450	583	1820	700	---	830	1320	1330	166	75	157	94
30	434	612	5830	660	---	909	1130	944	153	82	141	96
31	417	---	7000	620	---	864	---	940	---	81	129	---
TOTAL	29077	26980	44920	60992	29980	29931	38767	26962	20998	4228	4758	3851
MEAN	938	899	1449	1967	1071	966	1292	870	700	136	153	128
MAX	2520	2460	7000	7800	2680	1840	2900	2160	3710	224	414	180
MIN	228	370	644	620	500	654	600	413	153	75	75	94
CFSM	.90	.86	1.39	1.89	1.03	.93	1.24	.84	.67	.13	.15	.12
IN.	1.04	.96	1.60	2.18	1.07	1.07	1.38	.96	.75	.15	.17	.14
CAL YR 1990	TOTAL	390243	MEAN	1069	MAX	7780	MIN	116	CFSM	1.03	IN	13.93
WTR YR 1991	TOTAL	321444	MEAN	881	MAX	7800	MIN	75	CFSM	.85	IN	11.48

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-75, 1978 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: April 1978 to July 1981.

WATER TEMPERATURE: March 1966 to September 1972, April 1978 to July 1981.

SUSPENDED-SEDIMENT DISCHARGE: March 1966 to September 1972.

INSTRUMENTATION.--Water-quality monitor from Mar. 23 to July 13, 1981.

REMARKS.--Cross-sectional samples were collected at gaging station, or 0.8 mi upstream at bridge on Ida Maybee Road.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 1,020 microsiemens, Feb. 16, 1979;

minimum daily recorded (more than 20 percent missing record), 263 microsiemens, Jan. 25, 1981.

WATER TEMPERATURE (water years 1967, 1970-72, 1979-80): Maximum daily recorded (more than 20 percent missing record), 32.0°C, July 18, 1972; minimum daily, 0.0°C on many days during winter.

SEDIMENT CONCENTRATION (water years 1967-72): Maximum daily mean, 1,430 mg/L, Dec. 22, 1967; minimum daily mean, 1 mg/L on several days in 1970.

SEDIMENT LOAD: Maximum daily, 28,000 tons, Dec. 22, 1967; minimum daily, 0.29 ton, Aug. 31, 1971.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 200 microsiemens was measured Feb. 25, 1985.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI KF AGAR (COLS. PER 100 ML) (31673)
DEC 13...	1030	746	700	8.5	4.0	5.4	14.2	111	K73	100
APR 26...	1030	2020	555	8.2	11.0	25	10.5	97	K130	150
JUN 20...	1030	308	666	8.4	26.0	26	10.0	126	150	470
JUL 24...	1215	90	736	8.5	27.0	15	10.2	131	--	--
SEP 12...	0930	182	709	8.4	21.0	20	8.2	94	K64	1200

DATE	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L) (00904)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)
DEC 13...	340	92	100	23	15	2.8	298	5	252	70
APR 26...	280	85	81	18	10	3.2	234	--	192	51
JUN 20...	320	80	93	22	18	5.3	293	2	244	59
JUL 24...	320	--	87	24	28	13	--	--	--	100
SEP 12...	320	99	87	24	30	12	--	--	218	93

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
DEC 13...	38	0.3	7.4	426	0.58	858	0.02	<0.01	4.0	3.8
APR 26...	29	0.2	5.6	316	0.43	1720	0.06	0.03	4.2	4.2
JUN 20...	38	0.2	9.4	404	0.55	336	0.03	0.01	2.1	2.1
JUL 24...	51	0.3	8.1	424	0.58	103	--	0.01	--	0.26
SEP 12...	49	0.3	9.8	437	0.59	215	0.02	0.01	0.68	0.69



STREAMS TRIBUTARY TO LAKE ERIE  
04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
DEC 13...	0.04	0.04	1.0	0.05	0.02	0.03	0.02	<10	<1	93
APR 26...	0.04	0.03	0.9	0.13	0.05	0.05	0.02	<10	<1	42
JUN 20...	<0.01	0.01	0.9	0.04	0.04	0.04	0.02	30	2	62
JUL 24...	--	--	--	--	--	--	--	--	--	--
SEP 12...	0.02	0.02	0.8	0.14	0.03	0.04	0.01	<10	1	81
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
DEC 13...	<0.5	<1	<1	<3	2	20	<1	9	22	<0.1
APR 26...	<0.5	<1	<1	<3	2	16	1	4	7	<0.1
JUN 20...	<0.5	<1	<1	<3	2	9	1	9	4	<0.1
JUL 24...	--	--	--	--	--	--	--	--	--	--
SEP 12...	<0.5	<1	<1	<3	2	10	<1	12	8	<0.1
DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, DIS- SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
DEC 13...	<10	3	<1	<1	360	<6	7	4	8.1	80
APR 26...	10	1	<1	<1	250	<6	15	57	311	97
JUN 20...	<10	2	<1	<1	460	<6	6	--	--	--
JUL 24...	--	--	--	--	--	--	--	--	--	--
SEP 12...	10	5	<1	<1	710	<6	<3	40	20	--

STREAMS TRIBUTARY TO LAKE ERIE

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04176605 OTTER CREEK AT LA SALLE, MI

LOCATION.--Lat 41°52'01", long 83°27'13", in NW1/4 NW1/4 sec.23 (private claim 47), T.7 S., R.8 E., Monroe County, Hydrologic Unit 04100001, on right bank 150 ft upstream from bridge on State Highway 125 in La Salle, 2.3 mi downstream from South Branch, and 4.6 mi southwest of Monroe.

DRAINAGE AREA.--51.0 mi<sup>2</sup>.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 580 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 25-28, Jan. 4-9, and Jan. 22 to Feb. 4. Water-discharge records good except for estimated daily discharges and discharges below 1.0 ft<sup>3</sup>/s, which are fair.

EXTREMES FOR PERIOD OF RECORD--Maximum discharge, 2,050 ft<sup>3</sup>/s, Feb. 23, 1990, gage height, 10.73 ft, from rating curve extended above 700 ft<sup>3</sup>/s; no flow June 21 to July 16, 1988, July 27 to Aug. 10, Aug. 18, Sept. 20-30, 1991.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Dec. 4	0200	525	8.30	May 26	1500	1,540	10.04
Dec. 30	1200	*1,670	*10.21	June 3	0100	1,160	9.50
Apr. 20	1000	935	9.14				

No flow July 27 to Aug. 10, Aug. 18, Sept. 20-30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.3	11	38	306	25	46	43	44	191	3.2	.00	.38
2	2.8	11	31	185	32	98	42	46	444	3.5	.00	.30
3	2.4	10	200	129	38	143	37	38	739	3.8	.00	.19
4	3.6	9.9	397	100	44	86	35	33	251	3.5	.00	.42
5	5.1	64	178	75	52	67	39	37	121	3.4	.00	.93
6	4.7	255	105	60	54	68	42	222	77	2.6	.00	.62
7	3.7	142	79	50	54	63	36	138	55	2.0	.00	.29
8	3.5	87	64	45	52	48	33	83	42	2.1	.00	.17
9	25	65	55	44	53	44	126	65	34	2.0	.00	.11
10	177	57	50	43	52	41	93	54	28	1.7	.00	.12
11	215	47	44	52	45	37	57	45	27	1.5	.22	.18
12	111	38	42	117	36	34	44	40	33	1.2	.13	.16
13	71	31	38	87	38	32	46	58	26	1.3	.04	.15
14	51	27	32	74	37	30	75	160	20	1.5	.05	.12
15	39	25	38	107	18	27	138	68	17	1.3	.04	.08
16	30	24	51	250	37	25	111	47	15	.81	.02	.05
17	25	22	47	261	31	25	76	145	13	.51	.01	.03
18	77	20	56	150	33	39	57	79	11	.29	.00	.02
19	122	18	91	107	183	44	87	50	9.2	.26	5.4	.01
20	75	17	71	129	297	38	796	37	8.1	.17	50	.00
21	53	16	91	128	205	35	428	31	7.1	.11	22	.00
22	41	23	201	80	175	32	234	26	6.8	.13	8.6	.00
23	32	34	152	70	106	38	145	25	11	.12	4.5	.00
24	27	33	119	60	75	43	167	247	9.8	.06	2.9	.00
25	23	29	95	50	65	36	122	145	7.6	.03	2.2	.00
26	19	24	80	40	54	32	93	1030	6.2	.01	1.6	.00
27	17	30	70	35	46	37	75	526	5.0	.00	1.2	.00
28	15	57	55	32	40	217	64	216	4.2	.00	.93	.00
29	13	65	475	30	---	103	57	116	3.6	.00	.69	.00
30	12	47	1480	28	---	63	50	83	3.3	.00	.53	.00
31	11	---	697	26	---	48	---	83	---	.00	.47	---
TOTAL	1310.1	1338.9	5222	2950	1977	1719	3448	4017	2225.9	37.10	101.53	4.33
MEAN	42.3	44.6	168	95.2	70.6	55.5	115	130	74.2	1.20	3.28	.14
MAX	215	255	1480	306	297	217	796	1030	739	3.8	50	.93
MIN	2.4	9.9	31	26	18	25	33	25	3.3	.00	.00	.00
CFSM	.83	.88	3.29	1.87	1.38	1.09	2.26	2.55	1.46	.02	.06	.003
IN.	.96	.98	3.81	2.15	1.44	1.25	2.51	2.93	1.62	.03	.07	.00

CAL YR 1990	TOTAL	24240.62	MEAN 66.4	MAX 1480	MIN .01	CFSM 1.30	IN 17.68
WTR YR 1991	TOTAL	24350.86	MEAN 66.7	MAX 1480	MIN .00	CFSM 1.31	IN 17.76

## STREAMS TRIBUTARY TO LAKE ERIE

04176605 OTTER CREEK AT LA SALLE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972-73, 1990 to September 1991 (discontinued).

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)
JUL 24...	0945	0.06	630	8.0	23.5	4.5	4.7	57	260	68
SEP 11...	1045	0.2	840	7.6	19.0	3.0	8.1	89	360	98

DATE	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
JUL 24...	22	23	4.7	114	140	52	0.2	5.4	376	<0.01
SEP 11...	28	39	6.9	144	190	87	0.2	2.6	552	<0.01

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
JUL 24...	0.17
SEP 11...	0.082

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in time of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at crest-stage partial-record stations are presented in the following table. Discharge measurements made at low-flow partial-record sites and at miscellaneous sites and for special studies are given in separate tables.

## Crest-stage partial-record stations

The following table contains annual maximum discharges for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

## Maximum discharge at crest-stage partial-record stations.

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft³/s)	Date	Gage height (ft)	Dis- charge (ft³/s)
STREAMS TRIBUTARY TO LAKE SUPERIOR								
Perch River near Sidnaw, MI (04041000)	Lat 46°31'06", long 88°39'48", in NE1/4 sec.34, T.48 N., R.35 W., Baraga County, Hydrologic Unit 04020104, at State Highway 28, 2.5 mi east of Sidnaw. Drainage area is 63.1 mi².	1913-15†, 1957-91	04-09-91	9.27	407	04-24-60	11.07	1,100
Carp Creek at Ishpeming, MI (04044200)	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at Highway 41A in Ishpeming. Drainage area is 16.5 mi².	1970-91	04-09-91 09-12-78	<5.90 --	<116 a390	04-20-85	11.32	403
Two Hearted River near Paradise, MI (04044813)	Lat 46°41'15", long 85°26'26", in SE1/4 NW1/4 sec.33, T.50 N., R.9 W., Luce County, Hydrologic Unit 04020201, on right bank, 300 ft downstream from end of Trail Road, 3.2 mi upstream from mouth, and 20 mi northwest of Paradise. Drainage area is 200 mi².	1973-91	04-09-91	12.36	1,720	04-25-85	b8.42	3,210
West Branch Waiska River near Brimley, MI (04045538)	Lat 46°21'18", long 84°35'35", in SW1/4 NW1/4 sec.29, T.46 N., R.2 W., Chippewa County, Hydrologic Unit 04020203, at Tilson Road, 3.2 mi upstream from mouth, and 3.5 mi south of Brimley. Drainage area is 40.7 mi².	1973-91	04-15-91	7.61	507	04-18-74	c9.19	1,200
East Branch Waiska River near Brimley, MI (04045559)	Lat 46°25'07", long 84°28'24", in NW1/4 NE1/4 sec.6, T.46 N., R.1 W., Chippewa County, Hydrologic Unit 04020203, at 6 Mile Road, 4.0 mi upstream from mouth, and 4.7 mi east of Brimley. Drainage area is 30.1 mi².	1973-91	04-15-91	d11.07	759	04-21-85	e13.86	1,380

See footnotes at end of table.



DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN								
Black River near Garnet, MI (04046000)	Lat 46°07'05", long 85°21'55", in SE1/4 sec.13, T.43 N., R.9 W., Mackinac County, Hydrologic Unit 04060107, on right bank, 10 ft upstream from footbridge, 15 ft down- stream from Peters Creek, 3.5 mi upstream from mouth, and 4 mi southwest of Garnet. Datum of gage is 629.7 ft above National Geodetic Vertical Datum of 1929. Drainage area is approximately 28 mi <sup>2</sup> .	1951-78†, 1979-91	04-16-91	7.06	404	05-07-60	8.55	860
Black River near Republic, MI (04057900)	Lat 42°25'08", long 87°53'21", in NE1/4 sec.2, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030110, at county road, 4.4 mi east of Republic. Drainage area is 34.4 mi <sup>2</sup> .	1961-68†, 1970-91	04-08-91	3.88	310	04-20-85	6.32	1,160
Tenmile Creek at Perronville, MI (04059400)	Lat 45°48'38", long 87°22'00", in NW1/4 NW1/4 sec.2, T.39 N., R.25 W., Menominee County, Hydrologic Unit 04030109, at county road, 1 mi northwest of Perronville, and 11.5 mi upstream from Ford River. Drainage area is 38.4 mi <sup>2</sup> .	1971-77†, 1978-91	05-30-91	4.41	318	04-24-75	5.42	810
Michigamme River at Republic, MI (04062300)	Lat 46°23'03", long 87°58'48", in SE1/4 sec.18, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030107, on left bank 400 ft upstream from Old State Highway 95, 0.3 mi upstream from Trout Falls Creek, and 0.6 mi south of Republic. Drainage area is 240 mi <sup>2</sup> .	1961-75†, 1976-91	04-10-91	5.42	2,020	04-24-85	9.94	5,270
Beebe Creek near Hillsdale, MI (04096272)	Lat 41°57'15", long 84°38'20", in NW1/4 NE1/4 sec.15, T.6 S., R.3 W., Hillsdale County, Hydrologic Unit 04050001, at Moore Road, 1.2 mi northwest of Hillsdale. Drainage area is 42.4 mi <sup>2</sup> .	1974-78†, 1979-81, 1983-91	12-31-90	6.28	336	02-25-85	7.61	618
St. Joseph River at Clarendon, MI (04096340)	Lat 42°07'51", long 84°51'56", in SW1/4 SW1/4 sec.11, T.4 S., R.5 W., Calhoun County, Hydrologic Unit 04050001, at 22 Mile Road in Clarendon. Drainage area is 144 mi <sup>2</sup> .	1974-77†, 1978-91	12-31-90	7.06	564	06-04-89	8.02	1,000

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis-charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued								
Portage River near Vicksburg, MI (04097170)	Lat 42°06'53", long 85°29'08", in SW1/4 sec.16, T.4 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050001, at W Avenue, 2.4 mi east of Vicksburg. Datum of gage is 839.94 ft above National Geodetic Vertical Datum of 1929. Drainage area is 68.2 mi <sup>2</sup> .	1946-51†, 1965-80†, 1980-91	11-28-90	g5.03	197	06-02-89	h5.81	416
Rabbit River at Hamilton, MI (04108645)	Lat 42°40'31", long 86°00'13", in NE1/4 sec.6, T.3 N., R.14 W., Allegan County, Hydrologic Unit 04050003, at State Highway 40 in Hamilton. Drainage area is 274 mi <sup>2</sup> .	1979-91	11-28-90	16.28	3,000	06-01-89	118.2	5,260
Sycamore Creek near Mason, MI (04112700)	Lat 42°36'38", long 84°27'58", in NE1/4 NE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Harper Road, 0.7 mi downstream from Aurelius and Vevay Drain, and 2.6 mi northwest of Mason. Drainage area is 39.5 mi <sup>2</sup> .	1975-91	11-28-90	9.58	241	04-19-75	12.53	1,080
Carrier Creek near Grand Ledge, MI (04113090)	Lat 42°43'36", long 84°39'16", in SE1/4 SW1/4 sec.15, T.4 N., R.3 W., Eaton County, Hydrologic Unit 04050004, at St. Joe Highway, 3.7 mi upstream from mouth, and 4.0 mi southeast of Grand Ledge. Drainage area is 7.18 mi <sup>2</sup> .	1975-91	11-06-90	6.95	172	06-12-86	10.01	465
Quaker Brook near Nashville, MI (04117000)	Lat 42°33'57", long 85°05'37", in NW1/4 sec. 13, T.2 N., R.7 W., Barry County, Hydrologic Unit 04050007, on left bank 150 ft upstream from culvert on Clark Road, 500 ft upstream from small tributary, and 2.5 mi south of Nashville. Datum of gage is 821.89 ft above National Geodetic Vertical Datum of 1929. Drainage area is 7.60 mi <sup>2</sup> .	1954-75†, 1976-91	11-28-90	6.32	200	04-19-75	9.45	470
Plaster Creek at Grand Rapids, MI (04119055)	Lat 42°54'46", long 85°39'02", in SE1/4 sec.7, T.6 N., R.11 W., Kent County, Hydrologic Unit 04050006, at 28th Street in Grand Rapids. Drainage area is 46.6 mi <sup>2</sup> .	1974-91	11-28-90	11.99	1,550	03-04-79	--	1,700
Buck Creek at Grandville, MI (04119160)	Lat 42°54'09", long 85°45'46", in SE1/4 sec.18, T.6 N., R.12 W., Kent County, Hydrologic Unit 04050006, at Wilson Avenue in Grandville. Drainage area is 50.5 mi <sup>2</sup> .	1974-91	11-28-90	9.34	1,100	05-12-81	10.30	1,580

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued								
Black Creek near Muskegon, MI *(04120295)	Lat 43°12'14", long 86°09'17", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth. Drainage area is approximately 39 mi <sup>2</sup> .	1975, 1977, 1979-91	03-28-91	3.79	336	09-12-86	4.47	656
North Branch Pentwater River near Pentwater, MI (04122230)	Lat 43°47'42", long 86°21'30", in NE1/4 SE1/4 sec.8, T.16 N., R.17 W., Oceana County, Hydrologic Unit 04060101, at Oceana Drive, 3.5 mi north- east of Pentwater. Drainage area is 42.3 mi <sup>2</sup> .	1975-91	03-28-91	3.18	245	09-11-86	6.33	2,860
East Branch Pine River near Tustin, MI (04124500)	Lat 44°06'09", long 85°31'02", in NE1/4 NW1/4 sec.28, T.20 N., R.10 W., Osceola County, Hydrologic Unit 04060103, at Marion Road, 3.0 mi west of Tustin. Datum of gage is 1,077.65 ft above National Geodetic Vertical Datum of 1929. Drainage area is 60.0 mi <sup>2</sup> .	1952-63†, 1964-91	04-16-91	4.83	369	08-04-56	6.23	1,410
Betsie River near Benzonia, MI (04126600)	Lat 44°36'02", long 86°05'57", in NW1/4 NW1/4 sec.2, T.25 N., R.15 W., Benzle County, Hydrologic Unit 04060104, at U.S. Highway 31, 1.2 mi south of Benzonia. Datum of gage is 602.15 ft above National Geodetic Vertical Datum of 1929. Drainage area is approximately 170 mi <sup>2</sup> .	1975-91	04-15-91	3.67	625	03-28-89	5.46	993
Boyne River near Boyne City, MI (04127850)	Lat 45°11'48", long 84°57'26", in NW1/4 SW1/4 sec.5, T.32 N., R.5 W., Charlevoix County, Hydrologic Unit 04060105, at Dam Road, 0.3 mi downstream from Boyne River hydroelectric plant, and 2.8 mi southeast of Boyne City. Drainage area is 64.2 mi <sup>2</sup> .	1975-91	03-28-91	4.37	522	07-19-75	k3.93	662
STREAMS TRIBUTARY TO LAKE HURON								
Klackening Creek near Selkirk, MI (04140200)	Lat 44°20'05", long 84°08'46", in NE1/4 NE1/4 sec.2, T.22 N., R.2 E., Ogemaw County, Hydrologic Unit 04080101, at Campbell Road, 4.0 mi northwest of Selkirk. Drainage area is 7.51 mi <sup>2</sup> .	1953-91	05-30-91	--	j115	05-20-59	6.59	738

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE HURON--Continued								
Rifle River at Selkirk, MI (04140500)	Lat 44°18'48", long 84°04'10", in SE1/4 NE1/4 sec.9, T.22 N., R.3 E., Ogemaw County, Hydro- logic Unit 04080101, at State Road in Selkirk. Datum of gage is 828.47 ft above National Geodetic Vertical Datum of 1929. Drainage area is 117 mi <sup>2</sup> .	1950-82†, 1983-91	05-30-91	4.80	1,570	05-20-59	6.76	2,760
South Branch Flint River near Mill- ville, MI (04146020)	Lat 43°04'44", long 83°18'25", in SE1/4 sec. 29, T.8 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, at Saginaw Road, 1.6 mi north of Lapeer. Drainage area is 160 mi <sup>2</sup> .	1974-91	03-29-91	7.16	413	09-09-85	10.33	2,510
North Branch Flint River near Columbiaville, MI (04146450)	Lat 43°11'18", long 83°22'03", in NW1/4 sec. 24, T.9 N., R.9 E., Lapeer County, Hydro- logic Unit 04080204, at Barnes Lake Road, 2.9 mi northeast of Columbiaville. Drainage area is 223 mi <sup>2</sup> .	1987-91	03-29-91	13.64	807	03-13-90	14.04	860
Swartz Creek at Flint, MI (04148300)	Lat 42°59'16", long 83°43'57", in NW1/4 sec. 26, T.7 N., R.6 E., Genesee County, Hydrologic Unit 04080204, at South Ballenger Highway in Flint, 3.6 mi upstream from mouth. Datum of gage is 727.05 ft above National Geodetic Vertical Datum of 1929. Drainage area is 115 mi <sup>2</sup> .	1970-84†, 1991	11-28-90	6.89	934	04-19-75	9.02	3,160
Thread Creek near Flint, MI (04148440)	Lat 42°58'30", long 83°38'09", in SE1/4 SE1/4 sec. 28, T.7 N., R.7 E., Genesee County, Hydro- logic Unit 04080204, at Bristol Road, 6.0 mi upstream from mouth, and 4.0 mi southeast of Flint. Datum of gage is 764.36 ft above National Geodetic Vertical Datum of 1929. Drainage area is 54.4 mi <sup>2</sup> .	1970-84†, 1991	11-05-90	5.03	246	04-19-75	17.65	1,260
STREAMS TRIBUTARY TO ST. CLAIR RIVER								
Pine River near Rattle Run, MI (04160350)	Lat 42°52'49", long 82°34'04", in NE1/4 sec.9, T.5 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, at Gratiot Road, 1.9 mi north- east of Rattle Run. Drainage area is 135 mi <sup>2</sup> .	1974-91	05-27-91	115.96	1,340	04-19-75	23.87	5,400

See footnotes at end of table.



DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft³/s)	Date	Gage height (ft)	Dis- charge (ft³/s)
STREAMS TRIBUTARY TO LAKE ST. CLAIR								
Clinton River at Auburn Heights, MI (04161000)	Lat 42°38'00", long 83°13'28", in NW1/4 sec. 36, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at Auburn Road in Auburn Heights. Datum of gage is 846.50 ft above National Geodetic Vertical Datum of 1929. Drainage area is 123 mi².	1935-40†, 1957-82†, 1983-91	05-26-91	4.43	1,130	09-30-81	5.41	1,780
West Branch Stony Creek near Washington, MI (04161760)	Lat 42°43'53", long 83°06'02", in SE1/4 sec.25, T.4 N., R.11 E., Oakland County, Hydrologic Unit 04090003, at Huron-Clinton Metropolitan Park Road, 3.4 mi west of Washington. Drainage area is 22.5 mi².	1965-91	05-26-91	m2.73	60	04-19-75	n4.42	470
North Branch Clinton River at Almont, MI (04164010)	Lat 42°54'59", long 83°02'42", in NE1/4 sec.28, T.6 N., R.12 E., Lapeer County, Hydrologic Unit 04090003, at State Highway 53 in Almont. Drainage area is 9.56 mi².	1959-62, 1963-68†, 1969-91	05-26-91	<3.72	<167	09-06-85	o8.60	818
North Branch Clinton River near Romeo, MI (04164050)	Lat 42°49'11", long 82°58'35", in NW1/4 sec.31, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 33 Mile Road, 2.2 mi north- east of Romeo. Drainage area is 49.7 mi².	1959-64, 1965-69†, 1970-91	05-26-91	3.54	616	04-19-75	p5.44	3,500
North Branch Clinton River near Meade, MI (04164150)	Lat 42°43'50", long 82°54'23", in NE1/4 sec.34, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 27 Mile Road, 1.9 mi north- west of Meade. Drainage area is 89.6 mi².	1959-67, 1968-72†, 1973-91	12-30-90	6.48	1,150	04-19-75	q7.76	4,500
Coon Creek near Armada, MI (04164200)	Lat 42°47'41", long 82°52'58", in SW1/4 sec.1, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at North Road, 3.4 mi south of Armada. Drainage area is 10.0 mi².	1959-65, 1966-70†, 1971-91	05-26-91	5.99	249	04-19-75	r6.25	480
Highbank Creek near Armada, MI (04164350)	Lat 42°28'24", long 82°51'08", in NW1/4 sec.6, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 32 Mile Road, 3.0 mi southeast of Armada. Drainage area is 14.9 mi².	1959-65, 1965-70†, 1971-91	05-26-91	16.30	j940	09-06-85	16.77	2,240

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued								
East Branch Coon Creek near New Haven, MI (04164360)	Lat 42°45'46", long 82°50'57", in NW1/4 sec.19, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 29 Mile Road, 3.4 mi northwest of New Haven. Drainage area is 36.1 mi <sup>2</sup> .	1959-67, 1968-72†, 1973-91	05-26-91	8.47	1,130	09-06-85	9.48	4,140
Deer Creek near Meade, MI (04164400)	Lat 42°42'39", long 82°51'32", in NW1/4 sec.6, T.3 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 25 1/2 Mile Road, 0.9 mi southeast of Meade. Drainage area is 12.7 mi <sup>2</sup> .	1959-60, 1960-65†, 1966-91	05-26-91	7.38	461	09-06-85	8.90	691
McBride Drain near Macomb, MI (04164450)	Lat 42°41'14", long 82°55'14", in NE1/4 NE1/4 sec.16, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 24 Mile Road, 2.2 mi southeast of Macomb. Drainage area is 5.79 mi <sup>2</sup> .	1960-64†, 1965-91	05-26-91	8.26	175	02-10-65	8.82	220
Middle Branch Clinton River near Macomb, MI (04164600)	Lat 42°42'03", long 82°59'44", in SE1/4 sec.2, T.3 N., R.12 E., Macomb County, Hydrologic Unit 04090003, at Schoenherr Road, 2.0 mi west of Macomb. Drainage area is 22.2 mi <sup>2</sup> .	1959-64, 1965-69†, 1971-91	12-30-90	9.95	490	06-26-68	12.17	1,400
Middle Branch Clinton River at Macomb, MI (04164800)	Lat 42°42'23", long 82°57'33", in SW1/4 sec.5, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at Romeo Plank Road, 0.4 mi north of Macomb. Datum of gage is 603.23 ft above National Geodetic Vertical Datum of 1929. Drainage area is 41.0 mi <sup>2</sup> .	1959-62, 1963-68†, 1969, 1970-82†, 1983-91	05-26-91	13.85	1,160	06-26-68	16.11	1,580
Gloede Ditch near Waldenburg, MI (04165200)	Lat 42°37'39", long 82°57'10", in SW1/4 sec.32, T.3 N., R.13 E., Macomb County, Hydro- logic Unit 04090003, 2.2 mi south of Waldenburg. Drainage area is 16.0 mi <sup>2</sup> .	1959, 1959-64†, 1965-91	05-26-91	17.00	359	06-26-68	18.40	600
STREAMS TRIBUTARY TO DETROIT RIVER								
Frank and Poet Drain at Trenton, MI (04168660)	Lat 42°09'19", long 83°12'22", in NW1/4 sec.13, T.4 S., R.10 E., Wayne County, Hydro- logic Unit 04090004, at King Road in Trenton. Drainage area is 19.3 mi <sup>2</sup> .	1972-91	12-30-90	8.50	355	09-07-90	9.55	655

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
Maximum discharge at crest-stage partial-record stations--Continued

Station name and number	Location and drainage area	Period of record	Water year 1991 maximum			Period of record maximum		
			Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)	Date	Gage height (ft)	Dis- charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE ERIE								
Huron River near Andersonville, MI (04168800)	Lat 42°41'35", long 83°29'56", in NW1/4 SE1/4 sec.3, T.3 N., R.8 E., Oakland County, Hydrologic Unit 04090005, at White Lake Road, 2.5 mi south of Andersonville. Drainage area is 14.0 mi <sup>2</sup> .	1974-91	10-10-90	2.50	74	04-19-75	3.17	120
Mill Creek near Lima Center, MI (04173250)	Lat 42°15'56", long 83°56'45", in NE1/4 sec.34, T.2 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at Guenther Road, 2.0 mi up- stream from North Fork Mill Creek, and 2.2 mi south of Lima Center. Drainage area is 47.3 mi <sup>2</sup> .	1973-91	12-31-90	9.10	433	05-02-83	10.24	669
South Branch River Raisin near Adrian, MI (04175960)	Lat 41°55'03", long 84°00'37", in SE1/4 sec.25, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Howell Highway, 2.0 mi north- east of Adrian. Drainage area is 165 mi <sup>2</sup> .	1979-91	12-31-90	11.56	2,950	02-25-85	11.96	3,460
Saline River near Saline, MI (04176400)	Lat 42°07'50", long 83°46'35", in SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Maple Road, 2.8 mi south of Saline. Drainage area is 94.6 mi <sup>2</sup> .	1966-77†, 1978-91	12-31-90	11.56	1,580	06-26-68	13.37	3,990

† Operated as a continuous-record gaging station.

\* Also a low-flow partial-record station.

a Revised.

b Maximum gage height, 12.36 ft, Apr. 9, 1991, site and datum then in use.

c Maximum gage height, 9.84 ft, Apr. 6, 1988.

d Maximum gage height, 11.96 ft, Apr. 3, backwater from ice.

e Maximum gage height, 14.82 ft, Apr. 2, 1986, backwater from ice.

f Maximum gage height, 8.94 ft, Mar. 30, 1977, backwater from ice.

g Maximum gage height, 5.04 ft, Jan. 1, backwater from ice.

h Maximum gage height, 5.86 ft, Dec. 31, 1988, backwater from ice.

i From floodmark.

j Estimated.

k Maximum gage height, 4.66 ft, Mar. 12, 1990.

l Maximum gage height, 16.17 ft, Dec. 30, backwater from ice.

m Maximum gage height, 2.82 ft, Dec. 30, backwater from ice.

n Maximum gage height, 5.93 ft, Jan. 27, 1974, backwater from ice.

o Maximum gage height, 8.62 ft, Apr. 19, 1975.

p Maximum gage height, 7.1 ft, Mar. 12 or 13, 1962, backwater from ice, site and datum then in use.

q Maximum gage height, 7.85 ft, Mar. 12, 1962, backwater from ice.

r Maximum gage height, 6.95 ft, Sept. 6, 1985.

s Maximum gage height, 9.55 ft, June 26, 1968.

t Maximum gage height, 15.89 ft, Mar. 14, 1972, backwater from ice.

u Maximum gage height, 16.16 ft, Mar. 12, 1962, backwater from ice.

v Maximum gage height, 10.72 ft, Mar. 14, 1982, backwater from ice.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

## Low-flow partial-record stations

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. These measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of a stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1991

Station No.	Station Name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements	
					Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE SUPERIOR						
04044400	Carp River near Negaunee, MI	Lat 46°31'29", long 87°34'25", in SE1/4 sec.29, T.48 N., R.26 W., Marquette County, Hydrologic Unit 04020105, at U.S. Highway 41, 2.0 mi northeast of Negaunee.	51.4	1961-86†a, 1987-91a	10-26-90 06-13-91 07-25-91 09-04-91	b64.4 b40.2 b18.7 b19.7
STREAMS TRIBUTARY TO LAKE MICHIGAN						
04057580	Whitefish River near Rapid River, MI	Lat 45°57'56", long 86°55'15", in SE1/4 NW1/4 sec.10, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, about 800 ft downstream from Chippeny Creek, 3.5 mi northeast of Rapid River.	284	1973-91	05-22-91 06-07-91 06-25-91 08-09-91	294 219 128 84.0
04058120	Green Creek near Palmer, MI	Lat 46°22'22", long 87°36'21", in NW1/4 sec.19, T.46 N., R.26 W., Marquette County, Hydrologic Unit 04030110, at County Highway 565, 4.5 mi south of Palmer.	8.42	1961-65, 1970-91c	04-29-91 07-24-91 09-05-91 09-26-91	b20.1 b5.27 b2.00 b16.1
04059034	Escanaba River near Wells, MI	Lat 45°48'22", long 87°05'51", in SW1/4 NW1/4 sec.1, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030110, 600 ft downstream from Bichler Creek, 2.0 mi northwest of Wells, and 2.5 mi upstream from mouth.	d920	1981-91c	06-19-91 08-01-91 08-21-91 09-10-91	b483 b826 b302 b387
04096517	South Branch Hog Creek Tributary near Allen, MI	Lat 41°57'33", long 84°49'33", in SW1/4 SW1/4 sec.7, T.6 S., R.4 W., Hillsdale County, Hydrologic Unit 04050001, at Squires Road, 0.3 mi upstream from mouth, and 3.0 mi west of Allen.	2.61	1969-91	10-16-90 02-28-91 05-24-91 07-11-91	b6.47 1.58 1.97 1.25
04114594	Maple River near St. Johns, MI	Lat 43°02'43", long 84°28'11", in SE1/4 SE1/4 sec.30, T.8 N., R.1 W., Clinton County, Hydrologic Unit 04050005, at Colony Road, 4.5 mi northeast of St. Johns.	--	1981-91	11-14-90 04-02-91 06-18-91 08-02-91 09-11-91	b170 b169 82.1 24.0 19.4
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'17", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	d39	1974-91	10-30-90 01-29-91 06-04-91 08-28-91	41.9 44.8 43.2 30.6
04121239	Clam River at Cadillac, MI	Lat 44°15'49", long 85°24'04", in NE1/4 NE1/4 sec.33, T.22 N., R.9 W., Wexford County, Hydrologic Unit 04060102, at Smith Street in Cadillac.	d48	1983-84, 1986-91	10-31-90 01-31-91 03-20-91 06-21-91 08-28-91	b68.5 44.2 b41.7 3.96 3.39

† Operated as a continuous-record gaging station.

\* Also a crest-stage partial-record station.

a Affected by domestic diversion.

b Not base flow.

c Affected by diversion for industrial use.

d Approximately.



## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

## Special study and miscellaneous sites

Discharge measurements in the following table were made at special study and miscellaneous sites throughout the State.

Discharge measurements made at special study and miscellaneous sites during water year 1991

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE SUPERIOR							
04034100	Bond Falls Lower By-Pass	Middle Branch Ontonagon River	Lat 46°24'27", long 89°07'44", in SE1/4 SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Road, 2.2 mi west of Calderwood.	--	1942,1945, 1963-64, 1967,1969, 1971-72, 1974, 1979-81, 1983-84, 1987-90	07-29-91	a37.8
04043063	Unnamed Tributary	Lake Superior	Lat 46°48'54", long 88°28'57", in NE1/4 SW1/4 sec. 15, T.51 N., R.33 W., Baraga County, Hydrologic Unit 04020105, 600 ft downstream of culvert on logging road, 0.5 mi northwest of Assinins.	0.43	--	08-21-91	0.00
04043064	Unnamed Tributary	Lake Superior	Lat 46°49'07", long 88°29'22", in SE1/4 NE1/4 sec. 16, T.51 N., R.33 W., Baraga County, Hydrologic Unit 04020105, 600 ft downstream of culvert on logging road, 0.9 mi northwest of Assinins.	1.34	--	08-21-91	0.00
04043068	Unnamed Tributary	Lake Superior	Lat 46°49'27", long 88°29'03", in SW1/4 SW1/4 sec.10, T.51 N., R.33 W., Baraga County, Hydrologic Unit 04020105, at railroad culvert, 1.0 mi north of Assinins.	2.26	--	08-21-91	*0.05
STREAMS TRIBUTARY TO LAKE MICHIGAN							
04057044	Manistique River (Flume By-pass)	Lake Michigan	Lat 45°57'53", long 86°14'52", in SW1/4 NE1/4 sec.12, T.41 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, 650 ft downstream from control structure, in Manistique.	--	--	09-03-91 09-03-91 09-03-91 09-03-91	a48.0 a129 a261 a416
04062010	Brule River	Menominee River	Lat 45°56'51", long 88°13'04", in NW1/4 SW1/4 sec.17, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, 150 ft downstream from Brule Dam, 2.3 mi northeast of Florence, WI.	1,020	1945-46, 1953,1989	10-02-90 12-18-90 12-18-90	a77.4 a131 a123
04065110	Menominee River	Lake Michigan	Lat 45°45'53", long 87°58'00", in NE1/4 sec.23, T.39 N., R.30 W., Dickinson County, Hydrologic Unit 04030108, at intake at Champion International Corp. Quinnesec Pulpmill, 2.0 mi southeast of Niagara, WI.	2,470	1987-89	07-15-91 08-16-91 08-21-91 09-24-91	a1,740 a927 a1,260 a1,220
04096412	Unnamed Tributary	Marble Lake	Lat 41°55'20", long 84°53'02", in SW1/4 NW1/4 sec.27, T.6 S., R.5 W., Branch County, Hydrologic Unit 04050001, at Ray Quincy Road, 1.5 mi south of Quincy.	--	--	02-28-91 03-28-91	b5.04 b15.4
04096418	Fisher Creek	Marble Lake	Lat 41°52'07", long 84°53'01", in NE1/4 NE1/4 sec.16, T.7 S., R.5 W., Branch County, Hydrologic Unit 04050001, at Ray Quincy Road, 4.9 mi north of California.	--	--	02-28-91 03-28-91	b10.2 b25.1
040964235	Unnamed Tributary	Wright Lake	Lat 41°52'00", long 84°57'22", in NE1/4 NW1/4 sec.13, T.7 S., R.6 W., Branch County, Hydrologic Unit 04050001, at Quimby Road, 6.1 mi northwest of California.	--	--	02-28-91 03-28-91	*b1.19 b6.97
04096431	Talahassee Drain	Coldwater River	Lat 41°51'04", long 84°56'48", in NW 1/4 NE1/4 sec.24, T.7 S., R.6 W., Branch County, Hydrologic Unit 04050001, at private drive north of Talahassee Road, 5.0 mi northwest of California.	--	--	02-28-91 03-28-91	*b23.7 b42.8

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04108900	Grand River	Lake Michigan	Lat 42°10'08", long 84°23'02", in SE1/4 NE1/4 sec.35, T.3 S., R.1 W., Jackson County, Hydrologic Unit 04050004, at Draper Road, 2.0 mi south of Vandercook Lake.	41.0	1961, 1963-65, 1974-79, 1987, 1989-90	02-27-91 07-17-91	b53.4 *b7.72
04110663	Unnamed Tributary	Perry Creek	Lat 42°27'38", long 84°28'57", in SW1/4 NW1/4 sec.19, T.1 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Ridley Road, 2.0 mi west of Leslie.	--	1990	04-10-91	b2.86
04112670	Willow Creek	Sycamore Creek	Lat 42°32'18", long 84°29'26", in SW1/4 SE1/4 sec.24, T.2 N., R.2 W., Ingham County, Hydrologic Unit 04050004, at Toles Road, 3.7 mi southwest of Mason.	--	1990	02-27-91 04-10-91	*b2.37 b3.87
04112673	Unnamed Tributary	Willow Creek	Lat 42°32'33", long 84°27'45", in NW1/4 SW1/4 sec.20, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Tuttle Road, 0.2 mi south of Lyon Road, and 2.7 mi southwest of Mason.	--	1990	03-17-91 04-10-91 04-15-91	b0.74 b0.79 b2.40
04112694	Unnamed Tributary	Sycamore Creek	Lat 42°35'00", long 84°26'30", in NW1/4 SW1/4 sec.4, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at North Jefferson Avenue, in Mason.	2.60	1971, 1989-90	02-27-91 03-27-91	*b1.42 b23.2
04118235	Bear Creek	Grand River	Lat 43°03'55", long 85°25'58", in NE1/4 SE1/4 sec.24, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Kreuter Road, 2.2 mi northeast of Cannonsburg.	--	--	06-27-91 08-28-91	*b3.94 *b3.11
04118238	Unnamed Tributary	Bear Creek	Lat 43°03'21", long 85°25'51", in NW1/4 NW1/4 sec.30, T.8 N., R.9 W., Kent County, Hydrologic Unit 04050006, at Tiffany Road, 2.0 mi east of Cannonsburg.	--	--	08-28-91	*b0.13
04118241	Unnamed Tributary	Bear Creek	Lat 43°02'31", long 85°25'08", in NW1/4 NE1/4 sec.31, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at private drive 500 ft upstream of 5 Mile Road, 2.8 mi southeast of Cannonsburg.	--	--	08-28-91	b0.00
04118245	Unnamed Tributary	Bear Creek	Lat 43°03'00", long 85°25'51", in NW1/4 SW1/4 sec.30, T.8 N., R.9 W., Kent County, Hydrologic Unit 04050006, at Tiffany Road, 2.0 mi east of Cannonsburg.	--	--	08-28-91	*b0.69
04118247	Bear Creek	Grand River	Lat 43°03'17", long 85°27'02", in NW1/4 NW1/4 sec.25, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Giles Avenue, 1.0 mi east of Cannonsburg.	--	--	06-18-91	*b8.56
04118250	Bear Creek	Grand River	Lat 43°03'15", long 85°28'01", in NW1/4 NW1/4 sec.26, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Ramsdell Road, 0.2 mi northeast of Cannonsburg.	--	--	06-18-91 06-28-91	*b10.4 *b7.39
04118254	Unnamed Tributary	Bear Creek	Lat 43°03'22", long 85°28'32", in NE1/4 NE1/4 sec.27, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Cannonsburg Road, 0.4 mi west of Cannonsburg.	--	--	06-18-91 08-28-91	*b1.43 *b0.93
04118258	Bear Creek	Grand River	Lat 43°03'19", long 85°30'37", in NE1/4 NE1/4 sec.29, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Egypt Valley Road, 2.0 mi west of Cannonsburg.	--	--	06-18-91 08-28-91	*b18.4 *b12.0

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04118263	Armstrong Creek	Bear Creek	Lat 43°03'36", long 85°30'36", in SW1/4 SW1/4 sec.21, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Egypt Valley Road, 2.0 mi west of Cannonsburg.	--	--	08-28-91	*b1.68
04118270	Bear Creek	Grand River	Lat 43°03'26", long 85°32'02", in NE1/4 NE1/4 sec.30, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Cannonsburg Road, 3.2 mi west of Cannonsburg.	--	--	06-18-91	*b28.7
04118275	Bear Creek	Grand River	Lat 43°03'00", long 85°32'56", in SW1/4 NW1/4 sec.30, T.8 N., R.10 W., Kent County, Hydrologic Unit 04050006, at Chauncey Road, 4.0 mi west of Cannonsburg.	--	--	06-18-91 08-28-91	*b27.2 *b20.3
04119080	Buck Creek	Grand River	Lat 42°49'35", long 85°40'56", in NW1/4 NW1/4 sec. 13, T.5 N., R.12 W., Kent County, Hydrologic Unit 04050006, at 76th Street, 2.0 mi northeast of Byron Center.	--	--	06-19-91	*b3.57
04119090	Sharps Creek	Buck Creek	Lat 42°49'37", long 85°39'49", in SW1/4 SW1/4 sec.7, T.5 N., R.11 W., Kent County, Hydrologic Unit 04050006, at Division Avenue, in Cutlerville.	--	--	06-19-91	*b1.86
04119097	Unnamed Tributary	Buck Creek	Lat 42°49'56", long 85°39'49", in NW1/4 SW1/4 sec.7, T.5 N., R.11 W., Kent County, Hydrologic Unit 04050006, at Division Avenue, in Cutlerville.	--	--	06-19-91	b1.58
04119120	Pine Hill Creek	Buck Creek	Lat 42°51'22", long 85°39'50", in SW1/4 SW1/4 sec.31, T.6 N., R.11 W. Kent County, Hydrologic Unit 04050006, at Division Avenue, in Wyoming.	--	--	06-19-91	*b1.27
04119138	Unnamed Tributary	Buck Creek	Lat 42°52'17", long 85°39'52", in SE1/4 SE1/4 sec.25, T.6 N., R.12 W., Kent County, Hydrologic Unit 04050006, at Division Avenue, in Wyoming.	--	--	06-19-91	*b4.04
04119150	Buck Creek	Grand River	Lat 42°53'04", long 85°42'22", in SE1/4 SE1/4 sec.22, T.6 N., R.12 W., Kent County, Hydrologic Unit 04050006, at 44th Street, in Wyoming.	--	--	06-19-91	*b25.4
04119160	Buck Creek	Grand River	Lat 42°54'09", long 85°45'46", in SE1/4 SE1/4 sec.18, T.6 N., R.12 W., Kent County, Hydrologic Unit 04050006, at Wilson Avenue, in Grandville.	50.5	1974-90c	06-19-91	*b32.6
04120270	Black Creek	Mona Lake	Lat 43°14'03", long 86°04'03", in NE1/4 NE1/4 sec.27, T.10 N., R.15 W., Muskegon County, Hydrologic Unit 04060101, at Maple Island Road, 7.0 mi east of Muskegon.	--	1979	06-25-91	*b0.54
04120275	Muskegon Newaygo Drain	Black Creek	Lat 43°13'35", long 86°04'03", in NW1/4 SW1/4 sec.26, T.10 N., R.15 W., Muskegon County, Hydrologic Unit 04060101, at Maple Island Road, 7.0 mi east of Muskegon.	--	--	06-27-91	*b28.3
04120285	Black Creek	Mona Lake	Lat 43°12'56", long 86°05'43", in SW1/4 NE1/4 sec.33, T.10 N., R.15 W., Muskegon County, Hydrologic Unit 04060101, at Evanston Road, 2.4 mi southeast of Wolf Lake.	--	1978	06-27-91	*b34.4

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04120295	Black Creek	Mona Lake	Lat 43°12'14", long 86°09'17", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon.	d39	1974-90ce	06-27-91	*b46.9
04120300	Black Creek	Mona Lake	Lat 43°11'50", long 86°11'11", in NE1/4 SE1/4 sec.3, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Black Creek Road, 3.8 mi southeast of Muskegon.	--	1952, 1970, 1973-74	06-27-91	*b51.9
04120323	Little Black Creek	Mona Lake	Lat 43°13'11", long 86°10'28", in SW1/4 SE1/4 sec.26, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Laketon Road, 2.0 mi east of Muskegon.	--	--	06-25-91	*b0.91
04120325	Little Black Creek	Mona Lake	Lat 43°12'56", long 86°10'51", in SW1/4 NW1/4 sec.35, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Evanston Road, 2.0 mi southeast of Muskegon.	--	--	06-25-91	*b1.30
04120327	Little Black Creek	Mona Lake	Lat 43°12'29", long 86°12'53", in SE1/4 SW1/4 sec.33, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Roberts Street, in Muskegon.	--	--	06-25-91	*b3.92
04120330	Little Black Creek	Mona Lake	Lat 43°11'34", long 86°14'18", in SE1/4 SW1/4 sec.5, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Airline Highway, in Muskegon Heights.	6.00	1973-74	06-25-91	*b7.23
04121999	Penoyer Creek	Muskegon River	Lat 43°25'26", long 85°47'58", in SW1/4 SW1/4 sec. 18, T.12 N., R.12 W., Newaygo County, Hydrologic Unit 04060102, at State Highway 82, in Newaygo.	--	--	06-04-91	27.8
04127503	Mitchell Creek	Lake Michigan	Lat 44°42'32", long 85°35'28", SW1/4 NW1/4 sec.25, T.27 N., R.11 W., Grand Traverse County, Hydrologic Unit 04060105, at Hughes Drive, 2.5 mi southeast of Traverse City.	--	--	03-12-91 05-16-91 05-17-91 08-02-91	*b0.17 *b0.12 b0.26 b0.13
04127504	Unnamed Tributary	Mitchell Creek	Lat 44°42'41", long 85°35'44", in SE1/4 NE1/4 sec.26, T.27 N., R.11 W., Grand Traverse County, Hydrologic Unit 04060105, at Garfield Road, 2.2 mi southeast of Traverse City.	--	--	03-12-91 05-16-91 05-17-91 08-02-91	*b0.08 *b0.09 b0.18 b0.06
04127506	Mitchell Creek	Lake Michigan	Lat 44°43'48", long 85°34'30", in SW1/4 SW1/4 sec.18, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Town Line Road, in Traverse City.	--	--	03-12-91 05-17-91 08-02-91	*b6.36 b8.86 b5.62
04127507	Unnamed Tributary	Mitchell Creek	Lat 44°42'54", long 85°34'18", in NW1/4 NW1/4 sec.30, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Hammond Road, 1.0 mi south of Traverse City.	--	--	03-11-91 05-16-91 08-02-91	*b1.06 *b0.94 b1.11
04127510	Mitchell Creek	Lake Michigan	Lat 44°44'05", long 85°33'18", in NW1/4 SW1/4 sec.17, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Threemile Road, in Traverse City.	--	1983	03-11-91 05-17-91 08-02-91	*b9.03 b7.45 b4.44
04127511	Unnamed Tributary	Fourmile Creek	Lat 44°43'40", long 85°32'08", in NW1/4 NW1/4 sec.21, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Fourmile Road, 3.5 mi southwest of Acme.	--	--	03-11-91 05-17-91 08-02-91	*b1.18 b1.17 b1.26

See footnotes at end of table.



## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04127514	Vandarli Creek	Mitchell Creek	Lat 44°42'55", long 85°32'59", in SE1/4 SW1/4 sec.20, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Hammond Road, 4.0 mi southeast of Traverse City.	--	--	03-11-91	*b0.61
						05-16-91	*b0.45
						05-17-91	b1.21
						08-02-91	b0.30
04127518	Mitchell Creek	Lake Michigan	Lat 44°44'10", long 85°33'23", in NW1/4 SW1/4 sec.17, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at private drive, 750 ft downstream from Threemile Road, in Traverse City.	--	--	03-11-91	*b15.7
						05-17-91	b16.0
						08-02-91	b9.96
04127520	Mitchell Creek	Lake Michigan	Lat 44°44'52", long 85°33'30", in SE1/4 SE1/4 sec.7, T.27 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at first private drive upstream of Threemile Road, in Traverse City.	--	1949, 1983-84	03-11-91	*b10.6
						05-17-91	b8.94
						05-26-91	b12.3
						08-02-91	b4.78
04127522	Mitchell Creek	Lake Michigan	Lat 44°44'53", long 85°33'31", in NE1/4 SE1/4 sec.7, T.27 N. R.10 W., Grand Traverse County, Hydrologic Unit 04060105, at Threemile Road, in Traverse City.	--	--	03-11-91	*b17.9
						05-17-91	b15.0
						05-26-91	b18.1
						08-02-91	b8.43
041275532	Dingman River	Sixmile Lake	Lat 45°05'38", long 85°11'37", in SE1/4 SW1/4 sec.8, T.31 N., R.7 W., Antrim County, Hydrologic Unit 04060105, at Dingman School Road, 3.0 mi northwest of Pleasant Valley.	--	1990	10-02-90	21.1
						11-06-90	28.1
						12-05-90	24.2
						01-15-91	19.1
						02-05-91	23.5
						03-05-91	53.9
041275534	St. Clair Lake Outlet	Ellsworth Lake	Lat 45°09'57", long 85°14'24", in NW1/4 SW1/4 sec.13, T.32 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at Bridge Street, in Ellsworth.	--	1990	10-02-90	42.6
						11-06-90	60.1
						12-05-90	59.5
						01-15-91	45.7
						02-05-91	49.7
						03-05-91	90.3
041275536	Green River	Hanley Lake	Lat 45°05'47", long 85°15'26", in SE1/4 SW1/4 sec.11, T.31 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at Mohrman Bridge Road, 1.8 mi north of Central Lake.	--	1990	10-02-90	62.7
						11-06-90	97.8
						12-05-90	77.0
						01-15-91	72.4
						02-05-91	77.9
						03-05-91	133
041275538	Intermediate River	Lake Bellaire	Lat 44°59'20", long 85°12'27", in NE1/4 NW1/4 sec.19, T.30 N., R.7 W., Antrim County, Hydrologic Unit 04060105, 0.6 mi downstream from Intermediate Lake, 1.0 mi north of Bellaire.	--	1982,1990	10-03-90	f49.0
						11-07-90	125
						12-06-90	122
						01-16-91	97.1
						02-07-91	90.7
						03-06-91	175
04127568	Clam River	Torch Lake	Lat 44°56'30", long 85°16'55", in SE1/4 NW1/4 sec.4, T.29 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at East Torch Lake Drive, in Clam River.	--	1977,1990	10-02-90	281
						11-06-90	373
						12-05-90	363
						01-15-91	337
						02-05-91	306
						03-05-91	359
04127570	Torch River	Lake Skegemog	Lat 44°51'02", long 85°19'39", in NE1/4 SW1/4 sec.6, T.28 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at County Road 593, in Torch River.	--	1990	10-03-90	227
						11-07-90	438
						12-06-90	395
						01-16-91	360
						02-07-91	355
						03-06-91	413
04127590	Rapid River	Torch River	Lat 44°50'16", long 85°16'58", in NW1/4 SE1/4 sec.9, T.28 N., R.8 W., Kalkaska County, Hydrologic Unit 04060105, at Rapid City Road, in Rapid City.	--	1990	10-02-90	106
						11-06-90	113
						12-06-90	105
						01-15-91	101
						02-05-91	111
						03-05-91	105

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04127695	Elk River	Lake Michigan	Lat 44°53'59", long 85°24'33", in SE1/4 NW1/4 sec.21, T.29 N., R.9 W., Antrim County, Hydrologic Unit 04060105, at U.S. Highway 31, in Elk Rapids.	513	1990	10-02-90	533
						11-06-90	502
						12-05-90	488
						01-15-91	660
						02-05-91	791
						03-05-91	658
STREAMS TRIBUTARY TO LAKE HURON							
04137005	Au Sable River	Lake Huron	Lat 44°33'37", long 83°48'12", in SW1/4 NW1/4 sec.14, T.25 N., R.5 E., Alcona County, Hydrologic Unit 04070007, at Bamfield Road, 3.2 mi east of Curtisville.	--	1987	10-16-90	g730
						10-16-90	g924
						10-16-90	g1,120
						10-16-90	g2,920
						10-17-90	g1,310
						10-17-90	g1,500
						10-17-90	g1,630
						10-17-90	g1,750
						10-17-90	g1,900
						10-18-90	g1,280
						10-18-90	g1,460
						10-18-90	g1,610
10-18-90	g1,760						
04137830	Tawas River	Lake Huron	Lat 44°15'35", long 83°31'34", in SW1/4 NE1/4 sec.36, T.22 N., R.7 E., Iosco County, Hydrologic Unit 04080101, at U.S. Highway 23, 500 ft upstream from mouth, and in Tawas City.	--	--	04-18-91	b646
						06-20-91	b82.2
04138500	Au Gres River	Lake Huron	Lat 44°10'26", long 83°44'36", in NE1/4 NE1/4, sec.31, T.21 N., R.6 E. Iosco County, Hydrologic Unit 04080101, at former gaging station, at Cox Road, and 4.4 mi southwest of National City.	154	1951-81†, 1984, 1988	04-18-91	b666
04138535	Au Gres River	Lake Huron	Lat 44°05'05", long 83°40'56", in SW1/4 SW1/4 sec.31, T.20 N., R.7 E., Arenac County, Hydrologic Unit 04080101, at Bessinger Road, 2.5 mi north of Au Gres.	--	--	06-20-91	b62.1
04138540	Au Gres River	Lake Huron	Lat 44°02'53", long 83°41'13", in NE1/4 SE1/4 sec.13, T.19 N., R.6 E., Arenac County, Hydrologic Unit 04080101, at U.S. Highway 23, in Au Gres.	--	--	04-18-91	b1,220
04143150	Pine River	Lake Huron	Lat 44°00'05", long 83°55'37", in NE1/4 SE1/4 sec.36, T.19 N., R.4 E., Arenac County, Hydrologic Unit 04080102, at Foco Road, 2.1 mi northeast of Standish.	44	1970	06-20-91	b15.9
04143170	South Branch Pine River	Pine River	Lat 43°58'58", long 83°53'37", in SW1/4 SE1/4 sec.5, T.18 N., R.5 E., Arenac County, Hydrologic Unit 04080102, at Pine River Road, 3.3 mi east of Standish.	--	1974-75	06-20-91	b9.34
04143200	Pine River	Lake Huron	Lat 43°59'06", long 83°53'15", in SE1/4 SE1/4 sec.5, T.18 N., R.5 E., Arenac County, Hydrologic Unit 04080102, at Arenac State Road, 3.5 mi east of Standish.	91.9	1973-77	04-18-91	b235
04143300	Pinconning River	Lake Huron	Lat 43°51'30", long 83°57'58", in NW1/4 SW1/4 sec.23, T.17 N., R.4 E., Bay County, Hydrologic Unit 04080102, at U.S Highway 13, in Pinconning.		1942, 1973-75	06-20-91	b3.10

See footnotes at end of table.

## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
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STREAMS TRIBUTARY TO LAKE HURON--Continued							
04143310	Pinconning River	Lake Huron	Lat 43°51'11", long 83°56'45", in SW1/4 SW1/4 sec.24, T.17 N., R.4 E., Bay County, Hydrologic Unit 04080102, at Pinconning Road, 0.5 mi west of Pinconning.	--	--	04-18-91	b50.7
04143480	Kawkawlin River	Lake Huron	Lat 43°38'19", long 83°58'35", in NW1/4 NE1/4 sec.10, T.14 N., R.4 E., Bay County, Hydrologic Unit 04080102, at Wheeler Road, 1.8 mi southwest of Kawkawlin.	--	--	04-19-91 06-20-91	b228 b34.2
04143500	North Branch Kawkawlin River	Kawkawlin River	Lat 43°40'05, long 83°58'13", in SE1/4 SE1/4 sec.27, T.15 N., R.4 E., Bay County, Hydrologic Unit 04080102, at former gaging station, at Beaver Road, and 1.7 mi northwest of Kawkawlin.	101	1951-82†	04-18-91 06-20-91	b743 b33.6
04157200	Allen Drain	Lake Huron	Lat 43°37'28", long 83°33'54", in SW1/4 SW1/4 sec.8, T.14 N., R.8 E., Tuscola County, Hydrologic Unit 04080103, at State Highway 25, 7.0 mi north of Fairgrove.	--	--	04-19-91 06-21-91	b29.1 *b1.15
04157300	Wiscoggin Drain	Lake Huron	Lat 43°40'47", long 83°29'30" in NW1/4 NE1/4 sec.26, T.15 N., R.8 E., Tuscola County, Hydrologic Unit 04080103, at Forest Road, 1.5 mi northwest of Unionville.	d46	--	04-19-91	b52.8
04157500	State Drain	Sebewaing River	Lat 43°42'43", long 83°25'40", in SE1/4 SW1/4, sec.16, T.15 N., R.9 E., Huron County, Hydrologic Unit 04080103, at former gaging station, at Rescue Road, and 1.4 mi southeast of Sebewaing.	67.3	1940-54†, 1973-75	04-19-91 06-21-91	b68.1 *b5.23
04158000	Columbia Drain	Sebewaing River	Lat 43°43'38", long 83°23'46", in SE1/4 SE1/4 sec.10, T.15 N., R.9 E., Huron County, Hydrologic Unit 04080103, at Gettel Road, and 2.5 mi east of Sebewaing.	33.9	1940-54†, 1973-75, 1988-90†	04-19-91 06-21-91	b26.4 *b2.94
04158400	Mud Creek	Lake Huron	Lat 43°53'10", long 83°18'04", in SE1/4 SE1/4, sec. 21, T.17 N., R.10 E., Huron County, Hydrologic Unit 04080103, at Brown Road, 4.5 mi southwest of Caseville.	7.21	--	04-19-91 06-21-91	b8.64 b1.98
04159045	Pinnebog River	Lake Huron	Lat 43°55'14", long 83°07'32", in NE1/4 NE1/4 sec.12, T.17 N., R.11 E., Huron County, Hydrologic Unit 04080103, at Limerick Road, 1.5 mi southwest of Pinnebog.	d124	1973-78	06-21-91	b19.0
04159051	Pinnebog River	Lake Huron	Lat 43°59'36", long 83°04'33", in NW1/4 NE1/4 sec.16, T.18 N., R.12 E., Huron County, Hydrologic Unit 04080103, at State Highway 25, 5.0 mi northwest of Kinde.	--	--	04-19-91	b261
STREAMS TRIBUTARY TO DETROIT RIVER							
04166680	Sump Drain	Johnson Drain	Lat 42°24'59", long 83°51'52", in SE1/4 NE1/4 sec.7, T.1 S., R.8 E., Wayne County, Hydrologic Unit 04090004, at Ridge Road, 2.0 mi southwest of Northville.	--	--	03-18-91	b2.35

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## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE ERIE							
04174705	Fleming Creek	Huron River	Lat 42°16'58", long 83°39'59", in SE1/4 NE1/4 sec.25, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005, at Radrick Golf Course, 1.0 mi north of Geddes.	30.2	1989-90	10-24-90	*16.5
04175229	Swan Creek	Lake Erie	Lat 42°01'21", long 83°18'09", in NE1/4 NE1/4 sec.36, T.5 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at Labo Road, 1.5 mi north of Newport.	--	1990	09-11-91	*0.71
04175305	Paint Creek	Stony Creek	Lat 42°13'18", long 83°37'34", in private claim 681, T.3 S., R.7 E., Washtenaw County, Hydrologic Unit 04100001, about 1,600 ft downstream from Interstate 94, 0.5 mi south of Ypsilanti.	--	--	07-17-91	*b1.36
04175306	Paint Creek	Stony Creek	Lat 42°12'54", long 83°37'29", in NE1/4 NE1/4 sec. 20, T.3 S., R.7 E., Washtenaw County, Hydrologic Unit 04100001, 100 ft downstream from detention impoundment, about 4,700 ft downstream from Interstate 94, and 1.0 mi south of Ypsilanti.	--	--	07-17-91	bh1.27
04175308	Unnamed Tributary	Paint Creek	Lat 42°12'45", long 83°37'28", in NE1/4 NE1/4 sec.20, T.3 S., R.7 E., Washtenaw County, Hydrologic Unit 04100001, at farm road crossing near mouth, 1.0 mi south of Ypsilanti.	--	--	07-17-91	*b4.48
04175340	Stony Creek	Lake Erie	Lat 42°05'05", long 83°34'43", in NE1/4 NE1/4 sec.3, T.5 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at former gaging station, at Tuttle Hill Road, 0.3 mi northeast of Oakville.	68.0	1970-81†, 1984, 1990	07-24-91 09-11-91	*7.82 *12.1
04175407	Stony Creek	Lake Erie	Lat 41°57'12", long 83°19'22", in SE1/4 SE1/4 sec.23, T.6 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at township park off Nadeau Road, 1.0 mi northwest of Woodland Beach.	--	1990	07-23-91 09-11-91	*4.81 *8.93
04175463	Sandy Creek	Lake Erie	Lat 41°56'28", long 83°21'19", in NW1/4 SW1/4 sec.27, T.6 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at Yax Road, 1.8 mi east of Golfcrest.	--	1973, 1990	07-24-91 09-11-91	0.00 *0.04
04176173	Little River Raisin	River Raisin	Lat 41°56'43", long 83°42'15", in NE1/4 SW1/4 sec.22, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, adjacent to Brewer Road, 2.5 mi southwest of Dundee.	--	1990	07-23-91 09-10-91	*0.44 *1.45
04176262	Macon Creek	River Raisin	Lat 41°58'38", long 83°41'16", in NW1/4 SW1/4 sec.1, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Ann Arbor Road, 2.0 mi north of Dundee.	--	1990	07-23-91 09-10-91	*2.33 *3.86
04176315	North Branch Macon Creek	Macon Creek	Lat 42°00'29", long 83°40'04", in SE1/4 NW1/4 sec.36, T.5 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Delke Road, 0.8 mi south of Azalia.	--	1990	07-23-91 09-10-91	0.00 *10.05
04176332	Macon Creek	River Raisin	Lat 41°58'47", long 83°37'33", in NE1/4 NW1/4 sec.8, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, adjacent to Stowell Road, 2.0 mi northeast of Dundee.	--	1990	07-23-91 09-10-91	*10.8 *3.09
04176400	Saline River	River Raisin	Lat 42°07'50", long 83°46'35", in NW1/4 SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at former gaging station, at Maple Road, 2.8 mi south of Saline.	94.6	1965, 1966-77†, 1978-90c	07-24-91 09-11-91	*19.4 *20.7

See footnotes at end of table.



## DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1991--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Discharge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE ERIE--Continued							
04176430	Saline River	River Raisin	Lat 41°59'53", long 83°37'28", in NW1/4 NE1/4 sec.5, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, at Day Road, 3.3 mi northeast of Dundee.	127	1963, 1970, 1984, 1990	07-24-91 09-10-91	*21.8 *24.3
04176565	Plum Creek	Lake Erie	Lat 41°54'13", long 83°23'53", in private claim 499, T.7 S., R.9 E., Monroe County, Hydrologic Unit 04100002, at La Plaisance Road, in Monroe.	--	1976, 1990	07-23-91 09-10-91	*3.31 *6.43
04176638	Little Lake Creek	Lake Erie	Lat 41°46'35", long 83°30'23", in NW1/4 NW1/4 sec.20, T.8 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at State Highway 125, 1.5 mi southwest of Erie.	--	1990	07-23-91 09-10-91	*0.01 *0.01
04176680	Halfway Creek	Lake Erie	Lat 41°44'07", long 83°36'18", in NW1/4 NW1/4 sec.4, T.9 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at Smith Road, 2.3 mi southeast of Lambertville.	34.2	1971-73, 1990	07-23-91 09-10-91	*4.03 *0.71
04176727	North Tenmile Creek	Tenmile Creek	Lat 41°44'47", long 83°41'07", in NW1/4 NW1/4 sec.35, T.8 S., R.6 E., Monroe County, Hydrologic Unit 04100001, at Jeffs Road, 2.0 mi south of Whiteford Center.	--	1990	09-10-91	*0.01

\* Base flow.

† Operated as a continuous-record gaging station.

a Affected by regulation and diversion.

b Discharge measurement made by employees of Michigan Department of Natural Resources.

c Operated as a crest-stage partial-record station.

d Approximately.

e Operated as a low-flow partial-record station.

f Reverse flow.

g Flow regulated by powerplant.

h Flow controlled by impoundment.

i Estimated.

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Water-quality partial-record stations are particular sites where chemical-quality, biological and/or sediment data are collected systematically over a period of years for use in hydrologic analyses. These data are collected usually less than quarterly. Samples collected at sites other than gaging stations and partial-record stations to give better areal coverage in a river basin are referred to as miscellaneous sites.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
04175229 SWAN CREEK NEAR NEWPORT, MI (LAT 42 01 21N LONG 083 18 09W)											
SEP 1991 11...	1015	0.71	1040	7.8	19.0	17	3.3	36	380	100	31
04175340 STONY CREEK AT OAKVILLE, MI (LAT 42 05 05N LONG 083 34 43W)											
JUL 1991 24...	1000	7.8	708	8.3	20.0	4.0	7.8	88	340	95	24
04175407 STONY CREEK NEAR WOODLAND BEACH, MI (LAT 41 57 12N LONG 083 19 22W)											
JUL 1991 23...	1550	4.8	697	8.2	26.5	3.5	8.7	111	320	87	25
SEP 11...	0900	8.9	710	8.2	19.0	3.5	7.0	77	320	90	24
04175463 SANDY CREEK NEAR GOLFCREST, MI (LAT 41 56 28N LONG 083 21 19W)											
SEP 1991 11...	0830	0.04	938	7.3	17.0	2.5	3.6	38	430	120	31
04176173 LITTLE RIVER RAISIN NEAR DUNDEE, MI (LAT 41 56 43N LONG 083 42 15W)											
JUL 1991 23...	1445	0.44	504	8.8	33.5	9.3	11.0	159	200	43	23
SEP 10...	1445	1.4	470	7.9	23.0	22	10.3	123	220	54	21
04176262 MACON CREEK NEAR DUNDEE, MI (LAT 41 58 38N LONG 083 41 16W)											
JUL 1991 23...	1125	2.3	618	8.3	24.0	5.6	7.2	88	280	74	24
SEP 10...	1200	3.9	--	7.4	22.0	9.0	7.0	--	280	74	23
04176315 NORTH BRANCH MACON CREEK NEAR AZALIA, MI (LAT 42 00 29N LONG 083 40 04W)											
SEP 1991 10...	1330	EO.05	--	7.7	23.0	3.3	5.6	--	260	69	22
04176332 MACON CREEK NEAR DUNDEE, MI (LAT 41 58 47N LONG 083 37 33W)											
JUL 1991 23...	1315	11	3370	7.8	28.0	3.0	7.7	102	1200	440	25
SEP 10...	1030	3.1	1610	8.0	22.0	4.5	7.0	82	600	200	25
04176430 SALINE RIVER NEAR DUNDEE, MI (LAT 41 59 53N LONG 083 37 28W)											
JUL 1991 24...	1130	22	901	8.2	21.0	45	7.0	81	370	100	30
SEP 10...	1130	24	794	8.2	21.5	34	6.5	76	340	90	27
04176565 PLUM CREEK AT MONROE, MI (LAT 41 54 13N LONG 083 23 53W)											
JUL 1991 23...	1410	3.3	2190	8.0	24.0	1.1	9.7	119	1500	480	64
SEP 11...	0930	6.4	--	7.7	17.0	0.2	8.3	--	1500	480	64

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991--Continued

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
04175229	SWAN CREEK NEAR NEWPORT, MI (LAT 42 01 21N LONG 083 18 09W)									
SEP 1991 11...	59	8.6	182	210	100	0.5	1.9	638	0.24	1.8
04175340	STONY CREEK AT OAKVILLE, MI (LAT 42 05 05N LONG 083 34 43W)									
JUL 1991 24...	23	2.7	243	68	60	0.1	10	411	<0.01	0.51
04175407	STONY CREEK NEAR WOODLAND BEACH, MI (LAT 41 57 12N LONG 083 19 22W)									
JUL 1991 23...	25	3.1	211	91	59	0.2	6.5	411	<0.01	0.14
SEP 11...	22	3.3	218	92	51	0.2	7.6	415	<0.01	0.24
04175463	SANDY CREEK NEAR GOLFCREST, MI (LAT 41 56 28N LONG 083 21 19W)									
SEP 1991 11...	46	3.9	154	260	71	0.3	5.4	631	0.03	0.28
04176173	LITTLE RIVER RAISIN NEAR DUNDEE, MI (LAT 41 56 43N LONG 083 42 15W)									
JUL 1991 23...	23	5.1	125	54	58	0.2	6.7	276	<0.01	<0.05
SEP 10...	14	4.1	116	89	34	0.2	1.7	275	0.01	0.066
04176262	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 38N LONG 083 41 16W)									
JUL 1991 23...	15	4.2	191	92	36	0.2	2.4	345	<0.01	0.24
SEP 10...	16	5.3	188	83	33	0.2	2.5	335	<0.01	0.16
04176315	NORTH BRANCH MACON CREEK NEAR AZALIA, MI (LAT 42 00 29N LONG 083 40 04W)									
SEP 1991 10...	19	10	164	88	43	0.2	1.6	345	<0.01	0.12
04176332	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 47N LONG 083 37 33W)									
JUL 1991 23...	56	460	43	1700	170	1.4	5.0	2780	0.01	0.15
SEP 10...	34	170	110	670	75	0.5	6.3	1240	0.02	0.57
04176430	SALINE RIVER NEAR DUNDEE, MI (LAT 41 59 53N LONG 083 37 28W)									
JUL 1991 24...	47	4.4	261	100	87	0.3	11	516	0.02	1.7
SEP 10...	44	4.9	223	91	76	0.3	10	483	0.01	1.6
04176565	PLUM CREEK AT MONROE, MI (LAT 41 54 13N LONG 083 23 53W)									
JUL 1991 23...	17	3.5	131	1400	42	0.8	9.1	2050	0.02	0.43
SEP 11...	17	4.4	177	1300	34	0.9	8.9	2130	0.11	1.4

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991--Continued

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
04176638		LITTLE LAKE CREEK NEAR ERIE, MI (LAT 41 46 35N LONG 083 30 23W)									
JUL 1991											
23...	1300	0.01	--	8.1	27.5	13	8.3	--	300	85	22
SEP											
10...	1530	<0.01	780	8.2	23.0	9	7.5	89	370	89	36
04176680		HALFWAY CREEK NR LAMBERTVILLE, MI (LAT 41 44 07N LONG 083 36 18W)									
JUL 1991											
23...	1100	4.0	854	8.1	24.0	3.4	6.5	79	480	130	37
SEP											
10...	1430	0.71	909	8.2	22.0	5.6	6.7	78	440	120	35
04176727		NORTH TENMILE CREEK NEAR WHITEFORD CENTER, MI (LAT 41 44 47N LONG 083 41 07W)									
SEP 1991											
10...	1330	0.01	1030	7.9	22.0	2.5	4.5	53	420	140	18



ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991--Continued

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINIT LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
04176638	LITTLE LAKE CREEK NEAR ERIE, MI (LAT 41 46 35N LONG 083 30 23W)									
JUL 1991 23...	24	7.5	238	38	58	0.2	3.7	375	<0.01	<0.05
SEP 10...	18	3.2	195	150	56	0.2	5.3	479	0.03	0.15
04176680	HALFWAY CREEK NR LAMBERTVILLE, MI (LAT 41 44 07N LONG 083 36 18W)									
JUL 1991 23...	15	3.2	224	240	38	0.5	9.2	593	0.01	0.58
SEP 10...	18	3.4	213	240	35	0.5	9.4	590	0.02	0.38
04176727	NORTH TENMILE CREEK NEAR WHITEFORD CENTER, MI (LAT 41 44 47N LONG 083 41 07W)									
SEP 1991 10...	34	4.9	98	340	79	0.2	3.5	692	0.03	0.23

Figure 9.--Location of ground-water wells published in this report.



## GROUND-WATER LEVELS

## ARENAC COUNTY--Continued

440342083542801. Local number, 19N 5E 7DABA2.

LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer.

Owner: U.S. Geological Survey.

AQUIFER.--Lake bed sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 21 ft, screened 16 to 21 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.20 ft above land-surface datum.

PERIOD OF RECORD.--June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 1.55 ft below land-surface datum, May 2, 1991; lowest measured, 7.05 ft below land-surface datum, Oct. 16, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 17	4.63	JAN 8	3.03	MAY 2	1.55	JUN 10	2.72	JUL 24	3.63	SEP 6	4.31
NOV 30	2.49	FEB 15	3.25								

## BARAGA COUNTY

463353088144301. Local number, 48N 32W 12DDCC.

LOCATION.--Lat 46°33'53", long 88°14'43", Hydrologic Unit 04030107, 95 ft north of U.S. Highway 41, and 0.5 mi southeast of Nestoria Road. Owner: Michigan Department of Transportation.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.5 in., depth 10 ft, screened 7 to 10 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 1,630 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.78 ft above land-surface datum.

PERIOD OF RECORD.--September 1948 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.27 ft below land-surface datum, Apr. 30, 1965; lowest measured, 9.93 ft below land-surface datum, Jan. 30, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	6.43	DEC 20	6.50	FEB 21	6.79	APR 26	6.02	AUG 30	6.79	SEP 25	6.65
NOV 28	6.29	JAN 10	6.69	MAR 22	6.60	JUN 14	6.61				

## BARRY COUNTY

424540085232001. Local number, 4N 9W 5DAAA.

LOCATION.--Lat 42°45'40", long 85°23'20", Hydrologic Unit 04050007, on Soloman Road, 4 mi east and 3.5 mi north of Middleville. Owner: Michigan Department of Natural Resources.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 131 ft.

INSTRUMENTATION.--Quarterly measurement.

DATUM.--Elevation of land-surface datum is 860 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--December 1964 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.51 ft below land-surface datum, Mar. 20, 1978; lowest measured, 122.02 ft below land-surface datum, Mar. 5, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	116.00	JAN 4	115.79	APR 3	115.42	AUG 12	114.42



## GROUND-WATER LEVELS

## BAY COUNTY

435128083582401. Local number, 17N 4E 22DCAA.

LOCATION.--Lat 43°51'28", long 83°58'24", Hydrologic Unit 04080102, at end of Second Street in Pinconning. Owner: Pinconning Township.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 110 ft, cased to 60 ft, open bottom.

INSTRUMENTATION.--Monthly measurement. Water-level recorder from August 1962 to October 1979.

DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.10 ft above land-surface datum.

REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--August 1962 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.05 ft below land-surface datum, Mar. 5, 1976; lowest recorded, 10.53 ft below land-surface datum, Aug. 8, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 17	2.78	JAN 8	2.32	MAR 14	2.14	MAY 10	1.96	JUL 24	4.05	SEP 3	4.23
NOV 30	2.33	FEB 19	1.94	APR 10	1.91	JUN 11	2.77				

## BRANCH COUNTY

415602084593701. Local number, 6S 6W 22CABA.

LOCATION.--Lat 41°56'02", long 84°59'37", Hydrologic Unit 04050001, at Bennett and Tibbits Streets in Coldwater. Owner: City of Coldwater.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 113 ft, screened 108 to 113 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.50 ft above land-surface datum.

REMARKS.--Water levels affected by nearby pumping.

PERIOD OF RECORD.--January 1964 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.77 ft below land-surface datum, June 4, 1989; lowest recorded, 25.9 ft below land-surface datum, May 25, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	13.48	19.53	18.86	13.89	19.44	13.79	15.40	19.14	20.03	21.27	14.41	17.15
10	20.28	12.15	18.79	11.22	13.78	11.79	12.43	21.04	20.45	22.66	21.48	17.17
15	19.45	19.44	20.69	18.89	19.74	19.97	14.06	19.92	12.64	22.35	21.56	13.96
20	19.31	19.58	20.08	14.27	19.67	19.93	19.47	20.58	20.60	22.68	21.54	17.31
25	19.54	12.48	19.79	19.70	19.86	20.07	20.21	12.46	19.88	23.10	18.74	15.59
EOM	19.42	18.98	14.72	20.14	19.53	15.34	20.00	21.25	19.51	21.59	21.69	17.52

WTR YR 1991                      HIGHEST 10.00    JAN 8, 10, 13                      LOWEST 23.51    JUL 16, 17

## CALHOUN COUNTY

422422085071501. Local number, 1S 7W 10BBAB.

LOCATION.--Lat 42°24'22", long 85°07'15", Hydrologic Unit 04050003, at State Highways 78 and 66, 5 mi north of Battle Creek. Owner: Rilla Sabin.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Dug water-table well, diameter 1.25 in., depth 12 ft, screened 9 to 12 feet.

INSTRUMENTATION.--Weekly measurement by observer; converted to monthly measurement in February.

DATUM.--Elevation of land-surface datum is 970.99 ft above National Geodetic Vertical Datum of 1929.

Measuring point: Top of casing, 1.50 ft above land-surface datum.

PERIOD OF RECORD.--September 1946 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.89 ft below land-surface datum, Mar. 28, 1950; lowest, dry, July 29, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	4.60	NOV 7	4.22	DEC 5	4.00	JAN 2	3.43	FEB 23	3.32	JUN 22	3.16
10	4.78	14	4.18	12	3.70	9	3.40	MAR 23	3.33	JUL 23	3.94
17	4.54	21	4.14	19	3.64	16	3.38	APR 23	2.76	AUG 23	4.20
24	4.39	29	4.09	26	3.45	23	3.32	MAY 23	3.18	SEP 23	4.57
31	4.34					30	3.25				

## GROUND-WATER LEVELS

## CALHOUN COUNTY--Continued

422025085084001. Local number, 1S 7W 32DABA.

LOCATION.--Lat 42°20'25", long 85°08'40", Hydrologic Unit 04050003, at Verona well field in Battle Creek. Owner: City of Battle Creek.

AQUIFER.--Marshall Formation of Mississippian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 127 ft, cased to 103 ft.

INSTRUMENTATION.--Daily measurement by observer.

DATUM.--Elevation of land-surface datum is 830.79 ft above National Geodetic Vertical Datum of 1929.

Measuring point: Recorder base, 2.10 ft above land-surface datum.

REMARKS.--Water levels affected by nearby municipal pumping.

PERIOD OF RECORD.--October 1939 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.7 ft below land-surface datum, Apr. 26, 27, 1950; lowest measured, 16.75 ft below land-surface datum, July 16, 1959.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	9.60	8.25	7.30	6.70	6.40	6.50	7.10	7.05	8.10	8.70	9.15	9.80
10	9.20	8.10	6.60	6.90	6.40	6.40	7.20	7.50	7.85	9.40	9.80	9.40
15	8.60	8.10	6.60	6.45	6.50	7.00	6.60	8.00	8.20	9.60	10.45	9.30
20	8.20	7.75	8.70	6.00	7.00	6.50	6.90	7.90	9.10	9.60	9.40	9.90
25	8.70	7.55	6.50	6.10	6.80	7.50	6.90	7.70	9.35	9.80	9.00	9.55
EOM	8.60	7.80	6.50	6.30	6.75	6.65	7.20	7.80	9.50	10.00	9.50	9.45

## CASS COUNTY

414651085575601. Local number, 8S 14W 17BAAA.

LOCATION.--Lat 41°46'51", long 85°57'56", Hydrologic Unit 04050001, at U.S. Highway 112, 2 mi east of Adamsville. Owner: Ted Little.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Dug water-table well, diameter 28 in., depth 55 ft, cribbed with brick to open bottom.

INSTRUMENTATION.--Monthly measurement by observer.

DATUM.--Elevation of land-surface datum is 840 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of wooden platform, 0.80 ft above land-surface datum.

PERIOD OF RECORD.--September 1945 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.20 ft below land-surface datum, July 16, 1950; lowest measured, dry, Mar. 10, 1947, Jan. 23, Feb. 24, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 24	51.20	JAN 24	50.80	MAR 20	50.05	MAY 22	48.00	JUL 24	47.90	SEP 24	47.70
DEC 20	51.00	FEB 25	50.55	APR 23	49.20	JUN 24	47.70	AUG 26	47.40		

## CHEBOYGAN COUNTY

454427084424001. Local number, 39N 3W 29CBB1.

LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.

AQUIFER.--Dundee Formation of Devonian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 121 ft, cased to 104 ft, open bottom.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.90 ft above land-surface datum.

PERIOD OF RECORD.--January 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 4.71 ft below land-surface datum, Apr. 8, 1986; lowest measured, 11.68 ft below land-surface datum, Feb. 11, 1981.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	8.57	JAN 8	7.06	APR 4	4.92	MAY 23	5.66	JUL 11	7.85	AUG 15	9.00
NOV 27	7.12	FEB 28	7.50								

## GROUND-WATER LEVELS

## CHEBOYGAN COUNTY--Continued

454427084424002. Local number, 39N 3W 29CBB2.

LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 55 ft, screened 40 to 55 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.5 ft above land-surface datum.

PERIOD OF RECORD.--February 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 1.80 ft below land-surface datum, Apr. 8, 1986; lowest measured, 6.47 ft below land-surface datum, Feb. 11, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	4.42	JAN 8	3.62	APR 4	2.06	MAY 23	2.44	JUL 11	4.23	AUG 15	5.12
NOV 27	3.53	FEB 28	3.94								

## CHIPPEWA COUNTY

462159084442201. Local number, 46N 4W 24DADA.

LOCATION.--Lat 46°21'59", long 84°44'22", Hydrologic Unit 04020203, on trail 0.2 mi south of State Highway 28, 1 mi west of Raco. Owner: U.S. Forest Service.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 54 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.07 ft above land-surface datum.

PERIOD OF RECORD.--June 1952 to April 1965. November 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 18.40 ft below land-surface datum, June 7, 1971; lowest recorded, 28.43 ft below land-surface datum, Apr. 14, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.87	25.69	25.61	25.57	25.98	26.32	26.69	24.69	24.26	24.72	25.27	25.80
10	25.87	25.63	25.57	25.64	26.04	26.41	26.68	24.48	24.27	24.83	25.35	25.89
15	25.85	25.60	25.50	25.65	26.11	26.47	26.35	24.34	24.33	24.92	25.44	25.97
20	25.87	25.63	25.52	25.73	26.17	26.52	25.98	24.27	24.45	25.00	25.52	26.06
25	25.85	25.64	25.49	25.79	26.24	26.59	25.48	24.22	24.54	25.09	25.61	26.13
EOM	25.78	25.65	25.53	25.90	26.27	26.66	25.00	24.20	24.64	25.17	25.71	26.22

WTR YR 1991                      HIGHEST 24.17    MAY 29                      LOWEST 26.71    APR 8

## CLINTON COUNTY

425410084323501. Local number, 6N 2W 16DDAD.

LOCATION.--Lat 42°54'10", long 84°32'35", Hydrologic Unit 04050005, at U.S. Highway 27, 6 mi south of St. Johns. Owner: Michigan Department of Transportation.

AQUIFER.--Gravel of Pleistocene age.

WELL CHARACTERISTICS.--Driven water-table well, diameter 2 in., depth 26 ft, screened 23 to 26 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 803.32 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 0.10 ft below land-surface datum.

REMARKS.--Federal key well. Measuring point changed from 1.30 ft above land-surface datum to 0.10 ft below land-surface datum on Sept. 23, 1980.

PERIOD OF RECORD.--August 1948 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 13.84 ft below land-surface datum, Apr. 30, 1974; lowest measured, 19.93 ft below land-surface datum, Feb. 27, 1964.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 26	17.30	DEC 28	15.88	FEB 28	15.65	APR 26	14.08	JUN 27	16.01	AUG 29	17.27
NOV 29	16.50	JAN 30	15.58	MAR 29	14.88	MAY 30	15.01	JUL 29	16.73	SEP 30	17.46

[illegible]



## GROUND-WATER LEVELS

## EATON COUNTY

424435084365001. Local number, 4N 3W 12CDAD.  
 LOCATION.--Lat 42°44'35", long 84°36'50", Hydrologic Unit 04050004, at Robins Road, in Delta Township, 0.5 mi west of Lansing. Owner: F. Wheeler.  
 AQUIFER.--Saginaw Formation of Pennsylvanian age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 381 ft, cased to 140 ft.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 862.91 ft above National Geodetic Vertical Datum of 1929.  
 Measuring point: Plywood instrument shelf, 1.00 ft above land-surface datum.  
 REMARKS.--Water levels affected by pumping.  
 PERIOD OF RECORD.--October 1953 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 63.92 ft below land-surface datum, Feb. 20, 1991; lowest recorded, 103.6 ft below land-surface datum, Aug. 28, 1969.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	79.18	76.49	67.92	71.81	67.48	66.64	70.02	76.24	74.28	83.21	84.73	84.96
10	80.35	75.68	68.78	72.75	65.96	68.14	71.75	76.22	83.67	82.93	84.19	85.71
15	80.49	75.73	72.18	72.54	65.58	68.89	72.54	73.73	81.06	84.09	85.38	83.00
20	78.73	71.14	75.82	72.30	65.01	69.97	72.88	75.12	86.01	91.42	83.10	83.18
25	77.23	68.28	70.22	73.52	66.41	69.61	71.86	76.37	81.65	86.46	83.78	76.13
EOM	76.93	67.11	69.45	70.90	66.04	68.75	73.96	75.43	87.62	85.45	85.94	74.22

WTR YR 1991                    HIGHEST 63.92    FEB 20                    LOWEST 91.51    JUL 21

## GRAND TRAVERSE COUNTY

443921085213501. Local number, 26N 9W 14ABAA.  
 LOCATION.--Lat 44°39'21", long 85°21'35", Hydrologic Unit 04060105, 5.5 mi north of Fife Lake.  
 Owner: U.S. Geological Survey.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 80 ft, PVC pipe and screen.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 960 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.85 ft above land-surface datum.  
 PERIOD OF RECORD.--June 1976 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 21.32 ft below land-surface datum, Oct. 22, 26, 27, 1986; lowest recorded, 28.05 ft below land-surface datum, Apr. 3, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	24.60	24.97	25.29	25.45	25.58	25.70	25.40	24.41	24.18	24.47	24.80	25.12
10	24.66	25.04	25.33	25.48	25.60	25.74	25.14	24.28	24.20	24.53	24.84	25.17
15	24.73	25.09	25.35	25.49	25.62	25.76	24.95	24.18	24.24	24.58	24.89	25.22
20	24.79	25.15	25.38	25.51	25.65	25.78	24.81	24.13	24.32	24.63	24.94	25.29
25	24.85	25.20	25.41	25.54	25.67	25.79	24.70	24.10	24.37	24.68	25.00	25.33
EOM	24.92	25.25	25.43	25.56	25.68	25.70	24.55	24.12	24.42	24.74	25.07	25.39

WTR YR 1991                    HIGHEST 24.08    MAY 26, 30                    LOWEST 25.79    MAR 24-26

## HILLSDALE COUNTY

415154084315401. Local number, 7S 2W 15BCBA1.  
 LOCATION.--Lat 41°51'54", long 84°31'54", Hydrologic Unit 04100003, on Trail Road, 7 mi southeast of Hillsdale. Owner: U.S. Geological Survey.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 150 ft, screened 135 to 150 ft.  
 INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.  
 DATUM.--Elevation of land-surface datum is 1,092 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--November 1978 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.14 ft below land-surface datum, Apr. 13, 1982; lowest recorded, 49.49 ft below land-surface datum, Oct. 30, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	47.94	47.79	47.78	47.48	47.26	47.03	47.09	46.80	46.92	47.07	47.56	47.78
10	47.95	47.74	47.79	47.51	47.15	47.26	47.09	46.85	46.93	47.20	47.54	47.79
15	47.94	47.87	47.79	47.25	47.14	47.26	46.94	46.72	46.83	47.35	47.55	47.81
20	47.94	47.83	47.84	47.13	47.24	47.10	46.88	46.88	46.98	47.36	47.58	48.02
25	47.90	47.72	47.84	47.37	47.24	47.17	46.89	46.75	47.07	47.41	47.78	47.92
EOM	47.89	47.95	47.69	47.36	47.16	47.20	46.69	46.71	47.07	47.45	47.76	48.08

WTR YR 1991                    HIGHEST 46.61    MAY 6                    LOWEST 48.08    SEP 29, 30

## GROUND-WATER LEVELS

## HILLSDALE COUNTY--Continued

415236084313701. Local number, 7S 2W 10BDDD.

LOCATION.--Lat 41°52'36", long 84°31'37", Hydrologic Unit 04100003, at State Highway 34, 2.5 mi west of Pittsford. Owner: Michigan Department of Natural Resources.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 20 ft, screened 17 to 20 ft. INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.

PERIOD OF RECORD.--December 1965 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.79 ft below land-surface datum, Apr. 13, 1982; lowest measured, 11.1 ft below land-surface datum, Sept. 21, 1967.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	7.50	JAN 14	7.24	APR 11	7.61	JUL 11	8.64	AUG 15	9.16	SEP 26	9.29
DEC 4	7.88	FEB 28	7.68	MAY 24	7.68						

## HURON COUNTY

434947083233301. Local number, 16N 09E 02CDCA.

LOCATION.--Lat 43°49'47", long 83°23'33", Hydrologic Unit 04080103, 6 mi west of Pigeon at Wildfowl Bay State Wildlife Area. Owner: Huron County.

AQUIFER.--Saginaw, Marshall Formation (Pennsylvanian, Mississippian age).

WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 180 ft, cased to 147 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 582 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.20 ft above land-surface datum.

PERIOD OF RECORD.--February to September 1991.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 3.53 ft below land-surface datum, Apr. 22, 23, 1991; lowest recorded, 6.03 ft below land-surface datum, Sept. 30, 1991.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	---	---	---	---	---	4.20	4.12	3.81	4.06	4.66	5.49	5.93
10	---	---	---	---	---	4.44	3.95	3.80	4.12	4.89	5.57	5.97
15	---	---	---	---	---	4.50	3.90	3.80	4.15	5.04	5.60	5.85
20	---	---	---	---	4.24	4.31	3.76	3.96	4.31	5.07	5.65	6.01
25	---	---	---	---	4.40	4.27	3.72	3.92	4.44	5.22	5.79	5.90
EOM	---	---	---	---	4.36	4.15	---	3.84	4.54	5.30	5.83	6.03

WTR YR 1991                      HIGHEST    3.53    APR 22, 23                      LOWEST    6.03    SEP 30

## INGHAM COUNTY

424424084340301. Local number, 4N 2W 17ABAA.

LOCATION.--Lat 42°44'24", long 84°34'03", Hydrologic Unit 04050004, at Kirby and Logan Streets in Lansing. Owner: City of Lansing.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 20 in., depth 424 ft.

INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to August 1960.

DATUM.--Elevation of land-surface datum is 858.72 ft above National Geodetic Vertical Datum of 1929.

Measuring point: Plywood shelter base, 0.5 ft above land-surface datum.

REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--December 1929 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 34.3 ft below land-surface datum, December 1929; lowest recorded, 168.3 ft below land-surface datum, May 7, 1968.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	67.92	67.17	65.33	62.95	60.77	59.50	59.78	59.75	60.55	61.48	63.42	64.03
10	67.96	67.06	65.15	62.64	60.13	60.02	59.97	59.94	60.58	61.75	63.39	64.33
15	67.91	67.07	64.72	61.58	59.93	60.08	59.46	59.60	60.51	62.22	63.36	64.37
20	67.85	66.72	64.62	61.04	60.06	59.71	59.72	60.01	60.94	62.34	63.28	65.13
25	67.71	65.80	63.91	61.21	60.11	59.79	59.80	59.82	61.23	62.81	63.76	64.83
EOM	67.56	65.88	63.44	60.99	59.86	59.91	59.41	59.93	61.32	63.05	64.07	65.26

WTR YR 1991                      HIGHEST    58.68    MAR 27                      LOWEST    68.28    OCT 1, 2

## GROUND-WATER LEVELS

## IOSCO COUNTY

442839083312301. Local number, 24N 7E 13ADAD1.

LOCATION.--Lat 44°28'39", long 83°31'23", Hydrologic Unit 04070007, 10 mi west of Oscoda.

Owner: U.S. Geological Survey.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 69 ft, screened 54 to 69 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 760 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 25.49 ft below land-surface datum, Sept. 25, 1986; lowest measured, 32.71 ft below land-surface datum, Mar. 23, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	31.95	JAN 23	31.73	APR 17	31.29	JUN 5	29.97	JUL 19	29.78	AUG 13	30.03
DEC 18	32.02	FEB 20	31.67								

## IRON COUNTY

461257088542001. Local number, 44N 37W 14BBCA.

LOCATION.--Lat 46°12'57", long 88°54'20", Hydrologic Unit 04030106, at Old Federal Forest Highway 16, 0.5 mi south of Elmwood. Owner: Michigan Department of Transportation.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Driven water-table well, diameter 6 in., depth 102 ft.

INSTRUMENTATION.--Quarterly measurement.

DATUM.--Elevation of land-surface datum is 1,730 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of steel shelter base, 4.21 ft above land-surface datum.

PERIOD OF RECORD.--October 1959 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 90.57 ft below land-surface datum, Sept. 25, 1986; lowest measured, 97.11 ft below land-surface datum, Aug. 16, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 29	94.24	FEB 19	94.29	MAY 19	94.81	JUL 31	94.43

## JACKSON COUNTY

421346084230801. Local number, 3S 1W 11AADD1.

LOCATION.--Lat 42°13'46", long 84°23'08", Hydrologic Unit 04050004, at Belden and Mansion Streets in Jackson. Owner: City of Jackson.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 16 in., depth 360 ft, open bottom.

INSTRUMENTATION.--Daily measurement by observer; lowest monthly reading shown.

DATUM.--Elevation of land-surface datum is 935 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood recorder shelf, 5.00 ft above land-surface datum.

REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--June 1957 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 18.6 ft below land-surface datum, Jan. 2, 1961; lowest measured, 122.0 ft below land-surface datum, July 8, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	75.0	DEC 12	61.5	MAR 8	62.5	MAY 24	75.7	JUL 19	81.4	SEP 20	78.8
NOV 9	63.2	JAN 11	64.4	APR 26	73.9	JUN 28	90.6	AUG 30	76.9		





## GROUND-WATER LEVELS

## LEELANAU COUNTY

445020086012201. Local number, 28N 14W 8DDCA1.

LOCATION.--Lat 44°50'20", long 86°01'22", Hydrologic Unit 04060104, 2.5 mi northeast of Empire.

Owner: U.S. Geological Survey.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 138 ft, screened 123 to 138 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 750 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--February 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.25 ft below land-surface datum, Apr. 7, 1987; lowest measured, 114.49 ft below land-surface datum, June 21, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 12	112.47	JAN 9	112.59	APR 9	112.75	MAY 21	112.80	JUL 9	112.62	AUG 21	112.48
NOV 28	112.49	FEB 25	112.70								

445011086031401. Local number, 28N 14W 18BABB1.

LOCATION.--Lat 44°50'11", long 86°03'14", Hydrologic Unit 04060104, 2 mi north of Empire.

Owner: U.S. Geological Survey.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 60 ft, screened 45 to 60 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 625 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--November 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.79 ft below land-surface datum, Oct. 14, 15, 1986; lowest recorded, 24.76 ft below land-surface datum, Sept. 29, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	---	24.18	23.96	23.93	23.98	24.11	23.58	22.95	23.46	23.78	24.03	24.27
10	---	24.12	23.94	23.90	24.07	24.03	23.50	23.05	23.50	23.83	24.07	24.31
15	24.21	24.07	23.95	23.85	24.13	23.98	23.43	23.16	23.56	23.88	24.10	24.33
20	24.23	24.05	23.98	23.85	24.17	23.93	23.34	23.26	23.62	23.93	24.13	24.34
25	24.19	24.00	23.99	23.87	24.21	23.85	23.10	23.32	23.68	23.95	24.18	24.34
EOM	24.18	23.98	23.96	23.92	24.21	23.66	22.92	23.38	23.74	23.99	24.23	24.37

WTR YR 1991                      HIGHEST 22.92    APR 29 - MAY 2                      LOWEST 24.37    SEP 29, 30

## LENAWEE COUNTY

420246084150601. Local number, 5S 1E 12DDBD.

LOCATION.--Lat 42°02'46", long 84°15'06", Hydrologic Unit 04100002, in the Onsted State Game

Area, 2 mi west of Cambridge Junction. Owner: Michigan Department of Natural Resources.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 39 ft, screened 36 to 39 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 1,000 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.50 ft above land-surface datum.

REMARKS.--Water temperature also measured.

PERIOD OF RECORD.--December 1965 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 15.89 ft below land-surface datum, Mar. 26, 1982; lowest measured, 19.33 ft below land-surface datum, Sept. 2, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 26	16.67	JAN 18	16.21	APR 9	16.37	JUN 27	17.16	AUG 13	17.82	SEP 27	17.82
DEC 10	16.54	MAR 1	16.36	MAY 24	16.71						

## GROUND-WATER LEVELS

## LIVINGSTON COUNTY

422853083402801. Local number, 1N 6E 13DBAB.  
 LOCATION.--Lat 42°28'53", long 83°40'28", Hydrologic Unit 04090005, at Twelve Mile Road, 2 mi northwest of South Lyon. Owner: American Aggregate Corporation.  
 AQUIFER.--Glacial deposits of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 29 ft, 1.25 in. diameter screen.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--April 1970 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.1 ft below land-surface datum, Apr. 22, 1974; lowest recorded, 21.58 ft below land-surface datum, Oct. 30, 31, Nov. 1, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	15.91	15.70	15.65	15.29	15.20	15.10	15.07	14.76	14.66	15.10	15.52	15.73
10	15.82	15.61	15.65	15.25	15.17	15.10	15.06	14.75	14.66	15.18	15.56	15.78
15	15.51	15.61	15.67	15.21	15.19	15.09	15.03	14.74	14.73	15.25	15.57	15.85
20	15.56	15.63	15.68	15.19	15.21	15.07	14.99	14.83	14.84	15.31	15.58	15.92
25	15.57	15.65	15.65	15.20	15.15	15.10	14.86	14.86	14.93	15.35	15.58	16.19
EOM	15.68	15.66	15.42	15.20	15.14	15.07	14.77	14.77	15.02	15.45	15.69	16.25

WTR YR 1991                      HIGHEST    14.66    JUN 3-12                      LOWEST    16.25    SEP 29, 30

## MACKINAC COUNTY

460321084354801. Local number, 42N 2W 7AABB.  
 LOCATION.--Lat 46°03'21", long 84°35'48", Hydrologic Unit 04070002, at Pontchartrain and St. Ignace Roads, 2 mi north of Pontchartrain Shores. Owner: U.S. Forest Service.  
 AQUIFER.--Manistique Dolomite of Silurian age.  
 WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 102 ft.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 650 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter floor, 2.30 ft above land-surface datum.  
 PERIOD OF RECORD.--June 1956 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.49 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 32.3 ft below land-surface datum, Feb. 7, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.44	24.32	21.59	24.33	26.67	27.06	19.50	21.65	24.31	26.37	26.61	28.37
10	25.51	24.53	22.91	24.94	26.84	27.14	19.31	22.20	24.70	26.30	26.87	28.61
15	24.96	24.41	23.19	25.21	27.01	27.17	17.37	22.42	25.07	26.64	27.11	28.40
20	22.19	24.33	23.66	25.57	27.22	26.40	17.11	22.59	25.56	26.81	27.34	27.13
25	22.69	22.60	22.57	25.95	27.48	22.97	19.19	23.11	25.96	25.83	27.69	27.26
EOM	23.82	19.88	23.70	26.37	27.52	18.53	20.64	23.70	26.21	26.25	28.10	27.17

WTR YR 1991                      HIGHEST    15.49    APR 16                      LOWEST    28.72    SEP 14

## MARQUETTE COUNTY

462938087475901. Local number, 47N 28W 3CCDC.  
 LOCATION.--Lat 46°29'38", long 87°47'59", Hydrologic Unit 04020105, on U.S Highway 41 and State Highway 28, and 4.8 mi west of Ishpeming. Owner: Ely Township.  
 AQUIFER.--Sand and gravel of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 72 ft, screened 68 to 72 ft.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 1,571.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder base, 3.00 ft above land-surface datum.  
 REMARKS.--Federal key well.  
 PERIOD OF RECORD.--August 1961 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.41 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 19.26 ft below land-surface datum, Apr. 10, 11, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	15.64	14.62	15.09	15.58	16.15	16.54	15.41	13.67	13.63	13.86	14.22	14.98
10	15.72	14.73	15.17	15.68	16.20	16.64	14.54	13.58	13.70	13.90	14.33	15.07
15	15.76	14.83	15.23	15.76	16.26	16.72	14.15	13.53	13.79	14.03	14.46	15.14
20	15.33	14.94	15.30	15.85	16.34	16.75	13.72	13.54	13.89	14.16	14.58	15.21
25	14.65	15.01	15.38	15.93	16.43	16.54	13.72	13.58	13.98	14.21	14.70	15.25
EOM	14.56	15.04	15.47	16.05	16.47	15.70	13.68	13.54	13.99	14.12	14.89	15.32

WTR YR 1991                      HIGHEST    13.51    MAY 13, 16                      LOWEST    16.75    MAR 19, 20

## GROUND-WATER LEVELS

## MENOMINEE COUNTY

453504087331301. Local number, 37N 26W 19DADA.

LOCATION.--Lat 45°35'04", long 87°33'13", Hydrologic Unit 04030108, at U.S. Highway 41 at Carney.

Owner: Michigan Department of Transportation.

AQUIFER.--Trenton Limestone and Black River Formation of Middle Ordovician age.

WELL CHARACTERISTICS.--Water-table well, diameter 4 in., depth 17 ft, cased.

INSTRUMENTATION.--Quarterly measurement.

DATUM.--Elevation of land-surface datum is 800 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of 2 in. reducing nipple, 1.26 ft above land-surface datum.

REMARKS.--Water temperature also measured.

PERIOD OF RECORD.--September 1959 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.32 ft below land-surface datum, Mar. 31, 1986; lowest measured, 8.62 ft below land-surface datum, Jan. 17, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 20	5.07	MAR 21	4.14	JUN 5	4.14	SEP 18	5.06

## MONROE COUNTY

415206083414401. Local number, 7S 6E 15ACAA.

LOCATION.--Lat 41°52'06", long 83°41'44", Hydrologic Unit 04100002, at Teal Road, 2 mi southeast of Petersburg. Owner: U.S. Geological Survey.

AQUIFER.--Detroit River Group of Devonian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 72 ft, cased to 53 ft, open bottom.

INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.

DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.

PERIOD OF RECORD.--November 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 32.30 ft below land-surface datum, Mar. 26, 1982; lowest recorded, 46.54 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	40.88	39.94	39.37	38.13	37.56	36.99	37.46	37.03	36.35	39.87	43.97	42.49
10	40.81	39.72	39.39	38.08	37.43	37.26	37.61	36.99	37.13	40.44	43.78	42.40
15	40.71	39.74	39.08	37.60	37.19	37.32	37.45	36.83	37.18	41.32	43.81	42.27
20	40.33	39.73	39.16	37.29	37.30	37.26	37.37	37.66	38.07	44.28	43.04	42.52
25	40.15	39.54	38.90	37.41	37.34	37.37	37.22	37.96	38.39	43.48	43.06	42.28
EOM	40.11	39.64	38.60	37.46	37.16	37.40	36.82	36.47	39.80	43.03	42.74	42.43

WTR YR 1991                      HIGHEST    36.15    JUN 3                      LOWEST    44.36    AUG 7

415235083414001. Local number, 7S 6E 15ADBB.

LOCATION.--Lat 41°52'35", long 83°41'40", Hydrologic Unit 04100002, at Teal Road, 1.5 mi southeast of Petersburg. Owner: Michigan Department of Natural Resources.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 17 ft, screened 14 to 17 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 675 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.

PERIOD OF RECORD.--December 1965 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.00 ft below land-surface datum, Feb. 14, 1966; lowest measured, 7.58 ft below land-surface datum, Oct. 6, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 25	6.61	JAN 17	5.30	APR 10	5.89	JUN 26	5.42	AUG 12	6.78	SEP 26	7.33
DEC 7	6.00	FEB 28	5.72	MAY 23	5.44						

## GROUND-WATER LEVELS

## OAKLAND COUNTY

425116083321501. Local number, 5N 8E 8ACAC.  
 LOCATION.--Lat 42°51'16", long 83°32'15", Hydrologic Unit 04080204, at Van Atta Road, 6 mi northeast of Holly. Owner: Michigan Department of Natural Resources.  
 AQUIFER.--Sand and gravel of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 1.25 in., depth 42 ft, screened 39 to 42 ft.  
 INSTRUMENTATION.--Monthly measurement.  
 DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.00 ft above land-surface datum.  
 REMARKS.--Water temperature also measured.  
 PERIOD OF RECORD.--November 1965 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 22.30 ft below land-surface datum, Apr. 24, 1974; lowest measured, 26.48 ft below land-surface datum, Sept. 9, 1966.

## WATER LEVEL IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 31	25.74	DEC 28	25.43	MAR 21	24.95	MAY 1	24.68	JUN 13	25.29	SEP 5	26.28
NOV 15	25.58	FEB 5	25.25	APR 24	24.65	MAY 31	25.08	JUL 26	25.92		

## OCEANA COUNTY

433133086082601. Local number, 13N 15W 18AAAA.  
 LOCATION.--Lat 43°31'33", long 86°08'26", Hydrologic Unit 04060101, 6 mi southwest of Hesperia.  
 Owner: U.S. Geological Survey.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 79 ft, screened 69 to 79 ft.  
 INSTRUMENTATION.--Water-level recorder. Monthly measurements August 1977 to July 1979.  
 DATUM.--Elevation of land-surface datum is 703 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--August 1977 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 35.76 ft below land-surface datum, Dec. 2, 3, 1986; lowest recorded, 41.12 ft below land-surface datum, Dec. 13, 14, 16, 19, 20, 1990.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	40.54	40.83	41.08	41.06	41.03	40.98	40.75	39.44	38.62	38.45	38.77	39.08
10	40.59	40.88	41.11	41.05	41.02	40.97	40.51	39.26	38.56	38.51	38.82	39.13
15	40.64	40.92	41.10	41.02	41.03	40.96	40.25	39.08	38.50	38.57	38.87	39.18
20	40.69	40.96	41.12	41.02	41.04	40.93	40.03	38.94	38.48	38.60	38.91	39.24
25	40.74	41.01	41.10	41.04	41.04	40.91	39.84	38.80	38.46	38.67	38.96	39.27
EOM	40.79	41.04	41.07	41.04	41.03	40.89	39.64	38.68	38.44	38.72	39.03	39.34

WTR YR 1991                      HIGHEST 38.43      JUL 1                      LOWEST 41.12      DEC 13, 14, 16, 19, 20

## OGEMAW COUNTY

442514084164702. Local number, 23N 1E 2BAAA.  
 LOCATION.--Lat 44°25'14", long 84°16'47", Hydrologic Unit 04070007, at south side of Rose City Road, and 8 mi west of Rose City. Owner: Ogemaw County Road Commission.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 20 ft.  
 INSTRUMENTATION.--Quarterly measurement.  
 DATUM.--Elevation of land-surface datum is 1,265 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.30 ft above land-surface datum.  
 PERIOD OF RECORD.--November 1968 to October 1971, April 1974 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 7.62 ft below land-surface datum, Apr. 13, 1976; lowest measured, 13.6 ft below land-surface datum, December 1972.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 30	10.51	JAN 23	11.84	APR 26	9.30	JUL 25	8.88



## GROUND-WATER LEVELS

## ONTONAGON COUNTY

465002089321601. Local number, 51N 41W 8BDBC.  
 LOCATION.--Lat 46°50'02", long 89°32'16", Hydrologic Unit 04020101, 325 ft south of State Highway 64, 1.5 mi east of Silver City. Owner: Michigan Department of Corrections.  
 AQUIFER.--Freda Sandstone of Keweenaw age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 100 ft, cased to 32 ft.  
 INSTRUMENTATION.--Quarterly measurement.  
 DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Steel instrument shelf, 3.50 ft above land-surface datum.  
 PERIOD OF RECORD.--October 1958 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.20 ft below land-surface datum, Apr. 15, 1959; lowest measured, 21.82 ft below land-surface datum, Dec. 15, 1976.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 28	13.04	FEB 20	12.26	MAY 7	9.35	JUL 29	10.92

## OTSEGO COUNTY

445920084425801. Local number, 30N 3W 19ABBB.  
 LOCATION.--Lat 44°59'20", long 84°42'58", Hydrologic Unit 04070007, at Old Alba Road, 3 mi southwest of Gaylord. Owner: U.S. Geological Survey.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 87 ft, screened 72 to 87 ft.  
 INSTRUMENTATION.--Monthly measurement.  
 DATUM.--Elevation of land-surface datum is 1,307 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--January 1979 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured 30.56 ft below land-surface datum, Dec. 10, 1986; lowest measured, 35.82 ft below land-surface datum, Apr. 1, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 14	33.02	JAN 7	33.48	APR 22	33.07	MAY 22	32.32	JUL 10	32.45	AUG 14	32.79
NOV 26	33.33	FEB 28	33.69								

## PRESQUE ISLE COUNTY

451634083441801. Local number, 33N 6E 8BBBB.  
 LOCATION.--Lat 45°16'34", long 83°44'18", Hydrologic Unit 04070006, at south side of Grand Lake Highway, 2 mi west and 1 mi north of Posen. Owner: A. Styra.  
 AQUIFER.--Traverse Group.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 61 ft.  
 INSTRUMENTATION.--Quarterly measurement.  
 DATUM.--Elevation of land-surface datum is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 0.50 ft above land-surface datum.  
 PERIOD OF RECORD.--December 1959 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.10 ft below land-surface datum, Mar. 2, 1979; lowest measured, 16.83 ft below land-surface datum, Mar. 5, 1963.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 23	13.83	JAN 10	9.01	APR 18	5.86	AUG 16	6.08

## GROUND-WATER LEVELS

## ROSCOMMON COUNTY

442722084350701. Local number, 24N 2W 20BABA.  
 LOCATION.--Lat 44°27'22", long 84°35'07", Hydrologic Unit 04070007, at State Highway 103, 2 mi south of Roscommon. Owner: Michigan Department of Natural Resources.  
 AQUIFER.--Sand of Pleistocene age.  
 WELL CHARACTERISTICS.--Jetted water-table well, diameter 8 in., depth 14 ft, open bottom.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 1,145.30 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.50 ft above land-surface datum.  
 REMARKS.--Federal key well.  
 PERIOD OF RECORD.--December 1934 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 2.29 ft below land-surface datum, Apr. 19, 1985; lowest recorded, 6.23 ft below land-surface datum, Dec. 6-11, 1949.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.33	4.89	4.48	4.57	4.84	4.82	3.93	3.41	3.29	3.94	4.36	4.73
10	5.30	4.88	4.47	4.64	4.85	4.84	3.74	3.51	3.45	4.10	4.42	4.78
15	4.91	4.88	4.47	4.68	4.91	4.87	3.56	3.59	3.58	4.19	4.51	4.77
20	4.88	4.73	4.49	4.74	4.94	4.66	3.27	3.67	3.73	4.32	4.49	4.81
25	4.85	4.69	4.49	4.79	4.98	4.27	3.28	3.74	3.89	4.27	4.57	4.84
EOM	4.87	4.58	4.51	4.84	5.00	3.93	3.29	3.16	4.03	4.33	4.67	4.87

WTR YR 1991                      HIGHEST 3.16    MAY 30 - JUN 1                      LOWEST 5.33    OCT 2-9

## SAGINAW COUNTY

431457084194401. Local number, 10N 1E 22DADA1.  
 LOCATION.--Lat 43°14'57", long 84°19'44", Hydrologic Unit 04080203, at west side of Merrill Road, 0.35 mi north of Marion Springs. Owner: U.S. Geological Survey.  
 AQUIFER.--Saginaw Formation of Pennsylvanian age.  
 WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 210 ft, cased to 170 ft.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 657 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--December 1977 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 7.93 ft below land-surface datum, Feb. 10, 1981; lowest recorded, 10.92 ft below land-surface datum, Sept. 1, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	9.32	9.06	8.77	8.71	8.64	8.52	8.68	8.61	8.84	9.41	9.99	10.18
10	9.32	8.93	8.79	8.73	8.58	8.74	8.68	8.65	8.90	9.61	10.11	10.07
15	9.30	9.00	8.74	8.49	8.53	8.77	8.56	8.62	8.85	9.64	10.19	10.01
20	9.28	8.96	8.76	8.45	8.57	8.68	8.61	8.72	8.99	9.73	10.02	10.19
25	9.21	8.83	8.70	8.62	8.70	8.72	8.61	8.69	9.09	9.79	10.17	10.07
EOM	9.17	8.89	8.72	8.65	8.66	8.71	8.51	8.66	9.34	9.84	10.22	10.17

WTR YR 1991                      HIGHEST 8.33    FEB 14                      LOWEST 10.27    SEP 1

## SANILAC COUNTY

433439082523601. Local number, 13N 13E 12ADAA.  
 LOCATION.--Lat 43°34'39", long 82°52'36", Hydrologic Unit 04090001, at Wheatland Road, 3 mi east and 0.75 mi north of Argyle. Owner: U.S. Geological Survey.  
 AQUIFER.--Marshall Formation of Mississippian age.  
 WELL CHARACTERISTICS.--Drilled artesian observation well, diameter 6 in., depth 130 ft, cased with plastic pipe to 48 ft, open bottom.  
 INSTRUMENTATION.--Water-level recorder.  
 DATUM.--Elevation of land-surface datum is 805 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.  
 PERIOD OF RECORD.--October 1976 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.54 ft below land-surface datum, Apr 6, 1985; lowest recorded, 22.71 ft below land-surface datum, Nov. 20, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
 LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	20.70	19.29	18.23	17.81	17.53	17.19	16.62	16.41	16.64	18.12	19.36	20.53
10	20.32	18.59	18.17	18.01	---	17.11	16.36	16.43	16.92	18.40	19.53	20.74
15	19.33	18.57	---	17.84	17.85	17.24	16.34	16.56	17.11	18.63	19.73	20.90
20	19.12	18.68	---	17.74	17.55	17.09	16.29	16.69	17.36	18.93	19.79	21.05
25	19.20	18.66	---	18.02	17.48	17.09	16.22	16.94	17.66	19.14	20.04	21.13
EOM	19.29	18.26	18.09	18.04	17.54	16.71	16.00	16.14	17.95	19.27	20.33	21.23

WTR YR 1991                      HIGHEST 15.91    APR 29                      LOWEST 21.23    SEP 30

## GROUND-WATER LEVELS

## SCHOOLCRAFT COUNTY

461720085565201. Local number, 45N 13W 16CCCB.

LOCATION.--Lat 46°17'20", long 85°56'52", Hydrologic Unit 04060106, at headquarters building of Seney Wildlife Refuge. Owner: U.S. Fish and Wildlife Service.

AQUIFER.--Limestones of Upper Ordovician age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 151 ft, cased to 65 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 710 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.60 ft below land-surface datum.

PERIOD OF RECORD.--June 1952 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.64 ft below land-surface datum, Apr. 13, 1971; lowest recorded, 6.50 ft below land-surface datum, Oct. 23, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.42	5.42	5.38	5.33	5.25	5.12	5.12	5.36	5.36	5.51	5.62	5.97
10	5.48	5.38	5.41	5.35	5.22	5.19	5.21	5.33	5.38	5.51	5.69	5.94
15	5.45	5.39	5.38	5.28	5.19	5.20	5.19	5.29	5.33	5.59	5.75	5.84
20	5.35	5.42	5.37	5.29	5.19	5.18	5.34	5.29	5.43	5.63	5.79	5.84
25	5.30	5.40	5.35	5.27	5.21	5.10	5.35	5.29	5.50	5.59	5.86	5.79
EOM	5.39	5.40	5.35	5.25	5.19	5.12	5.28	5.26	5.52	5.58	5.98	5.78

WTR YR 1991                      HIGHEST 4.95    MAR 27, 28                      LOWEST 6.00    SEP 1, 2

## VAN BUREN COUNTY

421945085481502. Local number, 2S 13W 2BBCB2.

LOCATION.--Lat 42°19'45", long 85°48'15", Hydrologic Unit 04050001, at Fish Lake Road, 2.5 mi north of State Highway 43, and 16 mi east of Bangor. Owner: Van Buren County Road Commission.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 40 ft, screened 36 to 40 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 737 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.00 ft above land-surface datum.

PERIOD OF RECORD.--May 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.38 ft below land-surface datum, Oct. 6, 1986; lowest measured, 12.58 ft below land-surface datum, Sept. 19, 1984.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 18	10.68	JAN 11	10.21	APR 5	9.97	JUN 27	11.44	AUG 8	12.01	SEP 13	12.22
NOV 30	9.75	FEB 21	10.59	MAY 15	10.38						

## WASHTENAW COUNTY

421228083331601. Local number, 3S 7E 24CADB.

LOCATION.--Lat 42°12'28", long 83°33'16", Hydrologic Unit 04090005, at Bridge Street, and at Ypsilanti Township Waterworks. Owner: Ypsilanti Township.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 4 in., depth 80 ft, screened 77 to 80 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 665.65 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of coupling, 3.00 ft above land-surface datum.

REMARKS.--Water level affected by nearby pumping.

PERIOD OF RECORD.--July 1943 to June 1945, December 1949 to August 1991 (discontinued).

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.79 ft below land-surface datum, Jan. 5, 1950; lowest recorded, 22.66 ft below land-surface datum, Feb. 13, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.03	13.72	13.29	13.46	13.53	13.57	13.49	13.12	13.74	14.04	14.55	---
10	13.95	13.62	13.65	13.73	13.61	13.73	13.76	13.29	13.76	14.14	14.34	---
15	13.70	13.60	13.71	13.68	13.74	13.43	13.41	13.62	13.70	14.17	14.61	---
20	13.73	13.38	13.86	13.54	13.43	13.34	13.34	14.02	13.83	14.29	14.26	---
25	13.77	13.49	13.61	13.67	13.33	13.28	13.11	13.89	13.86	14.42	14.31	---
EOM	13.79	13.54	13.22	13.64	13.38	13.44	13.07	13.71	14.01	14.46	---	---

WTR YR 1991                      HIGHEST 12.93    APR 29, 30, MAY 6                      LOWEST 14.61    AUG 14, 15

## TEMPERATURE OF GROUND WATER

Temperatures of ground water are measured as part of a state-wide water resource investigation in cooperation with the Michigan Department of Natural Resources. The purpose of these measurements is to determine the natural ground-water temperature of selected points throughout the State. These data can be used to estimate ground-water temperatures in many areas in the State. Measurements of temperature were made by means of "lazy" thermometers (Heath, 1964).

TEMPERATURE (°C) OF GROUND WATER AT INDICATED DEPTH, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991

DATE	WATER TEMPER- ATURE (°C)	DATE	WATER TEMPER- ATURE (°C)	DATE	WATER TEMPER- ATURE (°C)
DICKINSON COUNTY, 43N 28W 32ADAB (LAT 46°04'58", LONG 87°49'39") DEPTH 31 FT					
OCT 4	7.0	FEB 7	7.0	JUN 6	6.0
NOV 8	7.0	MAR 7	7.0	JUL 2	6.0
DEC 5	7.5	APR 2	6.5	AUG 2	6.5
20	7.5	MAY 2	6.0	SEP 5	6.5
JAN 4	7.0				
LENAWEE COUNTY, 5S 1E 12DDBD (LAT 42°02'46", LONG 84°15'06") DEPTH 39 FT					
OCT 26	9.7	MAR 1	9.9	JUN 27	8.9
DEC 10	10.1	APR 9	9.4	AUG 13	9.2
JAN 18	10.1	MAY 24	9.0	SEP 27	9.7
MENOMINEE COUNTY, 37N 26W 19DADA (LAT 45°35'04", LONG 87°33'13") DEPTH 17 FT					
DEC 20	8.8	JUN 5	7.0	SEP 18	11.5
MAR 21	5.8				
OAKLAND COUNTY, 5N 8E 8ACAC (LAT 42°51'16", LONG 83°32'15") DEPTH 42 FT					
OCT 31	10.0	MAR 21	9.5	JUN 13	10.0
NOV 15	10.0	APR 24	10.0	JUL 26	9.5
DEC 28	9.5	MAY 1	10.0	SEP 5	9.5
FEB 5	10.0	31	10.0		





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October 1, 1978

## FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
<i>Length</i>		
inches (in)	$2.54 \times 10^1$	millimeters (mm)
	$2.54 \times 10^{-2}$	meters (m)
feet (ft)	$3.048 \times 10^{-1}$	meters (m)
miles (mi)	$1.609 \times 10^0$	kilometers (km)
<i>Area</i>		
acres	$4.047 \times 10^3$	square meters (m <sup>2</sup> )
	$4.047 \times 10^{-1}$	square hectometers (hm <sup>2</sup> )
	$4.047 \times 10^{-3}$	square kilometers (km <sup>2</sup> )
square miles (mi <sup>2</sup> )	$2.590 \times 10^0$	square kilometers (km <sup>2</sup> )
<i>Volume</i>		
gallons (gal)	$3.785 \times 10^0$	liters (L)
	$3.785 \times 10^0$	cubic decimeters (dm <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic meters (m <sup>3</sup> )
million gallons	$3.785 \times 10^3$	cubic meters (m <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
cubic feet (ft <sup>3</sup> )	$2.832 \times 10^1$	cubic decimeters (dm <sup>3</sup> )
	$2.832 \times 10^{-2}$	cubic meters (m <sup>3</sup> )
cfs-days	$2.447 \times 10^3$	cubic meters (m <sup>3</sup> )
	$2.447 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
acre-feet (acre-ft)	$1.233 \times 10^3$	cubic meters (m <sup>3</sup> )
	$1.233 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
	$1.233 \times 10^{-6}$	cubic kilometers (km <sup>3</sup> )
<i>Flow</i>		
cubic feet per second (ft <sup>3</sup> /s)	$2.832 \times 10^1$	liters per second (L/s)
	$2.832 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$2.832 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
gallons per minute (gal/min)	$6.309 \times 10^{-2}$	liters per second (L/s)
	$6.309 \times 10^{-2}$	cubic decimeters per second (dm <sup>3</sup> /s)
	$6.309 \times 10^{-5}$	cubic meters per second (m <sup>3</sup> /s)
million gallons per day	$4.381 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$4.381 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
<i>Mass</i>		
tons (short)	$9.072 \times 10^{-1}$	megagrams (Mg) or metric tons



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