

# Water Resources Data Michigan Water Year 1993



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-93-1

Prepared in cooperation with the State of Michigan  
and with other agencies



# CALENDAR FOR WATER YEAR 1993

1992

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	1	2	3	4	5	6	7			1	2	3	4	5
4	5	6	7	8	9	10	8	9	10	11	12	13	14	6	7	8	9	10	11	12
11	12	13	14	15	16	17	15	16	17	18	19	20	21	13	14	15	16	17	18	19
18	19	20	21	22	23	24	22	23	24	25	26	27	28	20	21	22	23	24	25	26
25	26	27	28	29	30	31	29	30						27	28	29	30	31		

1993

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		1	2	3	4	5	6		1	2	3	4	5	6
3	4	5	6	7	8	9	7	8	9	10	11	12	13	7	8	9	10	11	12	13
10	11	12	13	14	15	16	14	15	16	17	18	19	20	14	15	16	17	18	19	20
17	18	19	20	21	22	23	21	22	23	24	25	26	27	21	22	23	24	25	26	27
24	25	26	27	28	29	30	28							28	29	30	31			
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							1			1	2	3	4	5
4	5	6	7	8	9	10	2	3	4	5	6	7	8	6	7	8	9	10	11	12
11	12	13	14	15	16	17	9	10	11	12	13	14	15	13	14	15	16	17	18	19
18	19	20	21	22	23	24	16	17	18	19	20	21	22	20	21	22	23	24	25	26
25	26	27	28	29	30		23	24	25	26	27	28	29	27	28	29	30			
							30	31												
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	1	2	3	4	5	6	7				1	2	3	4
4	5	6	7	8	9	10	8	9	10	11	12	13	14	5	6	7	8	9	10	11
11	12	13	14	15	16	17	15	16	17	18	19	20	21	12	13	14	15	16	17	18
18	19	20	21	22	23	24	22	23	24	25	26	27	28	19	20	21	22	23	24	25
25	26	27	28	29	30	31	29	30	31					26	27	28	29	30		





# Water Resources Data Michigan Water Year 1993

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



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Prepared in cooperation with the State of Michigan  
and with other agencies



**U.S. DEPARTMENT OF THE INTERIOR**

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**U.S. GEOLOGICAL SURVEY**

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U.S. Geological Survey  
6520 Mercantile Way, Suite 5  
Lansing, Michigan 48911-5991**

**1994**



## 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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<b>16. Abstract (Limit: 200 words)</b> Water resources data for the 1993 water year for Michigan consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground water levels. This report contains discharge records for 148 streamflow-gaging stations; stage only records for 2 river-gaging stations and 7 lake-gaging stations; stage and contents for 4 lakes and reservoirs; water-quality records for 19 streamflow-gaging stations; water-level records for 43 ground-water wells. Also included are 33 crest-stage partial-record stations and 2 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Miscellaneous data were collected at 44 measuring sites. 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.				
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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, (s) sediment

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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 Lake near Curtis, MI (e)	04047200	118	1942-91
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

## 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			
Creighton River near Shingleton, MI (d)	04055500	a35	1938-42
West Branch Manistique River near Manistique, MI (d)	04056000	322	1938-56
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 Champion, MI (d)	04062200*	133	1961-78
Lake Michigamme near Champion, MI (e)	04062228	193	1942-91
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
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 Canal near Schoolcraft, MI (d)	04097195	--	1966-73, 1983-92
Gourdneck Creek near Schoolcraft, MI (d)	04097200	7.29	1964-73
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



## 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			
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
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
Sycamore Creek near Holt, MI (d)	04112850	80.6	1975-80, 1989-90
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
Houghton Lake near Houghton Lake Heights, MI (e)	442400084472801	222	1942-91
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
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
Intermediate River at Bellaire, MI (d)	04127565	146	1991
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
Mullett Lake near Cheboygan, MI (e)	04130000	889	1943-91
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
Cheboygan Pond at Cheboygan, MI (e)	04132052	a1,500	1943-91
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

## 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			
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
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
Holloway Reservoir near Otisville, MI (e)	04147000	526	1954-91
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 Fosters, MI (d)	04149000	1,188	1940-84, 1988-92
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
Galloway Creek near Auburn Heights, MI (d)	04161100	17.9	1960-91
Paint Creek near Lake Orion, MI (d)	04161500*	38.5	1955-75 1989-91
Clinton River at Sterling Heights, MI (d)	04161820	309	1979-83
Red Run near Warren, MI (d)	04162010	—	1980-88

## 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			
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
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 continuous-record surface-water-quality stations in Michigan have been discontinued. Daily records of temperature, specific conductance, or sediment were collected and published for the record shown for each 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.

[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
STREAMS TRIBUTARY TO LAKE SUPERIOR				
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
STREAMS TRIBUTARY TO ST. MARYS RIVER				
St. Marys River above Sault Ste. Marie, MI	04045580	a80,900	Temp., S.C.	1974-81
STREAMS TRIBUTARY TO LAKE MICHIGAN				
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. Sed.	1955-64 1962-63
Paint River near Alpha, MI	04062000	631	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
Beebe Creek near Hillsdale, MI	04066272	42.4	Sed.	1975,
			Temp., Sed.	1976-77
Sand Creek at Litchfield, MI	04096312	20.6	Temp., Sed.	1975-76, 1977
Soap Creek near Litchfield, MI	04096325	10.9	Temp., Sed.	1975-76, 1977

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

Station name	Station number	Drainage area (mi <sup>2</sup> )	Type of record	Period of record
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
St. Joseph River at Clarendon, MI	04096340	144	Temp., 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
West Fork Portage Creek at Kalamazoo, MI	04106400	18.7	Temp., S.C.	1971, 1972-73
Portage Creek at Kalamazoo, MI	04106500	46.8	S.C.	1968, 1972-75
Kalamazoo River near Cooper Center, MI	04106770	1,248	Temp., S.C.	1976-86, 1968, 1970, 1969, 1971-75
Kalamazoo River at Saugatuck, MI	04108690	a2,020	S.C.	1974, 1975-81
Grand River near Eaton Rapids, MI	04111000	661	Temp.	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 Ewart, 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 Fressoil, 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
STREAMS TRIBUTARY TO LAKE HURON				
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

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

Station name	Station number	Drainage area (mi <sup>2</sup> )	Type of record	Period of record
STREAMS TRIBUTARY TO LAKE HURON--Continued				
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
Rifle River near Sterling, MI	04142000	a320	Sed.	1966, 1970-72, 1975-81
			Temp., S.C.	
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
STREAMS TRIBUTARY TO ST. CLAIR RIVER				
St. Clair River at Port Huron, MI	04159130	a222,400	Temp., S.C.	1978-81
Black River at Fargo, MI	04159500	480	Sed.	1966,
			Temp.	1979-82
STREAMS TRIBUTARY TO LAKE ST. CLAIR				
Clinton River near Drayton Plains, MI	04160900	79.2	Temp.	1962-74
Clinton River near Fraser, MI	04164000	444	Sed.	1966
STREAMS TRIBUTARY TO DETROIT RIVER				
Detroit River at Detroit, MI	04165700	a228,800	Temp., S.C.	1974-81





## WATER RESOURCES DATA - MICHIGAN, 1993

### 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 148 streamflow-gaging stations, 33 crest-stage partial-record stations, 2 low-flow partial-record stations, and 44 miscellaneous sites; (2) stage only records for 2 gaging stations and 7 lake-gaging stations; (3) stage and content records for 4 lakes and reservoirs; (4) water-quality records for 19 streamflow-gaging stations; and (5) water-level records for 43 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-93-1." 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. Beginning with the 1990 water year, all water-data reports will also be available on Compact Disc - Read Only Memory (CD-ROM). All data reports published for the current water year for the entire Nation, including Puerto Rico and the Trust Territories, will be reproduced on a single CD-ROM disc.

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. A limited number of CD-ROM discs will be available for sale by the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, Colorado 80225.

### 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.

Michigan Department of Transportation, Patrick 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; Antrim County; Kalamazoo County; Otsego County; Wayne County; Huron-Clinton Metropolitan Authority; Cities of Adrian, Ann Arbor, Battle Creek, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Norway, Portage, Portland, Sturgis, and Ypsilanti; American Aggregates Co.; Consumers Power Co.; Cleveland Cliffs Iron Co.; French Paper Co.; Mead Corporation; Indiana Michigan Power Co.; Michigan Sugar Co.; STS Hydropower, Ltd; Swift-Eckrich, Inc.; Upjohn Co.; Upper Peninsula Power Co.; Wisconsin-Electric Power Co.; and Wolverine Power Supply Cooperative, Inc.

Organizations that supplied data are acknowledged in the station descriptions.

## WATER RESOURCES DATA - MICHIGAN, 1993

### SUMMARY OF HYDROLOGIC CONDITIONS

#### Surface Water

In the Upper Peninsula, streamflow at Sturgeon River near Sidnaw began the year in the normal range and except for above normal streamflow in November and December remained in the normal range for the remainder of the year. For most rivers, the 1993 mean streamflow was near the median except for several streams in the east end of the Upper Peninsula. The mean streamflow for the Pine, Tahquamenon, and Manistique Rivers ranged from the fourth to eighth highest for the period of record.

In the Lower Peninsula, streamflow at Muskegon River at Ewart was above normal for each month except for March and May when the streamflow was in the normal range. The yearly mean discharge for 1993 was about 35 percent higher than the yearly mean discharge during the period 1961-1990 (fig. 1). Streamflow at the Red Cedar River at East Lansing was above normal for each month except for normal streamflow in February and March. New record high monthly means were established during November and January. The November 1992 mean streamflow of 735 ft<sup>3</sup>/s (cubic feet per second) exceeded the next highest November mean by more than 55 percent. The January 1993 mean (739 ft<sup>3</sup>/s) exceeded the next highest January mean by about 4 percent.

At most rivers in the Lower Peninsula, the 1993 mean streamflow was much greater than the median. For the majority of streamflow gaging stations, 1993 was the wettest to fifth wettest year during the period of record. About 25 percent of the stations in the southern half of the Lower Peninsula recorded the wettest year during the period of record. Most noteworthy were the St. Joseph River, Grand River, and River Raisin basins. Although streamflow was above normal, the instantaneous peak discharges were not high. For the Muskegon River at Ewart and the Red Cedar River at East Lansing the annual recurrence interval was about 2 years.

The water levels of Lake Superior, Lakes Michigan-Huron, Lake St. Clair and Lake Erie were above the average and generally higher than levels recorded in the 1992 water year. Water levels for Lake Superior exceeded the long-term average by about 0.2 ft (feet) during the 1993 water year. Water levels for Lakes Michigan-Huron increased from near average at the beginning of the water year to about 0.8 ft above the average at the end of September. For Lake St. Clair, the water level was about 0.8 ft higher than the average, increasing to about 1.8 ft higher in January and February, then slowly decreasing to about 1.0 ft higher than the average at the end of September. Lake Erie followed the same pattern as Lake St. Clair, beginning the water year about 1.2 ft above normal, rising to about 2.1 ft higher than the average in January and February, then gradually decreasing to about 1.0 ft greater than the average at the end of September. Damage to lakefront property and shoreline was minimal in the 1993 water year.

#### Water Quality

Surface-water-quality data were collected at 15 National Stream Quality Accounting Network stations during the 1993 water year. 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 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 43 wells during the 1993 water year. This statewide network of ground-water wells (fig. 9) 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 the 1993 water year generally followed seasonal patterns. In the eastern Upper Peninsula and southeastern Lower Peninsula ground-water levels continued to remain below average throughout the year. In the western Upper Peninsula ground-water levels fluctuated slightly about the average during 1993. In the northern, southcentral, and southwestern parts of the Lower Peninsula ground-water levels were above or near average during the water year. In January at the Oakland County well, the water level was above average for the first time since September 1986. At the Clinton County well, monthly water-level records or second highest recorded levels were set for each month, November through January and June through September. Statewide, of all the wells monitored in 1993, only three wells recorded new highs, two in Kalamazoo County and one in Ingham County.



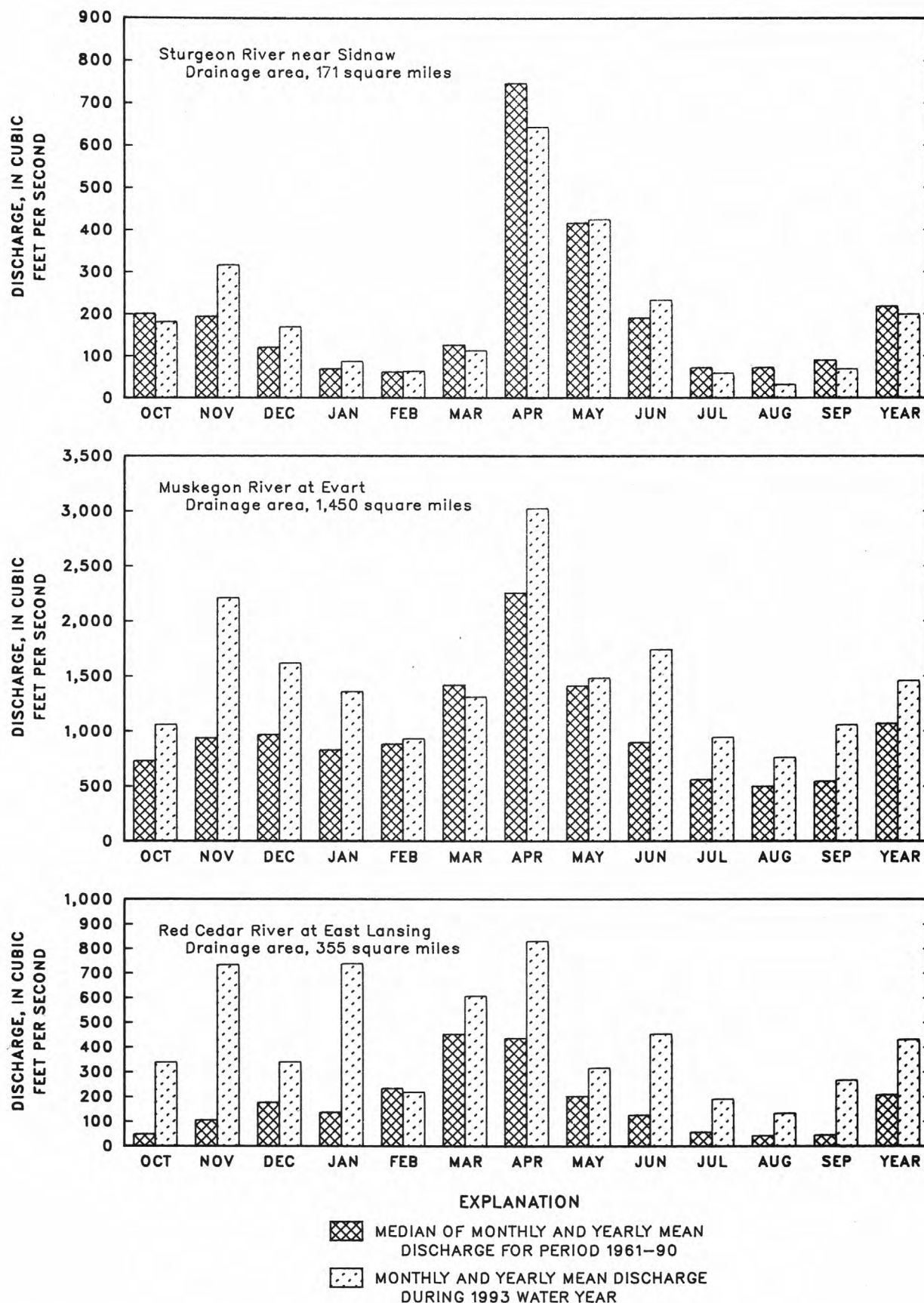


Figure 1.--Discharge during 1993 water year compared with median discharge for period 1961-90 for three representative stations.

## WATER RESOURCES DATA - MICHIGAN, 1993

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, in feet	Yield, in gallons per minute	
	Common range	Common range	
Glacial aquifers:			
Outwash: Mostly sand and gravel.	25-200	1-1,000	Water generally hard; iron concentrations common; deep wells may produce salty water in places.
Lacustrine sand: Mostly sand, some gravel.	25-100	80-500	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	5-200	Primary source of domestic supply in western Upper Peninsula.
Bedrock aquifers:			
Saginaw Formation: Sandstone, siltstone, some shale, limestone, and coal	25-300	100-300	One of Michigan's most important bedrock aquifers; water generally hard; salty in places at depth.
Marshall Formation: Sandstone and siltstone.	25-200	100-500	Another of Michigan's important bedrock aquifers; salty in places and at depth.
Silurian-Devonian rocks: Limestone and dolomite; some shale and sandstone.	25-150	10-300	Important aquifer in parts of eastern Upper Peninsula; water commonly hard.
Cambrian-Ordovician rocks: Sandstone, limestone, and dolomite.	25-150	10-100	Important aquifer in eastern Upper Peninsula; water commonly very hard; salty in places and at depth.
Precambrian sandstone: Sandstone interbedded with siltstone.	25-400	5-50	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 to about 900 ft. 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.

## WATER RESOURCES DATA - MICHIGAN, 1993

### 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.

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey is a long-term program with goals to describe the status and trends of water-quality conditions for a large, diverse, and geographically distributed part of the Nation's ground- and surface-water resources, and to identify, describe, and explain the major natural and human factors that affect these observed conditions and trends.

Assessment activities have begun in more than one-third of the study units and ultimately will be conducted in 60 study units (major watersheds and aquifer systems) that represent a wide range of environmental settings nationwide and that account for a large percentage of the Nation's water use. A wide array of chemical constituents will be measured in ground water, surface water, streambed sediments, and fish tissues. The coordinated application of comparative hydrologic studies at a wide range of spatial and temporal scales will provide information for decision making by water-resources managers and a foundation for aggregation and comparison of findings to address water-quality issues of regional and national interest.

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 1993 water year that began October 1, 1992, and ended September 30, 1993. 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 4-9. 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.

## WATER RESOURCES DATA - MICHIGAN, 1993

### 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.)

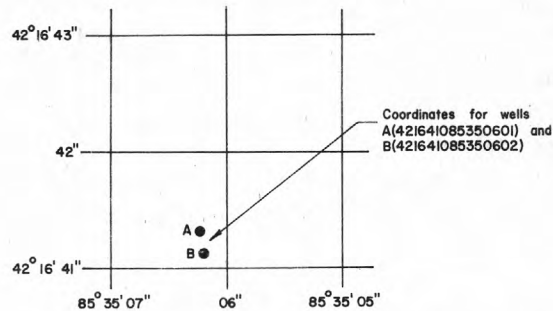


Figure 2.--System for numbering wells (latitude and longitude).

### 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.

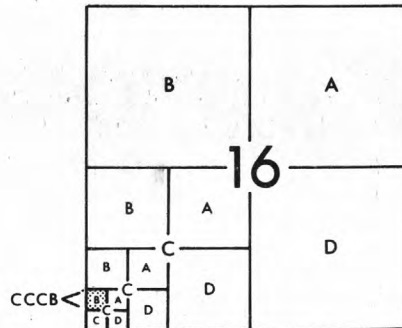


Figure 3.--Local well numbering system in Michigan.

### 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.



## WATER RESOURCES DATA - MICHIGAN, 1993

### 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

Streamflow data in this report are presented in a new format that is considerably different from the format in data reports prior to the 1992 water year. The major changes are that statistical characteristics of discharge now appear in tabular summaries following the water-year data table and less information is provided in the text or station manuscript above the table. These changes represent the results of a pilot program to reformat the annual water-data report to meet current user needs and data preferences.

The records published for each continuous-record surface-water discharge station (gaging station) now consist of four parts, the manuscript or station description; the data table of daily mean values of discharge for the current water year with summary data; a tabular statistical summary of monthly mean flow data for a designated period, by water year; and a summary statistics table that includes statistical data of annual, daily, and instantaneous flows as well as data pertaining to annual runoff, 7-day low-flow minimums, and flow duration.

## WATER RESOURCES DATA - MICHIGAN, 1993

Station manuscripts

The manuscript provides, under various headings, descriptive information, such as station location; period of record; historical extremes outside the period of record; 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 gaging station 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 records have been published 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 flow at it can reasonably be considered equivalent to flow at the present station.

**REVISED RECORDS.**--Because of new information, published records 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 sea level (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 are flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge".) The REMARKS paragraph is used to present information relative to the accuracy of the records, to special methods of computation, and to conditions that affect natural flow at the station. In addition, information may be presented pertaining to average discharge data for the period of record; to extremes data for the period of record and the current year; 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 U.S. Geological Survey by a cooperating organization are identified here.

**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.

**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 District Office (address 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 for a discontinued station 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.

Headings for AVERAGE DISCHARGE, EXTREMES FOR PERIOD OF RECORD, AND EXTREMES FOR CURRENT YEAR have been deleted and the information contained in these paragraphs, except for the listing of secondary instantaneous peak discharge in the EXTREMES FOR CURRENT YEAR paragraph, is now presented in the tabular summaries following the discharge table or in the REMARKS paragraph, as appropriate. No changes have been made to the data presentations of lake contents.

Data table of daily mean values

The daily table of discharge records for stream-gaging stations gives mean discharge for each day of the water year. In the monthly summary for the table, the line headed "TOTAL" gives the sum of the daily figures for each month; the line headed "MEAN" gives the average flow in cubic feet per second for the month; and the lines headed "MAX" and "MIN" give the maximum

## WATER RESOURCES DATA - MICHIGAN, 1993

and minimum daily mean discharges, respectively, for 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 or in acre-feet may be omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversion data or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

### Statistics of monthly mean data

A tabular summary of the mean (line headed "MEAN"), maximum (line headed "MAX"), and minimum (line headed "MIN") of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those figures. The designated period will be expressed as "FOR WATER YEARS \_\_\_\_ - \_\_\_\_," BY WATER YEAR (WY)," and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. It will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript.

### Summary statistics

A table titled "SUMMARY STATISTICS" follows the statistics of monthly mean data tabulation. This table consists of four columns, with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a designated period, as appropriate. The designated period selected, "WATER YEARS \_\_\_\_ - \_\_\_\_," will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (See line headings below.), except for the "ANNUAL 7-DAY MINIMUM" statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrences may be noted with footnotes or in the REMARKS paragraph of the manuscript. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designate-period column may not be within the selected water years listed in the heading. When this occurs, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow duration curve statistics and runoff data are also given. Runoff data may be omitted if there is extensive regulation or diversion of flow in the drainage basin.

The following summary statistics data, as appropriate, are provided with each continuous record of discharge. Comments to follow clarify information presented under the various line headings of the summary statistics table.

**ANNUAL TOTAL.**--The sum of the daily mean values of discharge for the year. At some stations the annual total discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

**ANNUAL MEAN.**--The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period. At some stations the yearly mean discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

**HIGHEST ANNUAL MEAN.**--The maximum annual mean discharge occurring for the designated period.

**LOWEST ANNUAL MEAN.**--The minimum annual mean discharge occurring for the designated period.

**HIGHEST DAILY MEAN.**--The maximum daily mean discharge for the year or for the designated period.

**LOWEST DAILY MEAN.**--The minimum daily mean discharge for the year or for the designated period.

**ANNUAL 7-DAY MINIMUM.**--The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The data shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

**INSTANTANEOUS PEAK FLOW.**--The maximum instantaneous discharge occurring for the water year or for the designated period. Note that secondary instantaneous peak discharges above a selected base discharge are stored in District computer files for stations meeting certain criteria. Those discharge values may be obtained by writing to the District Office. (See address on back of title page of this report.)



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**INSTANTANEOUS PEAK STAGE.**--The maximum instantaneous stage occurring for the water year or for the designated period. If the dates of occurrence for the instantaneous peak flow and instantaneous peak stage differ, the REMARKS paragraph in the manuscript or a footnote may be used to provide further information.

**INSTANTANEOUS LOW FLOW.**--The minimum instantaneous discharge occurring for the water year or for the designated period.

**ANNUAL RUNOFF.**--Indicates the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

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

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 the runoff is distributed uniformly in time and area.

Inches (INCHES) indicates the depth to which the drainage area would be covered if all of the runoff for a given time period were uniformly distributed on it.

**10 PERCENT EXCEEDS.**--The discharge that has been exceeded 10 percent of the time for the designated period.

**50 PERCENT EXCEEDS.**--The discharge that has been exceeded 50 percent of the time for the designated period.

**90 PERCENT EXCEEDS.**--The discharge that has been exceeded 90 percent of the time for the designated period.

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 by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated".

## 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.



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### 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 ( $\mu\text{g/L}$ ) 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 ( $\text{ng/L}$ ). Present data above the  $\mu\text{g/L}$  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 water year 1994.

### 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.

### 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 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 district office whose address is given on the back of the title page of this report.

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### 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.

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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 three parts, the station description, the data table of water levels observed during the current water year, and a graph of the water levels for the current water year or other selected period. 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 of the well description.



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**LOCATION.**--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); a landline location designation; 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) sea level; 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. A hydrograph for a selected period of record follows each water-level table.

## ACCESS TO WATSTORE DATA

The U.S. Geological Survey is the principal Federal water-data agency and, as such, collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. As part of the Geological Survey's program of releasing water data to the public, a large-scale computerized system has been developed for the storage and retrieval of water data collected through its activities.

The National Water Data Storage and Retrieval System (WATSTORE) was established in 1972 to provide an effective and efficient means for the processing and maintenance of water data collected through the activities of the U.S. Geological Survey and to facilitate release of the data to the public. A variety of useful products, ranging from data tables to complex statistical analyses such as Log Pearson Type III, can be produced using WATSTORE. The system resides on the central computer facilities of the U.S. Geological Survey at its National Center in Reston, Virginia, and consists of related files and data bases.

- \* **Station Header File** - Contains descriptive information on more than 440,000 sites throughout the United States and its territories where the U.S. Geological Survey collects or has collected data.
- \* **Daily Values File** - Contains more than 220 million daily values of stream flows, stages, reservoir contents, water temperatures, specific conductances, sediment concentrations, sediment discharges, and ground-water levels.
- \* **Peak Flow File** - Contains approximately 500,000 maximum (peak) streamflow and gage-height values at surface-water sites.
- \* **Water Quality File** - Contains approximately 2 million analyses of water samples that describe the chemical, physical, biological, and radio-chemical characteristics of both surface and ground water.
- \* **Ground-Water Site Inventory Data Base** - Contains inventory data for more than 900,000 wells, springs, and other sources of ground water. The data includes site location, geohydrologic characteristics, well-construction history, and one-time field measurements such as water temperature.



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In 1976, the U.S. Geological Survey opened WATSTORE to the public for direct access. The signing of a Memorandum of Agreement with the Survey is required to obtain direct access to WATSTORE. The system can be accessed either synchronously or asynchronously. The requestor will be expected to pay all computer costs he/she incurs. Direct access may be obtained by contacting:

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

In addition to providing direct access to WATSTORE, data can be provided in various machine-readable formats on magnetic tape or 5-1/4 inch floppy disk; and, as noted in the introduction, on CD-ROM discs. Beginning with the 1990 water year, all water-data reports will also be available on CD-ROM. All data reports published for the current water year for the entire Nation, including Puerto Rico and the Trust Territories, will be reproduced on a single CD-ROM disc. Information about the availability of specific types of data or products, and user charges can be obtained locally from each of the Water Resources Division's District offices. (See address on the back of title page.) A limited number of CD-ROM discs will be available for sale by the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, Colorado 80225.

## 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.

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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 ( $\text{g/m}^3$ ), and periphyton and benthic organisms in grams per square meter ( $\text{g/m}^2$ ).

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.

Annual 7-Day minimum is the lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

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

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

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Dissolved refers to that material in a representative water sample which passes through a 0.45  $\mu\text{m}$  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.



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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.

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey is a long-term program with goals to describe the status and trends of water-quality conditions for a large, diverse, and geographically distributed part of the Nation's ground- and surface-water resources, and to identify, describe, and explain the major natural and human factors that affect these observed conditions and trends.

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 ( $m^2$ ), 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.



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**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** [ $\text{mg (C/m}^2\text{) / time}$ ] for periphyton and macrophytes and [ $\text{mg (C/m}^3\text{) / time}$ ] 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** [ $\text{mg (O}_2\text{/m}^2\text{) / time}$ ] for periphyton and macrophytes and [ $\text{mg (O}_2\text{/m}^3\text{) / time}$ ] 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.

**Sea level** in this report refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

**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.

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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 (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 (mg/L) x discharge (ft<sup>3</sup>/s) x 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°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.

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.

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

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.

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**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
<u>Genus</u> .....	<u>Hexagenia</u>
<u>Species</u> .....	<u>Hexagenia limbata</u>

**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.

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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, 1993, is called the "1993 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. Ficken, 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. S. 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 W. 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.

## PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS--Continued

- 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, Nobuhiro 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.
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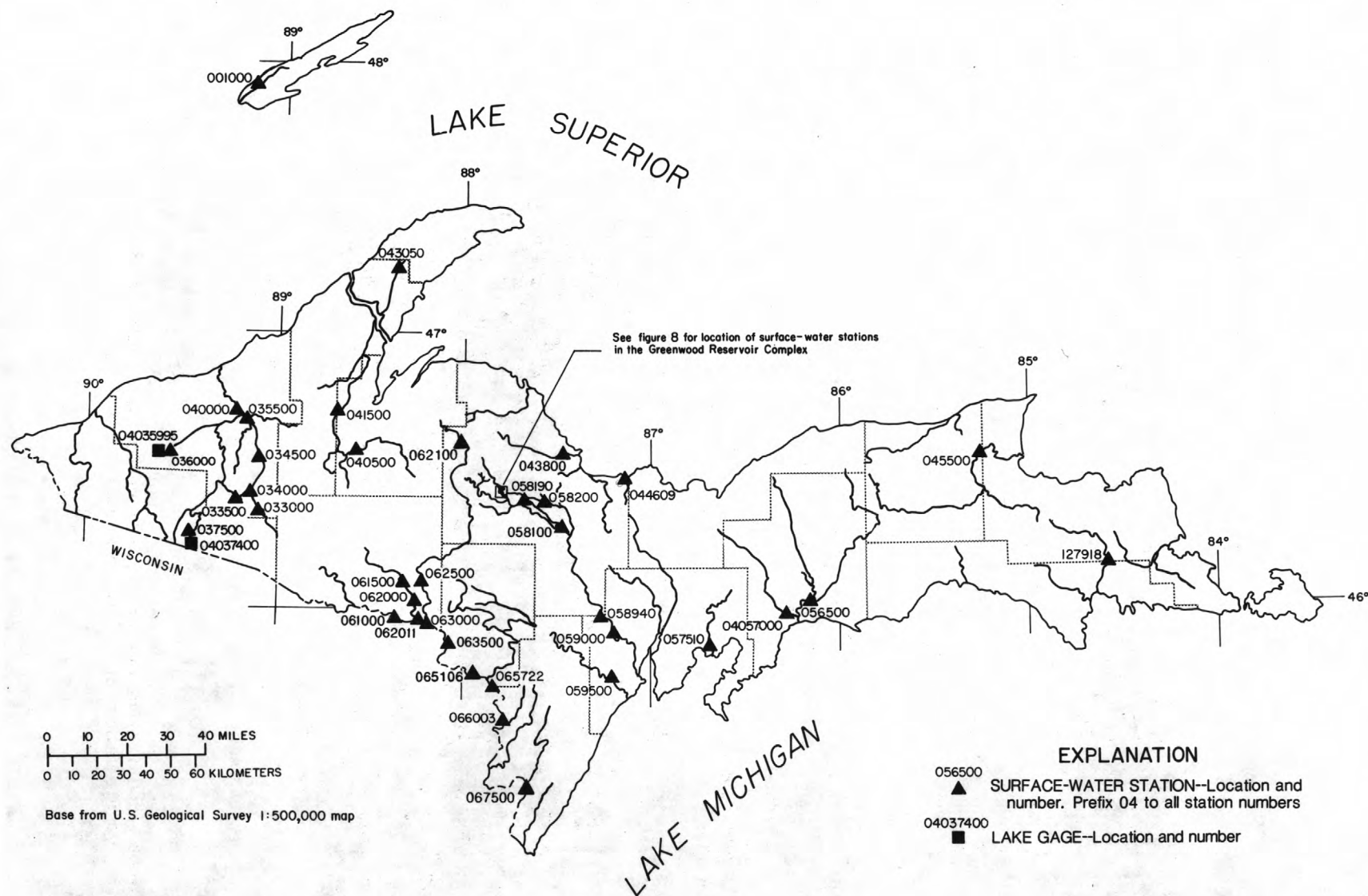
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- 6-A3. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 1: Model Description and User's Manual*, by L. J. Torak: USGS--TWRI Book 6, Chapter A3. 1993. 136 pages.
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**Figure 4.--Identification number and location of active surface-water gaging stations in the Upper Peninsula of Michigan.**



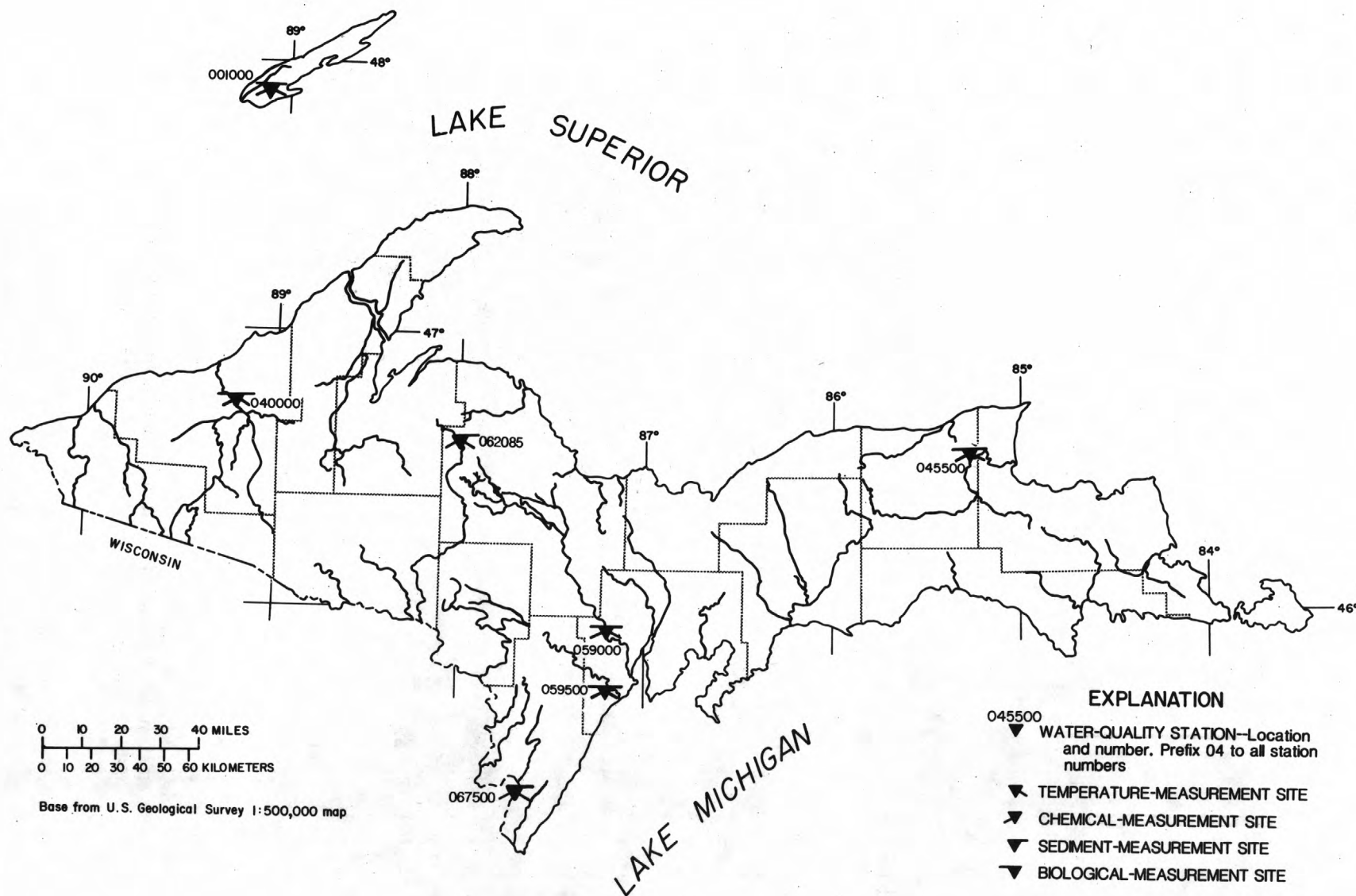
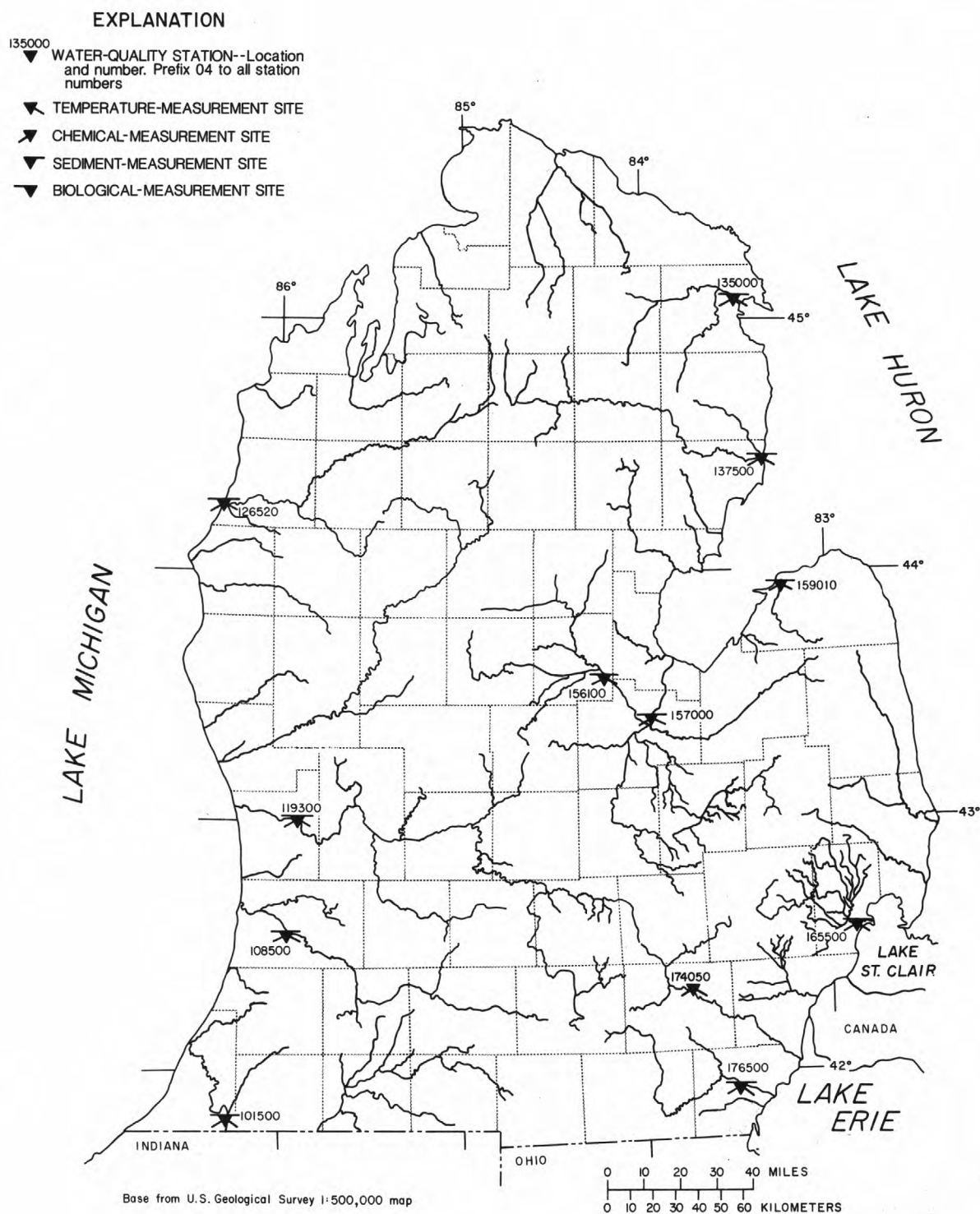


Figure 6.--Identification number and location of active surface-water-quality stations in the Upper Peninsula of Michigan.





**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 sea level, from topographic map.

REMARKS.--Water-discharge records good except for estimated daily discharges, which are poor.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.5	7.7	8.1	e4.9	e3.7	e2.4	e18	49	26	5.2	23	4.5
2	5.2	13	7.8	e4.8	e3.7	e2.5	e14	117	23	9.0	17	5.3
3	4.8	84	e7.4	e4.8	e3.6	e2.5	e11	135	19	7.9	12	7.7
4	4.4	83	7.0	e4.7	e3.5	e2.6	e9.0	90	16	11	9.4	5.4
5	4.1	53	6.7	e4.7	e3.5	e2.6	e10	70	14	7.6	7.2	4.3
6	4.0	34	e6.4	e4.7	e3.5	e2.6	e12	58	13	6.4	6.4	3.7
7	5.0	e25	6.3	e4.6	e3.4	e2.6	e17	48	14	5.5	5.4	3.4
8	9.1	19	e6.3	e4.6	e3.4	e2.6	e23	42	15	5.7	4.6	3.1
9	17	17	e6.4	e4.4	e3.3	e2.5	e35	36	16	9.6	8.3	18
10	20	20	e6.6	e4.3	e3.2	e2.5	e44	31	14	11	9.3	19
11	17	21	e6.5	e4.2	e3.1	e2.5	e42	27	12	8.6	6.1	12
12	13	20	e6.3	e4.2	e3.1	2.5	e39	23	11	7.2	4.9	8.8
13	11	20	e6.3	e4.1	e3.0	2.5	e37	19	9.5	5.9	4.4	7.5
14	11	e16	e6.5	e4.0	e2.9	2.4	e35	18	9.9	5.4	4.0	15
15	11	e13	e8.0	e4.0	e2.8	2.3	e33	18	8.7	4.8	3.9	13
16	9.6	e11	e15	e4.0	e2.8	2.4	33	18	7.6	4.3	3.9	10
17	9.4	9.4	e12	e4.0	e2.8	2.3	34	16	7.9	4.6	3.5	8.3
18	8.8	8.6	e10	e4.0	e2.8	1.9	33	14	8.3	4.3	3.2	7.0
19	7.9	8.6	e8.5	e4.0	e2.7	1.9	33	13	7.2	4.7	3.2	6.0
20	8.7	11	e7.6	e3.9	e2.7	2.0	37	12	7.6	6.8	3.0	5.4
21	12	21	e7.0	e3.7	e2.7	2.0	42	13	9.3	5.3	2.6	5.0
22	13	20	e6.6	e3.7	e2.6	2.0	53	12	7.7	3.7	2.2	4.7
23	14	17	e6.2	e3.6	e2.6	2.1	66	11	6.9	3.3	3.5	4.7
24	13	14	e5.7	e3.6	e2.5	2.2	131	31	11	3.1	4.0	4.3
25	11	e12	e5.4	e3.6	e2.4	2.4	158	46	18	3.6	3.1	4.0
26	10	e11	e5.3	e3.5	e2.4	e2.7	79	35	12	4.8	2.6	3.8
27	9.1	e11	e5.0	e3.5	e2.4	e3.3	59	32	8.9	3.9	1.8	3.6
28	8.4	e9.7	e5.0	e3.5	e2.4	e4.2	74	58	7.6	3.8	8.2	3.8
29	7.7	e9.0	e5.0	e3.5	---	e6.6	69	44	6.6	4.0	5.9	3.9
30	7.3	8.4	e5.0	e3.6	---	e8.0	56	35	5.9	3.3	5.5	3.4
31	7.0	---	e4.9	e3.7	---	e13	---	32	---	24	6.3	---
TOTAL	299.0	627.4	216.8	128.4	83.5	95.6	1336.0	1203	353.6	198.3	204.6	208.6
MEAN	9.65	20.9	6.99	4.08	2.98	3.08	44.5	38.8	11.8	6.40	6.60	6.95
MAX	20	84	15	4.9	3.7	13	158	135	26	24	23	19
MIN	4.0	7.7	4.9	3.5	2.4	1.9	9.0	11	5.9	3.1	2.2	3.1
CFSM	.73	1.58	.53	.31	.23	.23	3.37	2.94	.89	.48	.50	.53
IN.	.84	1.77	.61	.36	.24	.27	3.77	3.39	1.00	.56	.58	.59

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

	MEAN	12.3	15.4	7.52	4.44	3.85	12.6	70.6	38.7	14.0	6.40	4.33	7.76
MAX	33.8	47.2	18.3	18.1	13.0	58.7	154	103	34.2	18.4	14.0	55.1	
(WY)	1986	1992	1966	1966	1966	1966	1967	1972	1968	1968	1966	1977	
MIN	.76	.88	.63	.60	.61	1.10	20.3	5.13	2.87	1.04	.71	.57	
(WY)	1977	1977	1977	1977	1977	1965	1987	1977	1988	1988	1976	1976	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1965 - 1993

ANNUAL TOTAL	5376.0	4952.8	16.5	
ANNUAL MEAN	14.7	13.6	33.1	1966
HIGHEST ANNUAL MEAN			8.42	1990
LOWEST ANNUAL MEAN				
HIGHEST DAILY MEAN	176	Apr 20	412	Apr 25 1966
LOWEST DAILY MEAN	1.5	Aug 6	.44	Aug 25 1977
ANNUAL SEVEN-DAY MINIMUM	1.8	Jul 31	.47	Aug 19 1977
INSTANTANEOUS PEAK FLOW			(a)	May 1 1972
INSTANTANEOUS PEAK STAGE			5.00	(c) 6.88 Jan 13 1975
INSTANTANEOUS LOW FLOW			1.8	.44 Aug 25 1977
ANNUAL RUNOFF (CFSM)	1.11		1.03	
ANNUAL RUNOFF (INCHES)	15.15		13.96	
10 PERCENT EXCEEDS	27		33	
50 PERCENT EXCEEDS	7.1		7.0	
90 PERCENT EXCEEDS	3.3		2.7	

(a) Apr. 24, 25.

(b) From rating curve extended above 160 ft<sup>3</sup>/s based on runoff characteristics.

(c) Backwater from ice.

(e) Estimated.

## 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 September 30, 1991.

INSTRUMENTATION.--Water-temperature recorder from Oct. 20, 1964 to Sept. 30, 1991.

REMARKS.--Quarterly samples were collected at or near gage.

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.

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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)
OCT 21...	1500	12	114	7.7	3.0	1.9	12.9	96	330
FEB 10...	1230	3.2	151	7.7	0.0	1.7	14.4	99	K6
APR 30...	1300	54	62	7.5	2.5	3.5	12.2	91	K9
AUG 04...	1300	9.6	125	7.9	15.0	3.2	9.5	95	K370

DATE	STREP- TOCOC FECAL, KF AGAR (COLS. PER 100 ML) (31673)	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- LITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)
OCT 21...	38	52	2	14	4.2	2.2	0.40	61	50
FEB 10...	K2	71	7	19	5.8	3.4	0.30	78	64
APR 30...	K5	31	4	8.3	2.6	1.5	0.40	33	27
AUG 04...	280	69	8	19	5.2	2.5	0.40	74	61

DATE	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)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
OCT 21...	2.1	1.8	<0.10	11	94	0.13	3.05	0.010	0.072
FEB 10...	3.4	2.9	<0.10	15	101	0.14	0.87	<0.010	0.120
APR 30...	3.5	0.90	<0.10	8.7	74	0.10	10.8	<0.010	0.053
AUG 04...	1.3	1.7	<0.10	12	118	0.16	3.06	<0.010	0.059

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)
OCT 21...	0.030	0.50	0.020	0.020	<0.010	40	12	<3	300	<4
FEB 10...	0.040	0.30	<0.010	0.010	<0.010	20	12	<3	490	<4
APR 30...	0.040	0.50	0.030	0.030	<0.010	80	11	<3	160	<4
AUG 04...	0.070	0.60	0.010	<0.010	0.010	40	7	<3	540	<4

DATE	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	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)	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	ALPHA SED SUSP DRY WGH AS TH-230 (PC/L) (04127)
OCT 21...	12	<10	<1	<1	<1.0	28	<6	<0.6	<0.6	<0.6
FEB 10...	20	<10	<1	<1	<1.0	35	<6	--	--	--
APR 30...	5	<10	<1	<1	<1.0	15	<6	<0.6	<0.6	<0.6
AUG 04...	22	<10	<1	<1	<1.0	36	<6	--	--	--

DATE	ALPHA RADIO. WATER DISS AS TH-230 (PC/L) (04126)	GROSS BETA, DIS- SOLVED (PC/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PC/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PC/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PC/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PC/L) (09511)	URANIUM NATURAL DIS- SOLVED (UG/L AS U) (22703)	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 21...	<0.6	0.9	<0.6	0.8	<0.6	<0.02	0.02	6	0.19	91
FEB 10...	--	--	--	--	--	--	--	4	0.03	83
APR 30...	<0.6	1.1	<0.6	1.0	<0.6	0.02	0.01	17	2.5	78
AUG 04...	--	--	--	--	--	--	--	5	0.13	81





### 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 right bank 40 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 Paulling. Prior to Oct. 27, 1992, at site 40 ft upstream.

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

GAGE.—Water-stage recorder and concrete control. Datum of gage is 1,441.59 ft above sea level. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 3.00 ft higher. Oct. 1, 1968, to Aug. 17, 1987, water-stage recorder at same site and datum.

**REMARKS.**--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.8	7.7	10	287	196	e231	7.5	62	15	284	190	e172
2	6.8	8.3	64	289	195	231	7.4	56	14	294	190	e172
3	6.4	8.0	120	288	195	230	7.4	39	99	294	188	e173
4	6.4	7.9	118	217	194	230	7.5	14	201	293	188	e173
5	6.4	8.0	118	129	194	228	7.6	14	200	292	186	e173
6	6.4	8.1	118	112	222	226	7.6	13	201	297	186	e173
7	6.8	8.0	154	111	254	225	6.9	37	201	304	185	e173
8	6.8	8.1	198	157	251	225	5.0	69	201	303	185	171
9	6.8	8.1	198	204	249	223	4.9	69	130	302	185	170
10	6.8	8.0	197	e204	e248	223	4.8	174	16	301	185	170
11	6.8	8.2	197	e203	247	221	4.7	300	16	301	185	169
12	6.4	8.4	197	203	246	215	4.7	317	16	300	185	169
13	6.8	8.7	197	202	243	e212	4.5	317	16	298	184	143
14	6.8	8.5	196	201	242	e210	4.1	240	125	298	184	106
15	6.8	8.5	197	200	e240	e207	3.7	93	210	297	184	101
16	6.8	8.7	196	200	e239	179	3.4	92	164	296	182	100
17	6.8	8.6	195	e199	e238	141	2.8	188	200	294	182	101
18	6.8	8.9	195	e199	e237	133	2.4	301	271	294	182	100
19	6.8	8.9	195	198	e236	124	1.7	310	298	293	182	101
20	7.2	9.1	194	198	e235	125	.7	310	299	292	181	101
21	7.2	9.8	244	198	e233	124	.6	308	156	291	179	100
22	7.6	9.4	299	198	e232	122	.3	308	17	290	178	100
23	7.6	9.5	299	197	e231	121	19	307	17	288	176	100
24	7.6	9.8	298	e197	e231	122	66	213	17	287	173	100
25	7.6	9.9	296	e196	e231	122	57	71	16	287	e170	100
26	7.5	9.9	293	195	e231	123	36	15	74	286	e168	100
27	7.4	10	291	e195	e231	122	12	15	144	284	e172	100
28	7.6	9.8	291	e195	e231	123	12	14	144	255	e172	99
29	7.6	9.9	292	196	---	53	12	14	144	211	e172	100
30	7.6	10	291	195	---	8.0	33	15	215	192	e172	100
31	7.6	---	291	196	---	7.7	---	15	---	191	e172	---
TOTAL	217.3	264.7	6439	6159	6452	5086.7	347.2	4310	3837	8789	5603	3910
MEAN	7.01	8.82	208	199	230	164	11.6	139	128	284	181	130
MAX	7.6	10	299	289	254	231	66	317	299	304	190	173
MIN	6.4	7.7	10	111	194	7.7	30	13	14	191	168	99

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1993, BY WATER YEAR (WY)

MEAN	105	103	146	187	210	144	32.0	119	165	171	159	137
MAX	257	253	292	303	305	287	194	310	312	284	320	275
(WY)	1959	1972	1972	1986	1969	1984	1973	1986	1966	1993	1947	1944
MIN	.000	6.24	10.2	55.2	88.7	2.21	.33	.92	3.37	14.5	2.98	1.37
(WY)	1965	1944	1948	1990	1991	1959	1962	1962	1943	1949	1966	1959

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1942 - 1993
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ANNUAL TOTAL	48662.8		51414.9			
ANNUAL MEAN	133		141		140	
HIGHEST ANNUAL MEAN					206	1983
LOWEST ANNUAL MEAN					55.9	1977
HIGHEST DAILY MEAN	330	May 12	317	(a)	368	May 5 1960
LOWEST DAILY MEAN	1.5	Sep 23	.30	Apr 22	(b)	
ANNUAL SEVEN-DAY MINIMUM	3.7	Jul 11	1.7	Apr 16	(c)	
10 PERCENT EXCEEDS	274		291		297	
50 PERCENT EXCEEDS	164		172		140	
90 PERCENT EXCEEDS	6.8		7.2		4.8	

(a) May 12, 13.

(b) No flow for several days in 1963-70, 1973-75, 1982, 1987, 1991.

(c) No flow in 1963-65, 1967, 1975, 1987, 1991.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 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 sea level.

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, 38,670 acre-ft, June 22, 23, gage height, 139.90 ft; minimum, 9,530 acre-ft, Mar. 25, gage height, 125.74 ft.

## MONTHEND GAGE HEIGHT AND CONTENTS AT 1030, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 .....	130.8	19,120	—	—
Oct. 31 .....	134.3	26,130	+7,010	+114.0
Nov. 30 .....	138.3	34,990	+8,860	+148.9
Dec. 31 .....	136.0	29,800	-5,190	-84.4
CAL YR 1992 .....			-4,500	-6.2
Jan. 31 .....	132.8	23,100	-6,700	-109.0
Feb. 28 .....	128.4	14,560	-8,540	-153.8
Mar. 31 .....	126.5	10,950	-3,610	-58.7
Apr. 30 .....	136.7	31,340	+20,390	+342.7
May 31 .....	139.6	37,980	+6,640	+108.0
June 30 .....	139.6	37,980	0	0
July 31 .....	133.9	25,300	-12,680	-206.2
Aug. 31 .....	130.6	18,740	-6,560	-106.7
Sept. 30 .....	129.2	16,080	-2,660	-44.7
WTR YR 1993 .....			-3,040	-4.2

## 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 sea level (levels by Michigan Department of Natural Resources). Prior to Nov. 4, 1942, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	45	48	50	49	46	43	51	52	171	53	50	51
2	44	53	49	e48	46	43	48	59	324	54	49	51
3	44	56	49	e48	46	43	47	71	221	52	53	51
4	44	54	49	48	46	43	46	79	55	52	52	51
5	44	52	47	47	45	43	48	71	54	52	53	51
6	44	50	48	44	44	43	51	59	56	51	53	51
7	56	49	49	46	46	43	53	122	59	51	52	51
8	51	49	46	46	45	43	60	318	61	51	51	51
9	51	50	50	48	45	42	75	321	60	52	51	55
10	50	54	51	e50	45	42	72	256	146	52	51	54
11	51	53	49	e49	44	42	63	125	328	52	51	54
12	48	51	49	48	45	e42	56	49	321	52	51	54
13	48	52	49	48	45	e42	56	48	319	52	51	60
14	48	50	50	47	44	e42	56	47	219	52	51	59
15	48	50	51	46	44	e42	54	46	56	51	51	56
16	49	50	52	46	e44	42	52	46	56	51	51	54
17	48	49	50	46	e44	e42	51	46	58	51	51	54
18	49	49	46	46	e44	e42	57	46	57	51	51	54
19	48	49	51	46	e44	41	63	46	56	51	52	54
20	49	55	45	46	e44	42	58	46	80	51	52	54
21	50	83	49	47	44	41	54	46	124	50	51	53
22	51	68	50	47	43	44	54	45	360	50	51	45
23	50	88	47	47	43	42	54	47	410	50	51	44
24	49	217	52	47	e43	43	59	54	412	50	51	43
25	48	216	e48	44	e43	44	57	50	407	52	51	44
26	48	216	e48	45	e43	45	52	48	255	51	51	44
27	48	215	e48	48	43	47	52	51	55	50	53	45
28	48	184	48	47	43	50	71	51	54	54	51	46
29	48	127	44	44	---	53	59	49	53	51	51	47
30	48	51	49	47	---	59	55	52	52	50	55	46
31	48	---	48	48	---	60	---	58	---	50	53	---
TOTAL	1495	2488	1516	1453	1241	1375	1684	2504	4939	1592	1596	1527
MEAN	48.2	82.9	48.9	46.9	44.3	44.4	56.1	80.8	165	51.4	51.5	50.9
MAX	56	217	52	50	46	60	75	321	412	54	55	60
MIN	44	48	45	44	43	41	46	45	52	50	49	43

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1993, BY WATER YEAR (WY)

MEAN	55.6	56.9	48.5	47.1	46.6	50.9	82.9	108	99.6	71.7	58.2	54.0
MAX	221	239	102	84.7	76.7	118	297	422	461	253	105	216
(WY)	1943	1943	1943	1943	1943	1943	1943	1943	1943	1953	1952	1942
MIN	43.5	33.1	32.0	31.7	31.0	32.4	36.5	38.8	50.7	50.2	42.6	43.2
(WY)	1944	1949	1949	1949	1949	1949	1949	1949	1992	1989	1944	1967

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1942 - 1993

ANNUAL TOTAL	21183		23410									
ANNUAL MEAN	57.9		64.1									
HIGHEST ANNUAL MEAN										64.5		
LOWEST ANNUAL MEAN										187		1943
HIGHEST DAILY MEAN	420		412		Apr 29		Jun 24		1550		May 2	1951
LOWEST DAILY MEAN	42		41		May 8		Mar 19		30		Dec 1	1948
ANNUAL SEVEN-DAY MINIMUM	42		42		Sep 6		Mar 15		31		Mar 6	1949
INSTANTANEOUS PEAK FLOW			432				(a)		1750		Nov 7	1951
INSTANTANEOUS PEAK STAGE			3.14				(a)		5.05		Nov 7	1951
INSTANTANEOUS LOW FLOW									14		(b)	
10 PERCENT EXCEEDS	59		63						67			
50 PERCENT EXCEEDS	50		50						50			
90 PERCENT EXCEEDS	45		44						44			

(a) June 23, 24.

(b) Sometime during period Jan. 23 to Feb. 13, 1947, caused by ice jam upstream.

(c) Estimated.



## 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 sea level. 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	277	263	293	e300	e285	e230	1500	847	850	264	214	257
2	254	318	325	e300	e285	e235	1040	1160	823	290	209	236
3	233	1110	298	e300	e285	e240	831	2120	685	295	204	232
4	218	1170	281	e295	e285	e245	720	2140	374	272	209	237
5	211	822	234	e285	e285	e250	868	1790	324	269	225	230
6	204	619	e230	e280	e285	e250	1470	1150	302	260	254	226
7	633	444	e250	e270	e290	e255	1520	830	390	249	254	222
8	1010	426	e250	e265	e280	e255	2040	873	508	245	235	237
9	786	375	245	e260	e280	e255	3150	839	754	266	223	249
10	792	796	323	e250	e270	e250	3190	773	987	252	218	257
11	793	832	342	e250	e265	e250	2180	577	776	243	215	248
12	592	568	315	e250	e260	e245	1330	434	650	243	213	233
13	422	508	306	e255	e255	e240	1330	363	562	233	209	260
14	394	452	313	e255	e250	e240	1240	350	551	232	208	363
15	409	395	356	e255	e245	e235	1060	333	333	231	208	369
16	379	329	546	e255	e240	e235	869	309	293	223	221	318
17	404	e320	587	e255	e235	e235	738	302	311	222	250	282
18	462	e330	437	e260	e235	e235	1160	305	359	219	225	257
19	455	384	387	e260	e230	e235	1850	298	341	219	219	238
20	451	535	308	e260	e230	e235	1320	291	1700	216	214	227
21	518	3350	293	e260	e230	e235	1080	283	1660	212	210	226
22	870	2230	289	e260	e230	e240	1010	274	952	206	207	221
23	820	1160	284	e260	e230	e245	1010	276	840	202	213	218
24	585	962	e280	e260	e230	263	1360	563	752	201	223	223
25	447	840	e275	e260	e230	295	1610	685	693	216	209	209
26	380	700	e280	e260	e225	441	1030	466	745	225	203	207
27	339	604	e290	e265	e225	e900	822	466	366	219	209	216
28	309	495	e300	e265	e230	e1500	2200	907	319	219	217	230
29	300	442	e300	e265	---	e2000	1430	570	294	235	219	241
30	285	390	e300	e270	---	e2300	1030	478	276	227	217	256
31	273	---	e300	e280	---	2470	---	1040	---	219	260	---
TOTAL	14505	22169	9817	8265	7095	15739	41988	22092	18970	7324	6814	7425
MEAN	468	739	317	267	253	508	1400	713	632	236	220	247
MAX	1010	3350	587	300	285	2470	3190	2140	1700	295	260	369
MIN	204	263	230	250	225	230	720	274	276	201	203	207

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1993, BY WATER YEAR (WY)

	MEAN	439	467	327	268	267	574	1562	760	559	368	334	357
MAX	1026	1145	618	378	634	1652	2919	1672	1396	1181	1091	1224	
(WY)	1986	1989	1983	1946	1984	1973	1971	1973	1944	1949	1953	1942	
MIN	191	214	209	199	187	183	385	245	189	182	173	175	
(WY)	1949	1949	1990	1991	1949	1965	1987	1977	1992	1988	1976	1948	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR			FOR 1993 WATER YEAR			WATER YEARS 1942 - 1993		
ANNUAL TOTAL	182774			182203					
ANNUAL MEAN	499			499					
HIGHEST ANNUAL MEAN							521		
LOWEST ANNUAL MEAN							756		
HIGHEST DAILY MEAN	7400			3350			16300		
LOWEST DAILY MEAN	179			201			145		
ANNUAL SEVEN-DAY MINIMUM	183			210			163		
INSTANTANEOUS PEAK FLOW				4380			(b)27000		
INSTANTANEOUS PEAK STAGE				8.66			(c)21.20		
INSTANTANEOUS LOW FLOW				200			(d)142		
10 PERCENT EXCEEDS	857			1040			1020		
50 PERCENT EXCEEDS	284			285			291		
90 PERCENT EXCEEDS	199			219			210		

(a) Oct. 6, July 23-25.

(b) From rating curve extended above 7,500 ft<sup>3</sup>/s, on basis of slope area measurement of peak flow.

(c) From floodmarks.

(d) Discharge measurement.

(e) Estimated.

## 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 sea level. 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, 3.96 ft, June 8, result of wind action; minimum, 0.97 ft, Mar. 26.

**GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993**  
**DAILY MEAN VALUES**

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.90	2.69	2.74	2.23	1.77	1.38	1.30	2.79	3.39	2.99	2.87	2.90
2	2.88	2.73	2.71	2.20	1.78	1.34	1.36	2.88	3.35	3.03	2.84	2.89
3	2.84	2.83	2.68	2.20	1.75	1.32	1.39	2.98	3.31	3.01	2.79	2.85
4	2.81	2.80	2.66	2.19	1.74	1.31	1.41	3.09	3.29	3.04	2.79	2.87
5	2.79	2.79	2.66	2.18	1.71	1.29	1.44	3.22	3.26	3.05	2.80	2.82
6	2.76	2.80	2.62	2.16	1.71	1.27	1.47	3.34	3.25	3.10	2.83	2.82
7	2.78	2.81	2.57	2.15	1.70	1.26	1.50	3.42	3.25	2.97	2.84	2.80
8	2.86	2.78	2.53	2.10	1.68	1.25	1.57	3.48	3.29	2.98	2.83	2.83
9	2.98	2.77	2.51	2.07	1.67	1.24	1.71	3.47	3.31	2.97	2.87	2.86
10	3.03	2.81	2.47	2.04	1.65	1.22	1.83	3.43	3.26	2.97	2.84	2.80
11	3.05	2.82	2.42	2.02	1.64	1.21	1.95	3.45	3.22	2.98	2.83	2.82
12	3.07	2.80	2.40	2.00	1.64	1.20	2.04	3.37	3.19	2.96	2.87	2.80
13	3.04	2.82	2.39	2.00	1.63	1.18	2.09	3.42	3.14	2.93	2.89	2.80
14	3.00	2.82	2.39	1.99	1.63	1.16	2.13	3.39	3.14	2.92	2.90	2.81
15	2.98	2.83	2.38	1.98	1.61	1.15	2.14	3.39	3.08	2.91	2.91	2.83
16	2.99	2.83	2.39	1.96	1.59	1.15	2.19	3.33	3.09	2.90	2.91	2.88
17	3.02	2.83	2.39	1.94	1.59	1.13	2.22	3.31	3.05	2.91	2.91	2.84
18	2.97	2.81	2.37	1.92	1.58	1.12	2.24	3.31	3.03	2.89	2.91	2.82
19	2.98	2.81	2.37	1.90	1.56	1.11	2.27	3.31	3.02	2.90	2.93	2.81
20	2.97	2.82	2.33	1.87	1.55	1.10	2.32	3.33	3.11	2.88	2.88	2.80
21	2.95	2.89	2.31	1.88	1.54	1.09	2.37	3.31	3.21	2.84	2.89	2.81
22	2.96	2.94	2.31	1.88	1.53	1.07	2.40	3.32	3.21	2.83	2.89	2.83
23	2.94	2.94	2.30	1.86	1.50	1.06	2.43	3.31	3.21	2.82	2.90	2.81
24	2.92	2.92	2.28	1.88	1.47	1.05	2.47	3.39	3.16	2.82	2.93	2.83
25	2.93	2.89	2.30	1.86	1.46	1.05	2.53	3.46	3.16	2.88	2.91	2.79
26	2.88	2.87	2.27	1.86	1.46	1.04	2.56	3.43	3.10	2.91	2.90	2.80
27	2.85	2.86	2.24	1.84	1.45	1.04	2.56	3.43	3.02	2.85	2.94	2.79
28	2.81	2.83	2.23	1.83	1.45	1.07	2.64	3.40	2.98	2.89	2.91	2.78
29	2.80	2.80	2.23	1.84	---	1.10	2.68	3.39	2.99	2.84	2.90	2.81
30	2.78	2.77	2.22	1.82	---	1.16	2.75	3.36	2.98	2.85	2.92	2.89
31	2.75	---	2.23	1.79	---	1.24	---	3.37	---	2.86	2.91	---
MEAN	2.91	2.82	2.42	1.98	1.61	1.17	2.07	3.32	3.17	2.93	2.88	2.83
MAX	3.07	2.94	2.74	2.23	1.78	1.38	2.75	3.48	3.39	3.10	2.94	2.90
MIN	2.75	2.69	2.22	1.79	1.45	1.04	1.30	2.79	2.98	2.82	2.79	2.78
CAL YR 1992	MEAN 2.64	MAX 3.98	MIN 1.50									
WTR YR 1993	MEAN 2.51	MAX 3.48	MIN 1.04									



## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 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.

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 sea level (levels by Michigan Department of Natural Resources). July 15, 1942, to Oct. 28, 1969, nonrecording gage, and Oct. 28, 1969, to Oct. 23, 1989, water-stage recorder at site 90 ft downstream at same 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 sea level, during winter months and 1,684.0 ft, above sea level, 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, 4.24 ft, June 21; minimum, 3.42 ft, Nov. 30.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.04	3.80	3.47	3.57	3.43	3.51	3.52	3.57	4.02	3.99	4.03	3.99
2	4.03	3.82	3.48	3.57	3.44	3.48	3.51	3.61	4.03	4.01	4.01	3.98
3	4.03	3.84	3.50	3.58	3.44	3.48	3.51	3.63	4.02	4.03	4.02	3.98
4	4.02	3.79	3.52	3.58	3.45	3.48	3.51	3.67	4.01	4.07	4.02	3.97
5	4.02	3.77	3.54	3.57	3.45	3.49	3.50	3.70	3.98	4.07	4.03	3.95
6	4.00	3.75	3.55	3.55	3.47	3.50	3.51	3.76	3.97	4.07	4.04	3.94
7	4.05	3.73	3.56	3.53	3.48	3.52	3.51	3.82	3.97	4.04	4.02	3.93
8	4.05	3.70	3.55	3.51	3.49	3.54	3.53	3.88	4.00	4.00	4.01	3.95
9	4.05	3.68	3.55	3.49	3.50	3.54	3.57	3.92	3.99	3.98	4.00	3.98
10	4.02	3.66	3.53	3.47	3.50	3.54	3.57	3.92	3.95	3.98	3.97	3.98
11	3.99	3.63	3.52	3.46	3.50	3.54	3.57	3.95	3.94	3.97	3.98	4.01
12	3.93	3.60	3.50	3.47	3.51	3.53	3.57	3.96	3.95	3.96	3.98	4.02
13	3.96	3.61	3.48	3.50	3.50	3.52	3.55	4.00	3.94	3.97	3.99	4.04
14	3.99	3.62	3.48	3.51	3.50	3.52	3.53	4.00	3.92	3.98	4.00	4.05
15	4.02	3.60	3.49	3.52	3.49	3.52	3.51	3.97	3.90	3.99	4.00	4.03
16	4.02	3.59	3.51	3.53	3.48	3.51	3.54	3.99	3.97	4.00	3.99	4.00
17	4.03	3.57	3.50	3.53	3.48	3.51	3.55	4.00	4.00	4.00	3.98	3.95
18	4.02	3.55	3.49	3.53	3.48	3.51	3.54	3.99	4.02	4.00	3.99	3.91
19	4.01	3.52	3.48	3.53	3.48	3.50	3.53	3.98	4.04	3.98	3.96	3.93
20	4.00	3.54	3.47	3.52	3.48	3.49	3.51	3.97	4.17	3.97	3.94	3.95
21	3.99	3.59	3.45	3.53	3.48	3.48	3.49	3.96	4.22	3.98	3.95	3.95
22	3.98	3.59	3.45	3.53	3.49	3.47	3.49	3.96	4.18	3.98	3.96	3.96
23	3.95	3.56	3.45	3.52	3.51	3.48	3.49	3.97	4.15	3.99	3.97	3.94
24	3.93	3.54	3.47	3.53	3.52	3.50	3.51	4.00	4.10	3.99	3.95	3.96
25	3.94	3.51	3.48	3.52	3.53	3.52	3.51	3.99	4.06	4.02	3.95	3.96
26	3.88	3.49	3.48	3.51	3.53	3.55	3.52	3.96	4.00	4.00	3.96	3.97
27	3.88	3.48	3.49	3.50	3.53	3.55	3.52	3.97	3.96	4.02	3.98	3.97
28	3.86	3.47	3.49	3.49	3.52	3.56	3.55	3.94	3.93	4.03	3.98	3.99
29	3.84	3.45	3.50	3.48	---	3.56	3.56	3.97	3.95	4.03	3.98	4.01
30	3.83	3.44	3.52	3.47	---	3.55	3.56	3.99	3.98	4.03	3.99	4.06
31	3.81	---	3.57	3.45	---	3.54	---	4.01	---	4.04	3.99	---
MEAN	3.97	3.62	3.50	3.52	3.49	3.52	3.53	3.90	4.01	4.01	3.99	3.98
MAX	4.05	3.84	3.57	3.58	3.53	3.56	3.57	4.01	4.22	4.07	4.04	4.06
MIN	3.81	3.44	3.45	3.45	3.43	3.47	3.49	3.57	3.90	3.96	3.94	3.91

WTR YR 1993 MEAN 3.75 MAX 4.22 MIN 3.43



## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 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 sea level. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 4.00 ft higher.

REMARKS.--Records good except estimated daily discharges, which are fair and 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	28	55	7.0	25	e40	40	82	114	31	1.7	24	23
2	28	56	7.3	25	e22	39	62	117	31	1.7	24	22
3	27	75	7.7	26	e16	26	43	119	61	1.7	24	21
4	27	101	8.2	47	e10	6.1	43	121	86	2.3	24	21
5	27	100	8.9	65	e10	6.4	43	62	83	2.2	24	20
6	25	99	9.3	64	e10	6.4	43	5.8	82	30	45	19
7	53	97	27	63	e10	6.8	43	4.0	82	72	66	12
8	98	95	46	62	e10	7.5	46	2.6	82	93	65	.51
9	126	93	46	60	e10	24	47	1.9	112	61	46	.51
10	123	91	57	58	e10	42	98	1.5	137	23	22	.52
11	119	89	64	60	10	41	128	1.1	98	22	22	.52
12	52	88	63	48	25	41	121	.88	45	9.2	22	.58
13	2.0	87	62	21	44	41	110	12	44	.82	23	.23
14	1.9	89	61	22	43	40	106	25	29	.73	23	.74
15	1.9	87	61	22	43	40	103	24	21	.70	23	.90
16	29	86	63	23	42	40	109	25	23	.62	22	.89
17	72	85	62	23	42	39	111	36	24	.63	22	.84
18	70	84	62	24	42	39	106	45	25	.61	22	.43
19	70	82	61	33	35	39	105	45	28	.54	21	1.5
20	68	83	61	41	27	38	106	44	37	.43	10	1.3
21	68	104	60	41	27	38	103	44	116	.40	.87	1.2
22	68	128	37	50	19	22	100	43	181	.37	.51	.86
23	65	127	20	61	8.0	5.2	97	44	176	1.2	.50	.69
24	64	125	21	61	8.2	5.5	94	71	170	2.7	.45	.61
25	64	104	22	60	8.3	5.8	102	89	166	2.5	.41	.53
26	61	83	22	60	25	6.1	105	84	135	1.9	.39	.47
27	60	82	23	60	40	24	101	99	115	12	12	.48
28	59	81	22	59	40	41	105	56	60	25	22	.38
29	57	80	23	58	---	64	113	27	2.6	24	21	.38
30	56	41	24	57	---	84	115	28	2.3	25	22	.22
31	56	---	25	57	---	83	---	30	---	25	22	---
TOTAL	1725.8	2677	1143.4	1436	676.5	980.8	2687	1421.78	2282.9	444.95	675.93	574.04
MEAN	55.7	89.2	36.9	46.3	24.2	31.6	89.6	45.9	76.1	14.4	21.8	19.1
MAX	126	128	64	65	44	84	128	121	181	93	66	90
MIN	1.9	41	7.0	21	8.0	5.2	43	.88	2.3	.37	.39	.38

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1993, BY WATER YEAR (WY)

	MEAN	69.5	68.2	49.5	39.2	35.4	43.6	60.4	45.3	47.2	31.6	26.3	38.4
MAX	151	116	84.1	62.6	81.0	92.1	111	137	123	113	99.7	104	104
(WY)	1986	1968	1961	1983	1945	1973	1985	1960	1953	1953	1976	1977	1977
MIN	13.1	14.5	23.5	23.1	20.6	24.1	2.02	.17	.11	.25	.15	.23	.23
(WY)	1958	1945	1990	1959	1950	1956	1948	1977	1977	1977	1970	1976	1976

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1945 - 1993
ANNUAL TOTAL	15847.12	16728.10	
ANNUAL MEAN	43.3	45.8	46.2
HIGHEST ANNUAL MEAN			65.9
LOWEST ANNUAL MEAN			25.2
HIGHEST DAILY MEAN	190	181	288
LOWEST DAILY MEAN	.45	.37	.08
ANNUAL SEVEN-DAY MINIMUM	.51	.51	.09
INSTANTANEOUS PEAK FLOW		185	288
INSTANTANEOUS PEAK STAGE		5.62	(c)6.10
ANNUAL RUNOFF (CFSM)	.85	.90	.91
ANNUAL RUNOFF (INCHES)	11.63	12.27	12.39
10 PERCENT EXCEEDS	100	102	102
50 PERCENT EXCEEDS	37	40	38
90 PERCENT EXCEEDS	.81	1.6	1.0

(a) May 1-4, 1951.

(b) July 21, Aug. 2, 3, 1988.

(c) Present datum.

(e) Estimated.

## 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 sea level. 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.--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. National Weather Service gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	734	868	e1150	e950	e920	e900	4290	2710	2330	935	532	536
2	678	786	e1000	e800	e900	e900	3210	3020	2150	909	525	e590
3	681	2150	1030	e950	e900	e1100	2510	5260	1520	1010	522	e870
4	647	2830	e1000	e1070	e890	e980	2140	5560	1340	926	525	e560
5	568	2450	e850	e1070	e890	e860	2130	5390	1310	884	543	e490
6	675	1720	e720	e750	e850	e860	2990	3750	1180	881	730	e670
7	1110	1530	e900	e700	e850	e860	3440	2680	1420	858	654	e560
8	1870	1200	e1080	e800	e880	e960	4270	2100	1710	887	569	e680
9	1730	1300	e900	e800	e890	e1050	6750	1860	2360	901	604	638
10	2110	1760	1100	e830	e850	e850	7730	1750	3050	900	616	542
11	2310	2410	1250	e800	e820	e850	6460	1570	2380	765	672	460
12	1820	2010	1260	e900	e800	e850	4130	1430	2120	826	535	466
13	1430	1750	1220	e940	e860	e820	3450	1360	1630	712	546	694
14	1330	1570	1120	e870	e800	e760	3110	1320	1550	790	526	676
15	1200	1350	1060	e870	e850	e760	2990	1290	1250	752	526	776
16	1100	1150	1340	e850	e780	e800	2680	1130	1180	734	606	702
17	1130	1260	1460	e860	e750	e750	2180	946	994	684	572	710
18	1280	e1070	e1000	e840	e760	e680	2480	683	1140	629	544	658
19	1310	1180	e1150	e900	e800	e670	4240	667	1280	740	538	612
20	1300	1470	e1000	e900	e770	e720	3870	847	3050	627	532	636
21	1290	5830	e850	e850	e770	e700	3390	950	4270	671	527	520
22	1600	5900	e1000	e850	e800	e690	2930	848	3370	588	522	474
23	1980	3700	e1100	e850	e790	e680	2880	929	2420	670	531	482
24	1630	2860	e900	e870	e790	e720	3420	1390	1970	356	516	445
25	1300	2350	e750	e870	e790	e900	4200	1940	2010	593	527	318
26	1190	2110	e830	e800	e800	e1050	3150	1790	1650	785	590	397
27	1120	1740	e870	e870	e760	e2000	2540	1610	1400	741	465	527
28	1060	1420	e1000	e870	e800	e4000	4810	2070	1410	655	450	430
29	964	1320	e1100	e870	---	e4900	4160	1690	1220	641	484	496
30	901	1450	e1000	e840	---	5500	3470	1700	875	667	579	495
31	905	---	e1150	e920	---	5820	---	2150	---	537	606	---
TOTAL	38933	60594	32240	26910	23120	43840	110000	62390	55539	23254	17214	16910
MEAN	1256	2020	1040	868	826	1414	3667	2013	1851	750	555	564
MAX	2310	5900	1460	1070	920	5820	7730	5560	4270	1010	730	776
MIN	568	786	720	700	760	670	2130	667	875	356	450	318

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1993, BY WATER YEAR (WY)

	1135	1263	949	842	851	1534	4069	2031	1507	1012	821	888
MEAN	1135	1263	949	842	851	1534	4069	2031	1507	1012	821	888
MAX	3767	3232	1683	1473	1525	4355	6912	4621	3309	2879	2563	2679
(WY)	1986	1989	1983	1969	1984	1973	1971	1950	1951	1952	1942	1942
MIN	333	400	410	396	505	667	922	404	431	314	359	312
(WY)	1949	1949	1949	1949	1949	1956	1987	1977	1988	1988	1976	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1942 - 1993

ANNUAL TOTAL	527263	510944	1399
ANNUAL MEAN	1441	1400	1901
HIGHEST ANNUAL MEAN			1951
LOWEST ANNUAL MEAN			774
HIGHEST DAILY MEAN	18300	7730	31200
LOWEST DAILY MEAN	381	318	170
ANNUAL SEVEN-DAY MINIMUM	437	439	246
INSTANTANEOUS PEAK FLOW		(a)8390	(d)42000
INSTANTANEOUS PEAK STAGE		(b)14.66	(f)28.6
ANNUAL RUNOFF (CFSM)	1.08	1.04	1.04
ANNUAL RUNOFF (INCHES)	14.64	14.18	14.19
10 PERCENT EXCEEDS	2460	2990	2800
50 PERCENT EXCEEDS	900	901	880
90 PERCENT EXCEEDS	593	545	520

(a) Gage height, 12.52 ft.

(b) Backwater from ice.

(c) Aug. 13, 14, 1991.

(d) From rating curve extended above 14,000 ft<sup>3</sup>/s on basis of slope-area measurement of peak flow.

(e) Estimated.

(f) From floodmark.

## STREAMS TRIBUTARY TO LAKE SUPERIOR

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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00085)	PH WATER WHOLE FIELD (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-MP (COLS/ 100 ML) (31625)
OCT 19...	1430	1300	114	7.91	5.0	28	12.3	97	K29
FEB 09...	1050	894	137	7.7	0.0	15	13.0	91	K21
APR 05...	1645	2250	91	7.8	0.5	110	14.2	100	K17
JUL 28...	1215	945	139	8.0	23.0	1.9	8.1	97	K35
DATE	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	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- LITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)
OCT 19...	78	50	3	14	3.6	2.2	1.2	57	46
FEB 09...	--	65	8	18	4.9	2.6	0.90	70	57
APR 05...	K24	42	5	12	2.8	2.0	1.1	45	37
JUL 28...	20	68	10	19	4.9	2.4	0.80	70	57
DATE	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)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
OCT 19...	3.9	2.4	<0.10	7.3	89	0.12	312	<0.010	<0.050
FEB 09...	4.5	2.5	<0.10	11	91	0.12	220	<0.010	0.140
APR 05...	3.3	2.1	<0.10	8.0	75	0.10	456	<0.010	0.140
JUL 28...	3.7	2.0	0.10	8.2	95	0.13	242	<0.010	<0.050

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)
OCT 19...	0.070	0.50	0.050	<0.010	<0.010	120	28	<3	240	<4
FEB 09...	0.030	0.30	0.040	0.010	0.010	50	29	<3	190	<4
APR 05...	0.050	0.40	0.040	0.020	<0.010	220	31	<3	210	<4
JUL 28...	0.030	0.40	0.020	<0.010	<0.010	20	24	<3	110	<4

DATE	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	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)	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 19...	13	<10	<1	<1	<1.0	37	<6	37	130	95
FEB 09...	8	<10	<1	<1	<1.0	39	<6	--	--	--
APR 05...	16	<10	<1	<1	<1.0	28	<6	215	1310	94
JUL 28...	6	<10	<1	<1	<1.0	43	<6	14	36	95



## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 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.

REVISED RECORDS.--WSP 1507: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,214.40 ft above sea level. 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.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	193	140	e230	e115	e83	e48	497	883	423	147	36	33
2	164	146	e215	e110	e81	e49	432	775	362	132	32	30
3	141	236	e205	e100	e80	e50	376	886	291	120	30	33
4	125	254	e195	e98	e79	e51	319	1040	241	107	29	32
5	112	237	e185	e96	e78	e52	324	1100	209	98	28	30
6	103	214	e175	e93	e77	e52	401	969	186	90	31	30
7	117	191	e165	e91	e76	e51	422	789	204	80	29	28
8	132	179	e160	e90	e76	e51	555	651	226	72	27	47
9	134	169	e150	e88	e74	e50	859	531	241	69	27	66
10	134	223	e145	e86	e72	e49	907	452	238	63	33	71
11	143	285	e145	e84	e69	e49	899	384	203	58	35	62
12	135	280	e145	e83	e68	e49	772	327	173	55	31	52
13	121	255	e140	e82	e68	e50	695	281	146	50	28	74
14	135	236	e140	e83	e66	e50	656	250	134	48	24	211
15	169	e235	e160	e83	e62	e51	606	223	133	57	25	223
16	184	e225	e250	e84	e60	e52	512	199	123	49	104	179
17	191	e215	e250	e83	e58	e53	478	178	132	42	55	133
18	190	e200	e230	e80	e56	e53	518	177	154	39	47	100
19	182	194	e210	e78	e55	e53	588	175	153	42	38	85
20	180	249	e195	e77	e54	e54	603	160	232	42	32	70
21	189	803	e185	e78	e53	e55	576	145	322	37	28	60
22	246	814	e180	e78	e52	e56	588	132	277	34	26	55
23	344	717	e165	e79	e51	e60	619	123	211	32	24	50
24	348	634	e150	e80	e50	e68	736	238	191	29	24	46
25	311	523	e140	e82	e49	e80	876	316	389	28	22	43
26	265	e420	e130	e83	e48	e120	843	284	392	29	20	41
27	226	e360	e125	e84	e47	e200	735	241	358	29	19	46
28	198	e310	e120	e84	e47	e300	839	271	273	36	19	48
29	181	e280	e115	e85	---	e400	985	275	212	46	21	52
30	165	e250	e115	e85	---	558	1060	283	174	42	26	52
31	152	---	e115	e85	---	592	---	400	---	39	43	---
TOTAL	5610	9474	5230	2687	1789	3506	19276	13138	7003	1841	993	2082
MEAN	181	316	169	86.7	63.9	113	643	424	233	59.4	32.0	69.4
MAX	348	814	250	115	83	592	1060	1100	423	147	104	223
MIN	103	140	115	77	47	48	319	123	123	28	19	28
CFSM	1.06	1.85	.99	.51	.37	.66	3.76	2.48	1.37	.35	.19	.41
IN.	1.22	2.06	1.14	.58	.39	.76	4.19	2.86	1.52	.40	.22	.45

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1913 - 1993, BY WATER YEAR (WY)

	MEAN	182	198	119	71.3	62.5	159	768	458	216	126	82.5	130
MAX	547	599	242	162	191	744	1321	1147	579	503	319	586	
(WY)	1986	1989	1983	1969	1984	1973	1960	1965	1944	1968	1978	1968	
MIN	11.5	17.3	16.0	15.5	15.4	39.8	266	111	24.4	8.00	7.86	4.63	
(WY)	1977	1977	1977	1977	1977	1956	1946	1977	1988	1988	1976	1976	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1913 - 1993

ANNUAL TOTAL	81547	72629	213
ANNUAL MEAN	223	199	311
HIGHEST ANNUAL MEAN			1968
LOWEST ANNUAL MEAN			104
HIGHEST DAILY MEAN	2170	1100	4450
LOWEST DAILY MEAN	23	19	2.7
ANNUAL SEVEN-DAY MINIMUM	28	21	3.2
INSTANTANEOUS PEAK FLOW		1120	4630
INSTANTANEOUS PEAK STAGE		7.00	11.63
INSTANTANEOUS LOW FLOW		19	2.7
ANNUAL RUNOFF (CFSM)	1.30	1.16	1.25
ANNUAL RUNOFF (INCHES)	17.74	15.80	16.96
10 PERCENT EXCEEDS	477	520	521
50 PERCENT EXCEEDS	134	125	101
90 PERCENT EXCEEDS	58	34	30

(a) Aug. 26-28.

(e) Estimated.

## 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.

GAGE.--Water-stage recorder. Datum of gage is 709.64 ft above sea level. Prior to Jan. 5, 1948, nonrecording gage, and Jan. 5, 1948, to Sept. 30, 1963, water-stage recorder at same site at datum 39.34 ft lower.

REMARKS.--Records good. Flow regulated by powerplant at station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	469	345	307	303	216	208	1090	1620	674	447	166	117
2	347	345	305	302	215	208	1100	1470	674	370	167	117
3	347	346	303	301	215	208	986	1520	673	298	169	116
4	347	345	457	301	215	228	883	1700	619	297	168	116
5	348	422	605	302	216	245	728	1720	670	296	159	128
6	347	522	411	285	216	245	652	1630	383	296	147	137
7	363	520	302	269	215	243	739	1260	302	296	142	137
8	347	517	303	271	217	244	818	1370	302	275	142	137
9	346	418	303	270	216	243	1320	1160	324	257	142	137
10	346	342	303	271	216	242	1770	771	435	217	138	137
11	347	433	304	246	219	243	1690	843	577	187	130	145
12	347	551	304	219	219	243	1380	689	572	180	130	155
13	346	550	304	214	217	243	1100	681	450	174	131	160
14	347	549	303	213	216	243	1170	644	338	174	130	242
15	347	547	305	215	221	241	995	674	338	174	129	505
16	334	543	280	215	226	243	893	638	296	174	130	549
17	348	438	397	217	221	234	966	511	256	174	143	314
18	349	341	539	220	222	195	897	382	257	174	155	314
19	348	340	535	214	221	214	822	231	295	180	154	313
20	347	342	415	215	221	168	1050	258	433	158	155	275
21	346	1430	304	214	219	168	1110	238	665	128	154	196
22	346	1660	304	214	216	168	1040	278	680	127	154	151
23	564	1310	304	214	216	169	1030	299	678	127	154	151
24	770	1170	304	214	216	171	1110	451	605	126	149	151
25	760	1150	303	217	218	171	1340	616	672	126	145	151
26	596	901	258	215	218	199	1500	616	672	126	145	151
27	345	641	212	215	214	280	1350	640	674	126	149	146
28	346	496	212	216	209	469	1290	607	675	125	154	142
29	345	355	214	217	---	629	1380	646	656	147	154	143
30	346	307	266	215	---	838	1500	645	534	166	133	145
31	345	---	304	214	---	1000	---	659	---	166	117	---
TOTAL	12176	18176	10270	7428	6086	8843	33739	25467	15379	6288	4535	5778
MEAN	393	606	331	240	217	285	1125	822	513	203	146	193
MAX	770	1660	605	303	226	1000	1770	1720	680	447	169	549
MIN	334	307	212	213	209	168	652	231	256	125	117	116
CFSM	1.14	1.75	.96	.69	.63	.82	3.25	2.37	1.48	.59	.42	.56
IN.	1.31	1.95	1.10	.80	.65	.95	3.63	2.74	1.65	.68	.49	.62

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1932 - 1993, BY WATER YEAR (WY)

MEAN	347	388	271	212	200	367	1166	796	443	302	230	280
MAX	973	1001	433	380	412	1255	2093	1750	973	894	595	1056
(WY)	1986	1989	1988	1969	1984	1973	1960	1965	1944	1968	1978	1968
MIN	99.4	120	101	111	133	164	420	265	136	94.2	100	70.9
(WY)	1949	1949	1977	1977	1964	1940	1987	1988	1988	1988	1976	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1932 - 1993

ANNUAL TOTAL	163558	154165	419
ANNUAL MEAN	447	422	582
HIGHEST ANNUAL MEAN			1960
LOWEST ANNUAL MEAN			247
HIGHEST DAILY MEAN	3440	1770	6820
LOWEST DAILY MEAN	100	116	(a)1.0
ANNUAL SEVEN-DAY MINIMUM	131	121	1.1
INSTANTANEOUS PEAK FLOW		2050	7360
INSTANTANEOUS PEAK STAGE		6.91	13.09
ANNUAL RUNOFF (CFSM)	1.29	1.22	1.21
ANNUAL RUNOFF (INCHES)	17.58	16.57	16.44
10 PERCENT EXCEEDS	764	974	846
50 PERCENT EXCEEDS	304	301	267
90 PERCENT EXCEEDS	177	145	137

(a) Sept. 3, 4.

(b) About; caused by draining of pond for dam repair.

(c) Aug. 14-19, 1960.

## STREAMS TRIBUTARY TO LAKE SUPERIOR

## 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 sea level.

REMARKS.--Records good except for estimated daily discharges, Sept. 22-30, which are fair. Small diversions for sprinkler irrigation. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	18	26	22	23	18	93	95	94	18	16	16
2	16	22	26	22	23	19	73	179	67	21	15	14
3	15	80	24	e22	23	20	60	256	52	23	14	14
4	14	65	24	e22	22	20	52	206	44	20	14	13
5	13	50	24	e22	22	21	65	189	37	19	13	13
6	12	39	23	22	22	23	97	121	33	18	14	12
7	19	31	23	e22	22	20	135	90	41	17	14	12
8	40	29	22	22	21	20	206	74	43	18	13	12
9	37	27	21	22	21	20	276	65	44	18	12	15
10	38	35	22	e22	21	20	232	57	38	17	12	19
11	32	41	22	e22	20	19	184	50	32	16	12	14
12	26	36	21	23	20	19	115	43	26	16	11	13
13	23	38	21	24	20	19	98	39	24	15	11	18
14	21	32	21	23	20	18	114	36	29	15	11	38
15	20	27	32	22	20	18	98	36	30	15	11	36
16	21	25	79	22	19	18	81	37	25	14	12	25
17	23	24	61	22	19	17	73	36	24	15	12	20
18	25	22	47	21	19	17	100	34	24	15	11	17
19	23	22	41	21	19	17	125	32	23	15	11	16
20	24	31	34	21	19	17	125	29	30	14	11	16
21	26	158	34	22	19	17	130	28	48	13	11	16
22	34	122	31	23	19	16	156	27	29	13	10	e15
23	48	72	28	23	19	17	183	26	24	13	13	e14
24	39	55	26	23	19	18	251	73	22	13	25	e14
25	30	46	25	22	19	22	280	129	45	13	17	e14
26	27	39	e25	e22	19	32	148	71	30	17	16	e13
27	23	35	e24	e22	19	44	113	73	24	16	23	e13
28	22	32	24	22	19	59	248	167	21	16	24	e14
29	21	29	23	21	---	81	189	92	19	19	19	e14
30	20	28	23	22	---	109	125	91	18	18	17	e14
31	19	---	23	23	---	127	---	160	---	17	18	---
TOTAL	769	1310	900	686	567	922	4225	2641	1040	507	443	494
MEAN	24.8	43.7	29.0	22.1	20.2	29.7	141	85.2	34.7	16.4	14.3	16.5
MAX	48	158	79	24	23	127	280	256	94	23	25	38
MIN	12	18	21	21	19	16	52	26	18	13	10	12
CFSM	.89	1.56	1.04	.79	.72	1.06	5.03	3.04	1.24	.58	.51	.59
IN.	1.02	1.74	1.20	.91	.75	1.22	5.61	3.51	1.38	.67	.59	.66

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

	33.4	41.5	27.2	21.2	20.5	43.0	182	76.1	38.6	21.9	18.2	23.8
MEAN	33.4	41.5	27.2	21.2	20.5	43.0	182	76.1	38.6	21.9	18.2	23.8
MAX	94.6	134	43.9	33.2	42.8	112	283	223	117	63.5	70.2	92.5
(WY)	1986	1989	1988	1989	1984	1973	1976	1972	1968	1968	1988	1968
MIN	8.71	9.66	9.28	9.03	9.00	16.1	70.3	22.0	11.7	11.4	9.78	9.57
(WY)	1977	1977	1977	1977	1977	1972	1987	1977	1977	1967	1970	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1967 - 1993

ANNUAL TOTAL	14978	14504	
ANNUAL MEAN	40.9	39.7	45.6
HIGHEST ANNUAL MEAN			62.6
LOWEST ANNUAL MEAN			31.5
HIGHEST DAILY MEAN	689	280	1120
LOWEST DAILY MEAN	12	10	6.8
ANNUAL SEVEN-DAY MINIMUM	12	11	7.1
INSTANTANEOUS PEAK FLOW		345	1590
INSTANTANEOUS PEAK STAGE		6.68	10.72
INSTANTANEOUS LOW FLOW		9.4	(a)1.7
ANNUAL RUNOFF (CFSM)	1.46	1.42	1.63
ANNUAL RUNOFF (INCHES)	19.90	19.27	22.11
10 PERCENT EXCEEDS	74	94	91
50 PERCENT EXCEEDS	23	22	22
90 PERCENT EXCEEDS	14	14	13

(a) Caused by ice jam upstream.

(e) Estimated.

## 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 sea level, from topographic map.

REMARKS.--Records good except those 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	177	179	251	e175	174	283	339	349	351	227	51	51
2	169	256	112	e175	178	288	257	350	348	226	47	51
3	.16	280	166	e175	173	293	170	354	349	226	48	51
4	.19	340	240	e260	173	290	168	360	348	225	48	51
5	171	339	182	e250	173	293	290	354	347	225	59	52
6	105	285	181	e250	116	272	340	349	346	224	65	52
7	112	179	256	e230	117	269	340	344	348	219	63	52
8	163	180	249	215	177	247	273	339	347	222	61	52
9	164	269	255	110	179	204	172	337	345	223	53	51
10	.20	261	256	111	174	289	174	338	339	157	48	52
11	.22	265	213	181	175	289	172	334	294	111	48	52
12	120	261	181	180	176	292	291	339	209	112	48	51
13	171	240	e180	178	116	276	340	342	209	112	48	49
14	172	178	e260	175	117	275	345	346	208	112	50	e58
15	167	178	e260	177	175	269	343	347	209	112	50	58
16	165	254	e260	113	176	288	340	348	210	112	49	56
17	.36	253	e290	120	179	291	343	347	210	112	50	54
18	.30	253	e290	181	160	291	344	348	210	111	49	60
19	.77	252	e350	178	175	258	343	347	210	111	50	66
20	179	253	e350	174	113	164	271	347	211	102	51	65
21	174	e180	e350	172	114	165	229	347	209	87	e51	63
22	162	e180	e350	172	178	251	249	346	202	79	52	63
23	142	260	e328	116	216	288	251	346	210	76	51	63
24	.31	276	e175	115	288	232	e201	350	208	76	52	63
25	.33	255	e175	178	288	180	e245	349	e232	75	51	63
26	182	180	e175	175	283	180	e273	348	228	75	51	63
27	180	178	e175	174	258	181	e254	349	229	75	51	63
28	198	180	e256	175	257	182	e262	350	229	68	51	65
29	243	179	e260	176	---	210	330	348	229	62	51	65
30	326	259	e260	116	---	197	352	350	228	58	51	65
31	179	---	e260	115	---	272	---	354	---	56	50	---
TOTAL	3900.07	7082	7546	5292	5078	7759	8301	10756	7852	4068	1598	1720
MEAN	126	236	243	171	181	250	277	347	262	131	51.5	57.3
MAX	326	340	350	260	288	293	352	360	351	227	65	66
MIN	.16	178	112	110	113	164	168	334	202	56	47	49

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 1993, BY WATER YEAR (WY)

	1990	1991	1992	1993
MEAN	141	228	245	176
MAX	213	295	304	190
(WY)	1991	1991	1992	1993
MIN	83.3	152	189	166
(WY)	1992	1992	1991	1992

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1990 - 1993

ANNUAL TOTAL	67682.33	70952.07	185
ANNUAL MEAN	185	194	185
HIGHEST ANNUAL MEAN			194
LOWEST ANNUAL MEAN			180
HIGHEST DAILY MEAN	358	360	360
LOWEST DAILY MEAN	.00	.16	.00
ANNUAL SEVEN-DAY MINIMUM	.11	49	.11
10 PERCENT EXCEEDS	344	346	346
50 PERCENT EXCEEDS	178	180	176
90 PERCENT EXCEEDS	.31	51	12

(a) June 13-18, 1992.

(e) Estimated.



DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.61	9.43	5.32	5.12	5.00	4.85	5.77	5.84	10.06	9.69	8.81	8.22
2	8.82	9.45	5.30	5.10	5.00	4.86	5.59	5.81	9.59	9.66	8.76	8.19
3	8.63	9.54	5.27	5.10	5.01	4.87	5.49	6.62	9.22	9.62	8.72	8.16
4	8.62	9.60	5.24	5.09	5.01	4.87	5.42	7.15	9.38	9.61	8.70	8.14
5	8.62	9.66	5.20	5.08	5.01	4.88	5.43	6.95	9.54	9.57	8.66	8.11
6	8.61	9.70	5.20	5.07	5.00	4.88	5.52	7.04	9.65	9.58	8.64	8.09
7	8.60	9.70	5.19	5.06	4.99	4.89	5.64	8.41	9.70	9.54	8.62	8.06
8	8.58	9.68	5.16	5.04	4.99	4.90	5.82	9.12	9.75	9.52	8.60	8.06
9	8.58	9.67	5.14	5.03	4.98	4.90	6.19	9.54	9.78	9.50	8.58	8.05
10	8.56	9.71	5.15	5.03	4.98	4.89	6.46	9.78	9.77	9.45	8.57	8.07
11	8.54	9.75	5.14	5.02	4.97	4.89	6.32	9.89	9.75	9.41	8.55	8.07
12	8.54	9.78	5.14	5.02	4.96	4.88	6.04	9.81	9.72	9.37	8.52	8.08
13	8.52	9.82	5.14	5.02	4.96	4.88	5.82	9.67	9.69	9.33	8.49	8.10
14	8.51	9.81	5.15	5.02	4.96	4.87	5.71	9.54	9.66	9.29	8.47	8.28
15	8.50	9.79	5.30	5.01	4.95	4.86	5.60	9.62	9.62	9.26	8.45	8.54
16	8.57	9.75	6.01	5.01	4.94	4.85	5.49	9.71	9.60	9.21	8.44	8.73
17	8.77	9.72	6.20	5.00	4.93	4.84	5.51	9.75	9.54	9.18	8.43	8.82
18	8.94	9.70	5.85	5.00	4.92	4.83	5.60	9.75	9.49	9.15	8.42	8.86
19	9.08	9.68	5.72	5.00	4.90	4.83	5.83	9.75	9.46	9.14	8.42	8.88
20	9.20	9.70	5.50	5.00	4.88	4.83	5.99	9.74	9.46	9.19	8.46	8.89
21	9.30	9.63	5.41	5.00	4.88	4.83	6.04	9.73	9.47	9.18	8.46	8.88
22	9.40	8.55	5.38	5.00	4.88	4.82	6.14	9.72	9.49	9.16	8.46	8.88
23	9.43	7.18	5.32	5.01	4.88	4.83	6.30	9.70	9.53	9.13	8.45	8.84
24	9.46	6.17	5.24	5.01	4.87	4.86	6.54	9.81	9.53	9.09	8.42	8.83
25	9.49	5.81	5.22	5.02	4.86	4.95	7.10	9.89	9.61	9.06	8.40	8.80
26	9.50	5.68	5.18	5.00	4.85	5.12	6.63	9.88	9.68	9.03	8.37	8.78
27	9.51	5.60	5.15	5.00	4.84	5.31	6.18	9.87	9.76	8.99	8.35	8.75
28	9.50	5.50	5.14	5.00	4.84	5.44	6.18	9.87	9.78	8.97	8.32	8.78
29	9.48	5.43	5.14	4.99	—	5.60	6.23	9.87	9.76	8.92	8.29	8.81
30	9.47	5.39	5.14	4.99	—	5.77	6.03	9.86	9.72	8.89	8.27	8.88
31	9.45	—	5.13	4.99	—	5.89	—	10.07	—	8.86	8.24	—
MEAN	8.94	8.62	5.32	5.03	4.94	4.99	5.95	9.09	9.63	9.28	8.49	8.49
MAX	9.51	9.82	6.20	5.12	5.01	5.89	7.10	10.07	10.06	9.69	8.89	8.89
MIN	8.50	5.39	5.13	4.99	4.84	4.82	5.42	5.81	9.22	8.86	8.24	8.05
CAL YR 1992	MEAN 7.41		MAX 9.82		MIN 4.95							
WTR YR 1993	MEAN 7.41		MAX 10.07		MIN 4.82							

## 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 sea level.

REMARKS.--Water-discharge records good.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	765	887	1550	721	477	323	1540	2900	1400	875	611	390
2	730	828	1420	691	489	320	1650	2820	1470	793	699	381
3	689	915	1280	666	490	323	1710	2790	1500	711	763	361
4	653	1030	1180	645	492	327	1730	2850	1470	645	819	361
5	619	1140	1070	629	488	333	1780	2950	1410	589	833	346
6	580	1230	1010	621	497	338	1850	3020	1320	946	823	338
7	554	1280	951	609	494	345	1910	3030	1210	1190	951	333
8	534	1280	901	595	484	350	2040	2960	1120	1320	1010	323
9	557	1250	851	579	474	360	2340	2850	1150	1390	1000	338
10	629	1240	795	569	463	366	2720	2690	1170	1490	1000	384
11	692	1220	753	548	458	372	3050	2500	1170	1520	985	442
12	726	1210	717	518	452	379	3240	2280	1130	1570	940	467
13	762	1280	688	496	446	377	3290	2100	1070	1570	870	479
14	791	1320	666	481	439	378	3260	1900	1040	1530	798	593
15	808	1320	663	467	430	370	3150	1680	1040	1450	732	775
16	886	1290	856	457	422	362	3160	1490	1060	1350	683	875
17	1100	1280	1100	448	420	362	3200	1340	1070	1250	643	902
18	1240	1220	1190	446	415	364	3250	1190	1160	1140	624	901
19	1340	1150	1240	440	404	362	3260	1090	1220	1030	593	883
20	1410	1100	1250	438	395	360	3230	1010	1250	924	554	847
21	1470	1250	1240	439	383	358	3190	946	1240	833	538	797
22	1520	1550	1210	444	371	358	3110	910	1200	742	503	750
23	1510	1710	1170	448	363	358	3000	857	1150	660	478	690
24	1470	1830	1090	457	356	366	2930	879	1060	582	460	657
25	1440	1900	1020	464	348	387	2940	911	1030	509	448	611
26	1360	1880	954	467	341	434	2880	943	1040	470	426	575
27	1290	1860	893	466	337	516	2860	954	1040	453	407	538
28	1210	1810	847	470	330	642	2900	995	1030	462	398	516
29	1130	1730	809	473	---	820	2930	1040	990	515	397	513
30	1060	1640	777	466	---	1060	2920	1070	942	599	387	515
31	974	---	749	467	---	1330	---	1250	---	631	383	---
TOTAL	30499	40630	30890	16125	11958	13700	81020	56195	35152	29739	20756	16881
MEAN	984	1354	996	520	427	442	2701	1813	1172	959	670	563
MAX	1520	1900	1550	721	497	1330	3290	3030	1500	1570	1010	902
MIN	534	828	663	438	330	320	1540	857	942	453	383	323
CFSM	1.25	1.71	1.26	.66	.54	.56	3.42	2.29	1.48	1.21	.85	.71
IN.	1.44	1.91	1.45	.78	.56	.65	3.82	2.65	1.68	1.40	.98	.79

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1953 - 1993, BY WATER YEAR (WY)

	MEAN	850	1030	791	496	465	720	2776	1689	703	502	427	635
MAX	1768	2284	1756	983	809	1710	4575	4511	1736	1081	1126	1623	
(WY)	1979	1989	1967	1983	1984	1973	1976	1960	1974	1956	1973	1970	
MIN	256	420	339	303	279	335	1537	511	243	209	217	249	
(WY)	1964	1977	1977	1963	1963	1956	1987	1986	1988	1963	1991	1955	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1953 - 1993

ANNUAL TOTAL	317327	383545	924	
ANNUAL MEAN	867	1051	1294	1971
HIGHEST ANNUAL MEAN			618	1963
LOWEST ANNUAL MEAN			6820	May 10 1960
HIGHEST DAILY MEAN	3730	Apr 24	320	Mar 2
LOWEST DAILY MEAN	229	Aug 29	328	Feb 27
ANNUAL SEVEN-DAY MINIMUM	233	Aug 25	3300	(a)
INSTANTANEOUS PEAK FLOW			7.72	(a)
INSTANTANEOUS PEAK STAGE			318	(b)
INSTANTANEOUS LOW FLOW			1.33	
ANNUAL RUNOFF (CFSM)	1.10		18.06	1.17
ANNUAL RUNOFF (INCHES)	14.94			15.89
10 PERCENT EXCEEDS	1600		1930	
50 PERCENT EXCEEDS	691		870	
90 PERCENT EXCEEDS	316		378	

(a) Apr. 12, 13.

(b) Mar. 2, Sept. 8, 9.

(c) July 26, 1955, July 8, 1988.

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to July 1993 (discontinued).

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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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)
OCT 07...	1140	557	134	7.6	12.0	2.1	7.8	73	K9	K2
JAN 26...	1530	466	154	7.4	0.0	2.6	6.9	49	K4	K5
APR 21...	1530	3320	61	7.3	4.5	2.6	10.2	80	K2	K1
JUL 15...	1300	1490	119	7.1	19.0	2.1	3.6	39	30	K16

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 07...	67	10	19	4.7	2.1	0.50	69	56	8.2	2.3
JAN 26...	75	14	21	5.5	2.2	0.60	74	61	11	2.0
APR 21...	30	9	8.2	2.2	1.2	0.70	25	21	5.9	1.5
JUL 15...	69	14	20	4.5	1.4	0.50	67	55	3.8	2.0

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, NITRATE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	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) (00655)
OCT 07...	<0.10	6.8	113	0.15	170	<0.010	<0.050	0.030	1.1	0.030
JAN 26...	<0.10	9.3	107	0.15	135	0.020	0.150	0.080	0.40	<0.010
APR 21...	<0.10	4.1	60	0.08	538	<0.010	<0.050	0.060	0.50	0.030
JUL 15...	<0.10	7.0	132	0.18	531	<0.010	<0.050	0.050	1.3	0.030

## STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM DIS- SOLVED (UG/L AS MO) (01060)
OCT 07...	0.020	<0.010	70	25	<3	410	<4	17	<10
JAN 26...	<0.010	0.010	60	27	<3	510	<4	46	<10
APR 21...	0.030	<0.010	120	16	<3	210	<4	6	<10
JUL 15...	<0.010	<0.010	130	22	<3	1500	<4	70	<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)	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 07...	<1	<1	<1.0	47	<6	5	7.5	98
JAN 26...	<1	<1	<1.0	48	<6	4	5.0	90
APR 21...	1	<1	<1.0	22	<6	3	27	77
JUL 15...	<1	<1	<1.0	48	<6	7	28	95





## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level (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, collected from March 1938 to September 1971, August 1992 to present; annual peak discharge 1972-82. Established legal level: 613.27 ft, above sea level. Surface area of lake is 8,660 acres.

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

**EXTREMES FOR CURRENT YEAR.**—Maximum gage height, 5.06 ft, July 8; minimum, 3.21 ft, Mar. 3-6, 19, 20.

**GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993**  
**DAILY MEAN VALUES**

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.56	4.35	4.43	3.91	3.49	3.22	3.56	4.47	4.69	4.57	4.71	4.77
2	4.56	4.31	4.42	3.89	3.49	3.22	3.62	4.47	4.70	4.59	4.70	4.77
3	4.54	4.44	4.38	3.88	3.50	3.22	3.66	4.54	4.70	4.62	4.71	4.78
4	4.53	4.43	4.33	3.87	3.48	3.21	3.69	4.65	4.70	4.63	4.75	4.77
5	4.51	4.41	4.30	3.86	3.48	3.21	3.71	4.72	4.68	4.71	4.73	4.72
6	4.50	4.38	4.25	3.84	3.47	3.22	3.74	4.77	4.66	4.99	4.75	4.69
7	4.48	4.34	4.20	3.81	3.46	3.22	3.76	4.82	4.65	5.02	4.77	4.66
8	4.46	4.31	4.16	3.79	3.45	3.23	3.79	4.83	4.64	5.02	4.76	4.65
9	4.49	4.27	4.12	3.76	3.44	3.24	3.85	4.82	4.69	4.98	4.75	4.66
10	4.50	4.27	4.11	3.73	3.43	3.24	3.90	4.80	4.69	4.95	4.76	4.65
11	4.49	4.25	4.09	3.70	3.42	3.25	3.93	4.76	4.68	4.89	4.76	4.61
12	4.51	4.24	4.06	3.68	3.41	3.25	3.96	4.69	4.66	4.87	4.75	4.59
13	4.47	4.31	4.03	3.69	3.39	3.25	3.98	4.61	4.63	4.81	4.75	4.61
14	4.43	4.23	3.99	3.68	3.39	3.24	3.98	4.55	4.68	4.76	4.73	4.70
15	4.43	4.21	3.98	3.66	3.38	3.23	4.01	4.51	4.70	4.70	4.71	4.73
16	4.51	4.17	4.06	3.64	3.37	3.22	4.13	4.44	4.65	4.64	4.70	4.77
17	4.55	4.15	4.10	3.63	3.36	3.24	4.17	4.41	4.66	4.58	4.68	4.82
18	4.56	4.12	4.11	3.61	3.35	3.23	4.19	4.41	4.67	4.56	4.66	4.85
19	4.57	4.08	4.15	3.59	3.33	3.22	4.23	4.40	4.66	4.57	4.66	4.86
20	4.60	4.09	4.16	3.58	3.31	3.22	4.26	4.38	4.66	4.55	4.66	4.86
21	4.63	4.26	4.12	3.58	3.30	3.22	4.28	4.37	4.67	4.53	4.61	4.87
22	4.65	4.33	4.09	3.59	3.29	3.22	4.29	4.35	4.66	4.51	4.59	4.88
23	4.67	4.39	4.10	3.58	3.28	3.22	4.29	4.38	4.62	4.51	4.58	4.86
24	4.69	4.45	4.07	3.58	3.27	3.23	4.31	4.45	4.58	4.52	4.58	4.85
25	4.69	4.49	4.08	3.58	3.26	3.25	4.37	4.48	4.58	4.57	4.57	4.82
26	4.70	4.55	4.05	3.58	3.25	3.28	4.36	4.49	4.56	4.66	4.60	4.81
27	4.69	4.55	3.98	3.58	3.24	3.31	4.36	4.48	4.52	4.68	4.66	4.78
28	4.68	4.53	3.95	3.58	3.23	3.34	4.43	4.56	4.51	4.73	4.69	4.72
29	4.63	4.52	3.93	3.57	---	3.39	4.44	4.56	4.53	4.76	4.69	4.66
30	4.54	4.49	3.92	3.56	---	3.45	4.47	4.60	4.54	4.72	4.71	4.62
31	4.45	---	3.93	3.52	---	3.50	---	4.70	---	4.71	4.76	---
MEAN	4.56	4.33	4.12	3.68	3.38	3.26	4.06	4.56	4.64	4.71	4.69	4.75
MAX	4.70	4.55	4.43	3.91	3.50	3.50	4.47	4.83	4.70	5.02	4.77	4.88
MIN	4.43	4.08	3.92	3.52	3.23	3.21	3.56	4.35	4.51	4.51	4.57	4.59
CAL YR 1992	MEAN 4.24	MAX 5.02	MIN 3.29									
WTR YR 1993	MEAN 4.23	MAX 5.02	MIN 3.21									

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 September 1971, water years 1972-82 (annual maximum), August 1992 to current year.

**GAGE.**—Water-stage recorder. Datum of gage is 608.66 ft above sea level (levels by Michigan Department of Natural Resources). Prior to July 9, 1942, nonrecording gage at site 0.5 mi northwest at same datum. October 1971 to September 1982, operated as a crest-stage gage at same site and datum. Auxiliary water-stage recorder 1.5 mi downstream from base gage at same datum. Prior to Nov. 9, 1967, auxiliary nonrecording gage at same site and datum.

REMARKS.--Records fair. Indian lake is regulated by two vertical lift gates in concrete and earth-fill dam 1.5 mi downstream from lake on outlet. Stage records for Indian Lake (station 04057000), collected at base gage since March 1938.

[illegible]

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04057000 INDIAN RIVER NEAR MANISTIQUE, MI--Continued

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	307	563	584	449	351	297	366	e596	442	137	365	181
2	311	555	582	445	351	297	380	e596	445	150	367	185
3	311	587	566	441	352	296	391	e614	443	156	369	176
4	308	585	556	439	349	294	399	e645	445	159	370	292
5	303	578	540	436	350	295	406	e663	443	190	368	360
6	300	573	522	430	348	296	409	e679	438	514	374	356
7	298	561	523	426	346	297	414	e694	438	591	376	352
8	293	553	511	420	343	298	422	e697	435	671	371	347
9	297	544	503	413	340	302	436	e694	448	716	369	344
10	296	542	501	407	338	301	447	e689	443	709	367	338
11	293	537	495	399	337	301	455	e675	444	694	368	336
12	288	534	489	394	335	301	464	653	441	687	368	335
13	286	551	480	396	332	301	468	631	435	675	364	337
14	279	532	471	394	330	301	469	614	438	661	361	347
15	277	526	470	390	329	301	476	602	436	646	362	361
16	275	515	487	386	327	297	510	586	436	632	358	368
17	297	511	496	385	324	301	e517	462	440	619	352	376
18	298	504	499	380	321	299	e524	399	440	614	351	379
19	299	493	509	374	316	297	e533	391	442	614	352	387
20	305	497	509	371	314	296	e542	392	443	525	347	385
21	312	536	502	373	312	296	e548	388	443	461	341	388
22	319	555	495	373	310	297	e552	335	441	400	336	390
23	315	574	498	373	308	297	e552	230	437	291	336	375
24	318	590	487	370	305	298	e557	227	430	190	331	378
25	322	598	492	371	303	303	e568	224	428	145	225	372
26	316	614	458	372	302	310	e565	223	422	132	164	369
27	320	614	469	371	301	315	e565	242	414	143	161	415
28	315	611	462	371	299	321	e583	220	327	156	170	476
29	480	609	455	371	---	332	e586	243	166	280	176	462
30	610	601	451	369	---	343	e596	242	131	366	174	458
31	589	---	452	357	---	354	---	366	---	368	173	---
TOTAL	10137	16743	15514	12246	9173	9434	14700	14912	12454	13292	9866	10625
MEAN	327	558	500	395	328	304	490	481	415	429	318	354
MAX	610	614	584	449	352	354	596	697	448	716	376	476
MIN	275	493	451	357	299	294	366	220	131	132	161	176
CFSM	1.08	1.85	1.66	1.31	1.08	1.01	1.82	1.59	1.37	1.42	1.05	1.17
IN.	1.25	2.06	1.91	1.51	1.13	1.16	1.81	1.84	1.53	1.64	1.22	1.31

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1938 - 1993, BY WATER YEAR (WY)

	MEAN	350	402	404	341	310	320	550	578	402	346	271	304
MAX	533	675	615	442	421	491	808	1435	917	830	446	476	
(WY)	1952	1971	1971	1966	1969	1966	1951	1960	1943	1943	1951	1968	
MIN	184	219	269	244	225	180	326	286	183	142	151	179	
(WY)	1949	1964	1948	1948	1948	1964	1963	1946	1963	1962	1957	1948	

## SUMMARY STATISTICS

## FOR 1993 WATER YEAR

## WATER YEARS 1938 - 1993

ANNUAL TOTAL  
ANNUAL MEAN  
HIGHEST ANNUAL MEAN  
LOWEST ANNUAL MEAN  
HIGHEST DAILY MEAN  
LOWEST DAILY MEAN  
ANNUAL SEVEN-DAY MINIMUM  
ANNUAL RUNOFF (CFSM)  
ANNUAL RUNOFF (INCHES)  
10 PERCENT EXCEEDS  
50 PERCENT EXCEEDS  
90 PERCENT EXCEEDS

149096			
408			
		382	
		546	1960
		256	1963
716	Jul 9	2030	May 12 1960
131	Jun 30	(a) 8.7	Aug 20 1966
156	Jun 29	57	Jul 13 1962
1.35		1.27	
18.37		17.20	
590		591	
380		348	
290		225	

(a) Corrected; almost no flow occasionally when ice jams form at lake outlet.

(e) Estimated.



## 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 sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	129	120	263	e155	e105	e64	e400	542	382	128	96	91
2	119	151	236	e150	e100	e66	e345	535	322	118	90	87
3	111	272	215	e145	e100	e68	315	707	272	112	89	83
4	103	281	199	e140	e98	e70	283	864	243	108	107	79
5	98	257	181	e135	e98	e72	285	897	211	108	106	76
6	93	234	e175	e130	e97	e72	309	843	187	306	116	72
7	100	210	e165	e125	e96	e72	333	729	176	268	118	69
8	103	190	e160	e120	e94	e70	359	618	179	198	103	69
9	106	182	e155	e115	e92	e68	460	517	213	186	94	74
10	109	199	e155	e112	e90	e66	495	426	253	219	97	81
11	108	e220	e155	e108	e88	e64	464	356	233	189	107	83
12	107	e240	e150	e104	e86	e63	417	299	197	171	99	81
13	99	e220	e140	e100	e83	e62	368	268	173	151	94	99
14	103	e210	e140	e98	e80	e62	330	241	194	137	88	457
15	110	e195	e160	e97	e77	e62	319	222	243	129	83	573
16	134	e185	463	e96	e74	e61	353	212	207	115	79	431
17	197	e185	525	e95	e72	e61	343	202	222	106	76	336
18	209	e180	401	e95	e72	e61	388	195	309	150	74	284
19	199	e190	e320	e95	e68	e61	476	201	272	193	76	238
20	190	e210	e270	e97	e67	e62	521	189	250	165	85	205
21	199	e330	e245	e99	e66	e63	521	182	237	137	82	185
22	195	e520	e225	e100	e64	e64	508	176	204	121	77	166
23	191	e700	e200	e100	e63	e66	460	167	177	110	84	154
24	182	e530	e190	e100	e62	e70	492	184	156	100	85	142
25	170	469	e180	e100	e60	e80	613	226	216	103	80	132
26	159	407	e175	e100	e60	e100	558	212	242	109	75	126
27	153	361	e165	e100	e61	e130	484	192	195	101	76	121
28	144	319	e165	e105	e62	e185	636	211	173	103	79	117
29	137	280	e160	e105	---	e250	681	215	153	129	80	118
30	130	282	e160	e105	---	e350	604	203	139	115	77	116
31	124	---	e155	e105	---	e440	---	375	---	103	86	---
TOTAL	4311	8329	6648	3431	2235	3105	13120	11406	6630	4488	2758	4945
MEAN	139	278	214	111	79.8	100	437	368	221	145	89.0	165
MAX	209	700	525	155	105	440	681	897	382	306	118	573
MIN	93	120	140	95	60	61	283	167	139	100	74	69
CFSM	.76	1.52	1.17	.60	.44	.55	2.39	2.01	1.21	.79	.49	.90
IN.	.88	1.69	1.35	.70	.45	.63	2.67	2.32	1.35	.91	.56	1.01

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

MEAN	180	232	175	110	98.6	178	564	293	190	122	109	135
MAX	337	532	369	182	181	378	847	524	411	254	330	354
(WY)	1983	1978	1971	1969	1984	1973	1979	1972	1979	1968	1978	1978
MIN	55.5	64.4	49.8	50.0	54.2	89.5	271	91.6	50.3	45.7	48.1	40.7
(WY)	1977	1977	1977	1977	1977	1980	1987	1987	1988	1988	1976	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1967 - 1993

ANNUAL TOTAL	65632	71406	199
ANNUAL MEAN	179	196	121
HIGHEST ANNUAL MEAN			289
LOWEST ANNUAL MEAN			121
HIGHEST DAILY MEAN	1170	897	2030
LOWEST DAILY MEAN	53	60	33
ANNUAL SEVEN-DAY MINIMUM	54	61	35
INSTANTANEOUS PEAK FLOW		905	2120
INSTANTANEOUS PEAK STAGE		7.53	11.50
INSTANTANEOUS LOW FLOW			32
ANNUAL RUNOFF (CFSM)	.98	1.07	1.09
ANNUAL RUNOFF (INCHES)	13.34	14.52	14.75
10 PERCENT EXCEEDS	355	411	410
50 PERCENT EXCEEDS	115	151	130
90 PERCENT EXCEEDS	74	72	68

(e) Estimated.

## 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 sea level (Cleveland-Cliffs Iron Co. bench mark). Prior to Sept. 1, 1960, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	24	70	e39	e24	e15	127	302	127	32	9.9	9.8
2	23	27	64	e39	e23	e15	125	251	97	30	9.4	8.9
3	20	51	59	e37	e23	e15	96	260	81	28	9.7	11
4	17	58	56	e36	e22	e16	87	290	69	25	12	10
5	16	52	54	e34	e22	e16	85	355	61	23	12	9.7
6	15	47	51	e33	e22	e16	92	321	55	24	15	9.0
7	17	42	48	e32	e21	e15	99	248	64	21	13	11
8	19	38	46	e32	e21	e15	123	197	66	19	11	14
9	17	37	44	e31	e21	e15	167	158	71	18	10	16
10	17	51	44	e31	e21	e15	197	133	63	18	11	17
11	18	67	44	e30	e20	e15	195	137	56	16	10	14
12	17	62	42	e29	e20	e15	160	114	48	16	9.3	12
13	16	e58	40	e30	e20	e15	139	98	42	15	12	19
14	19	e56	39	e30	e20	e15	131	87	37	16	11	89
15	21	e52	46	e30	e19	e15	116	77	36	15	10	84
16	25	e49	87	e29	e19	e15	101	71	32	13	14	56
17	30	46	93	e28	e18	e15	126	65	41	13	30	42
18	30	44	99	e27	e17	e14	125	72	44	13	16	34
19	27	42	74	e26	e17	e14	127	67	36	13	14	25
20	27	49	66	e25	e17	e14	128	62	50	13	14	21
21	29	126	59	e25	e16	e14	128	60	66	12	11	22
22	36	198	56	e25	e16	e14	138	55	58	11	9.9	20
23	52	233	52	e25	e16	e14	159	52	45	11	10	19
24	47	172	48	e25	e16	e15	205	96	38	10	24	19
25	41	130	e47	e26	e15	e20	309	104	75	11	15	19
26	38	107	e45	e26	e15	e30	319	83	70	12	12	13
27	36	89	e43	e26	e15	e45	250	74	58	12	12	12
28	31	e85	e42	e26	e15	e60	257	92	48	13	13	13
29	29	e80	e41	e25	---	e80	410	81	41	13	11	13
30	27	76	e40	e25	---	e111	391	77	37	12	11	14
31	26	---	e40	e24	---	e130	---	136	---	10	12	---
TOTAL	812	2248	1679	906	531	833	5112	4275	1712	508	394.2	676.4
MEAN	26.2	74.9	54.2	29.2	19.0	26.9	170	138	57.1	16.4	12.7	22.5
MAX	52	233	99	39	24	130	410	355	127	32	30	89
MIN	15	24	39	24	15	14	85	52	32	10	9.3	8.9
CFSM	.57	1.63	1.18	.64	.41	.58	3.70	3.00	1.24	.36	.28	.49
IN.	.66	1.82	1.36	.73	.43	.67	4.13	3.46	1.38	.41	.32	.55

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1959 - 1993, BY WATER YEAR (WY)

	MEAN	57.2	60.9	39.8	24.7	21.2	39.7	204	124	61.0	30.8	26.1	39.1
MAX	191	197	77.5	41.5	55.9	149	423	326	153	89.9	76.5	184	184
(WY)	1986	1989	1992	1966	1984	1973	1985	1972	1989	1968	1978	1978	1978
MIN	5.87	5.97	5.57	5.30	6.00	11.5	74.9	35.4	13.3	7.57	5.80	4.91	4.91
(WY)	1977	1977	1977	1977	1977	1964	1987	1977	1988	1988	1976	1976	1976

## SUMMARY STATISTICS

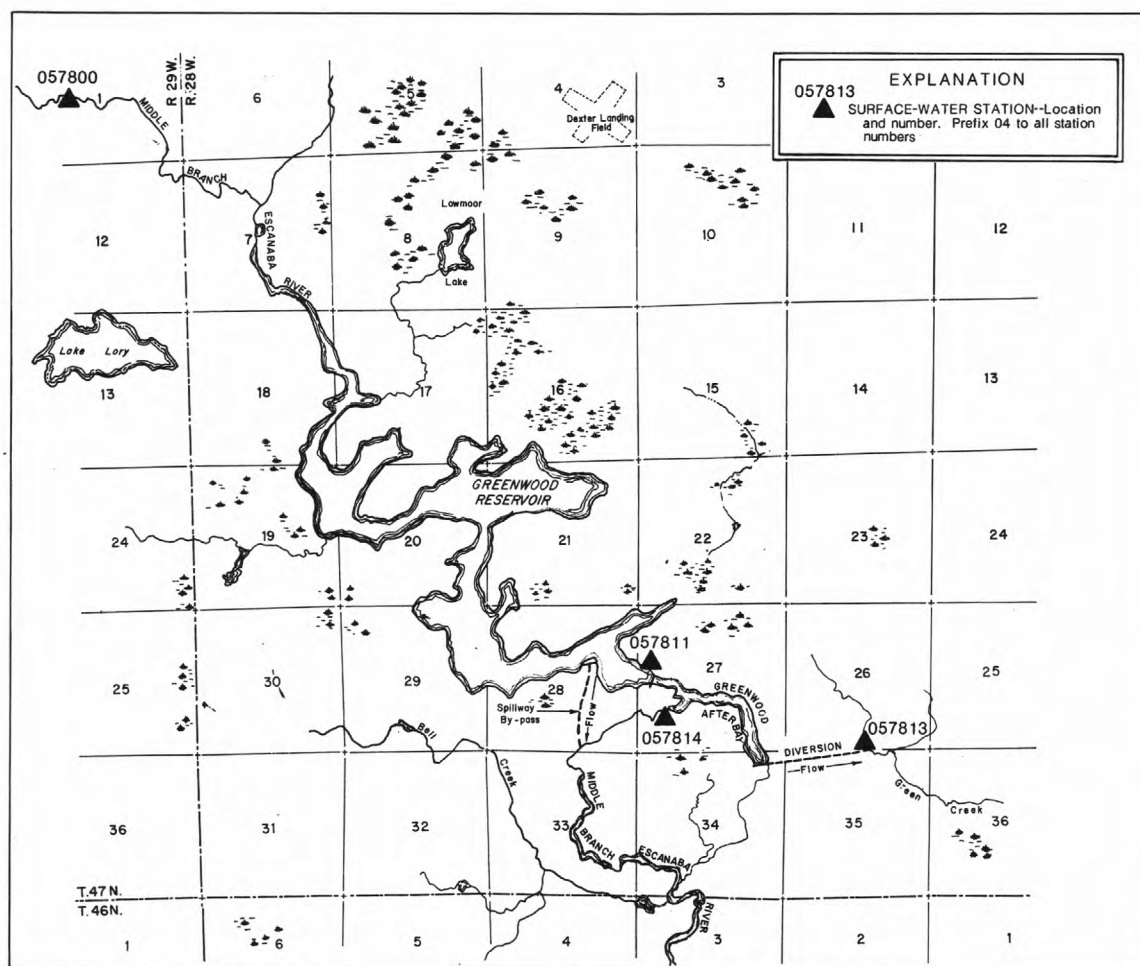
## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1959 - 1993

ANNUAL TOTAL	20917	19686.6	60.4
ANNUAL MEAN	57.2	53.9	95.3
HIGHEST ANNUAL MEAN			1960
LOWEST ANNUAL MEAN			1987
HIGHEST DAILY MEAN	847	410	1830
LOWEST DAILY MEAN	12	8.9	4.2
ANNUAL SEVEN-DAY MINIMUM	14	9.9	4.5
INSTANTANEOUS PEAK FLOW		447	1930
INSTANTANEOUS PEAK STAGE		5.23	9.21
INSTANTANEOUS LOW FLOW		8.1	4.0
ANNUAL RUNOFF (CFSM)	1.24	1.17	1.31
ANNUAL RUNOFF (INCHES)	16.92	15.92	17.85
10 PERCENT EXCEEDS	113	127	131
50 PERCENT EXCEEDS	32	30	32
90 PERCENT EXCEEDS	16	12	11

(e) Estimated.



**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 sea level (levels by Cleveland-Cliffs Iron Co.); gage readings have been converted to sea level elevations. 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, 24,460 acre-ft, May 6, elevation, 1,515.83 ft; minimum recorded, 19,600 acre-ft, Nov. 1, 2, elevation, 1,512.08 ft, but may have been less during period of no gage-height record Oct. 1-21.

## MONTHEND ELEVATION, IN FEET ABOVE SEA LEVEL, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 .....	1,512.8	20,460	--	--
Oct. 31 .....	1,512.1	19,620	-840	-13.7
Nov. 30 .....	1,515.2	23,580	+3,960	+66.5
Dec. 31 .....	1,515.1	23,440	-140	-2.3
CAL YR 1992 .....			+140	+0.2
Jan. 31 .....	1,514.9	23,170	-270	-4.4
Feb. 28 .....	1,513.9	21,870	-1,300	-23.4
Mar. 31 .....	1,513.4	21,220	-650	-10.6
Apr. 30 .....	1,515.8	24,420	+3,200	+53.8
May 31 .....	1,515.3	23,720	-700	-11.4
June 30 .....	1,515.1	23,440	-280	-4.7
July 31 .....	1,513.9	21,870	-1,570	-25.5
Aug. 31 .....	1,513.0	20,700	-1,170	-19.0
Sept. 30 .....	1,512.6	20,220	-480	-8.1
WTR YR 1993 .....			-240	-0.3



## 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 sea level (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug. 22, 1973, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	13	3.0	12	25	17	1.9	1.8	12	11	27	5.1
2	26	13	3.0	12	22	13	1.9	1.8	12	14	17	5.1
3	26	11	3.0	12	18	13	1.9	1.9	12	13	10	5.1
4	26	7.2	2.9	12	18	13	1.8	1.9	12	13	10	5.0
5	26	5.9	2.8	12	18	15	1.8	1.9	12	13	12	5.0
6	26	5.9	2.8	12	18	26	1.8	1.9	12	15	14	5.0
7	26	5.9	2.8	12	18	27	1.8	1.9	12	19	14	5.0
8	26	5.9	2.8	12	18	27	1.8	1.9	12	19	14	8.5
9	26	4.7	2.8	12	18	26	1.8	1.9	12	19	14	14
10	26	3.2	2.7	12	18	26	1.8	1.9	12	20	14	16
11	26	3.2	7.9	12	18	26	1.8	1.9	12	20	14	18
12	26	3.2	11	12	19	26	1.8	1.9	12	20	13	18
13	26	3.2	12	12	24	26	1.8	1.9	12	20	13	18
14	26	3.1	12	12	24	26	1.8	2.0	12	20	14	18
15	26	3.1	12	12	24	26	1.8	1.9	12	20	14	11
16	26	3.1	12	12	24	26	1.8	1.9	12	20	14	4.4
17	26	3.1	12	12	24	26	1.8	1.9	12	20	14	4.4
18	26	3.0	13	12	24	26	1.8	7.8	12	20	14	4.4
19	26	3.0	13	12	24	26	1.8	12	12	20	14	4.4
20	26	3.0	13	15	24	26	1.8	12	12	22	14	11
21	26	3.1	13	24	24	26	1.8	12	10	28	14	20
22	25	3.1	13	24	24	26	1.8	12	7.5	28	14	19
23	25	3.1	12	24	24	26	1.8	12	7.5	27	14	19
24	25	3.1	12	24	24	26	1.8	13	7.5	27	9.9	19
25	25	3.1	12	24	24	20	1.8	13	7.6	26	5.1	19
26	21	3.1	12	25	21	9.3	1.8	13	7.7	26	5.1	20
27	17	3.1	12	25	18	5.8	1.8	12	7.6	25	5.1	20
28	15	3.0	12	25	19	5.8	1.9	12	7.5	26	5.1	20
29	13	3.0	12	25	---	3.8	1.8	12	7.5	26	5.1	20
30	13	3.0	12	25	---	1.9	1.8	12	7.5	27	5.1	20
31	13	---	12	25	---	1.9	---	12	---	27	5.1	---
TOTAL	738	137.4	280.5	513	598	615.5	54.4	199.0	317.9	651	371.6	381.4
MEAN	23.8	4.58	9.05	16.5	21.4	19.9	1.81	6.42	10.6	21.0	12.0	12.7
MAX	26	13	13	25	25	27	1.9	13	12	28	27	20
MIN	13	3.0	2.7	12	18	1.9	1.8	1.8	7.5	11	5.1	4.4

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1973 - 1993, BY WATER YEAR (WY)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	13.3	10.9	12.6	17.1	17.2	13.1	7.06	9.61	12.8	17.0	16.4	15.3									
MAX	25.0	24.4	25.0	25.7	25.8	25.8	17.2	22.7	26.0	26.1	25.2	26.0									
(WY)	1992	1979	1979	1990	1982	1982	1980	1980	1977	1988	1991	1989									
MIN	.046	.37	.19	.19	.28	.31	.11	.22	.28	1.63	1.20	.39									
(WY)	1978	1974	1974	1974	1974	1974	1977	1973	1974	1982	1977	1977									

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1973 - 1993

	1992 CALENDAR YEAR	1993 WATER YEAR	WATER YEARS 1973 - 1993
ANNUAL TOTAL	5950.94	4857.7	
ANNUAL MEAN	16.3	13.3	13.7
HIGHEST ANNUAL MEAN			18.7
LOWEST ANNUAL MEAN			4.06
HIGHEST DAILY MEAN	29	28	30
LOWEST DAILY MEAN	.03	1.8	(d).01
ANNUAL SEVEN-DAY MINIMUM	.35	1.8	.02
10 PERCENT EXCEEDS	26	26	25
50 PERCENT EXCEEDS	21	12	14
90 PERCENT EXCEEDS	3.0	1.9	.66

(a) July 21, 22.

(b) June 25-28, 1977, Nov. 9, 1979.

(c) Apr. 4-27, Apr. 29 to May 2.

(d) Minimum daily discharge since diversion began Jan. 7, 1973; no flow, Dec. 27, 1972, to Jan. 6, 1973.

(f) Apr. 16, 17, 1987.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04057814 GREENWOOD RELEASE NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'22", long 87°47'52", in NW 1/4 SW 1/4 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 sea level (Cleveland-Cliffs Iron Co. bench mark). Prior to Nov. 7, 1973, nonrecording gage at same site and different datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	26	25	26	26	29	26	26	26	26	29	27
2	26	25	25	26	26	31	26	26	26	26	29	27
3	26	24	25	26	26	31	26	26	26	25	28	27
4	26	22	25	26	26	31	26	26	25	25	28	27
5	26	24	24	26	26	29	26	26	25	25	28	27
6	26	24	24	26	26	27	25	26	25	25	28	27
7	26	24	24	26	25	26	25	26	25	25	27	27
8	26	24	24	26	25	26	25	26	25	25	27	27
9	26	24	24	26	25	26	25	26	25	26	27	27
10	26	24	24	26	25	26	25	26	25	26	27	27
11	26	25	24	25	25	26	25	25	25	26	26	28
12	26	25	24	25	25	26	25	25	25	26	26	28
13	25	25	25	25	25	26	25	25	25	26	26	28
14	25	24	25	25	25	25	25	25	25	26	26	28
15	25	24	25	25	25	25	25	25	25	27	27	28
16	25	24	26	25	25	26	25	25	25	27	27	27
17	26	24	27	25	25	26	25	25	25	27	27	26
18	25	e24	27	25	25	26	25	25	25	27	27	25
19	25	e24	27	25	25	26	25	25	25	27	27	25
20	25	e24	27	25	25	26	25	25	25	27	27	25
21	25	24	27	25	25	26	25	26	25	26	27	25
22	25	24	27	25	25	26	25	26	25	25	27	25
23	25	24	27	25	25	26	25	26	25	25	27	25
24	25	24	27	26	25	26	25	27	26	24	27	25
25	25	e24	27	26	25	26	25	27	26	e24	27	25
26	25	e24	27	26	25	27	25	27	26	24	27	25
27	26	e24	27	26	27	27	25	26	27	26	27	25
28	26	e24	27	26	27	27	26	26	27	27	27	25
29	26	e24	27	26	---	27	26	26	27	27	27	25
30	26	24	27	26	---	27	26	26	27	28	27	25
31	26	---	26	26	---	27	---	26	---	28	27	---
TOTAL	793	724	797	793	710	832	758	799	765	804	841	788
MEAN	25.6	24.1	25.7	25.6	25.4	26.8	25.3	25.8	25.5	25.9	27.1	26.3
MAX	26	26	27	26	27	31	26	27	27	28	29	28
MIN	25	22	24	25	25	25	25	25	25	24	26	25

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1973 - 1993, BY WATER YEAR (WY)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	31.6	30.8	26.5	25.6	26.3	29.3	29.4	27.6	27.7	26.8	25.9	26.1									
MAX	141	122	35.6	32.6	35.9	56.3	44.9	40.3	42.2	42.2	29.1	30.2									
(WY)	1973	1973	1974	1974	1986	1989	1989	1976	1975	1974	1982	1984									
MIN	23.6	23.3	24.3	18.9	22.0	22.0	23.2	23.8	23.8	20.3	22.8	24.1									
(WY)	1988	1988	1988	1973	1973	1973	1987	1985	1985	1973	1973	1987									

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1973 - 1993

ANNUAL TOTAL	9475		9404																		
ANNUAL MEAN	25.9		25.8																		
HIGHEST ANNUAL MEAN																					
LOWEST ANNUAL MEAN																					
HIGHEST DAILY MEAN	30		31																		
LOWEST DAILY MEAN	22		22																		
ANNUAL SEVEN-DAY MINIMUM	24		24																		
10 PERCENT EXCEEDS	27		27																		
50 PERCENT EXCEEDS	26		26																		
90 PERCENT EXCEEDS	24		25																		

(a) Mar. 2-4.

(b) Prior to regulation; since regulation began, 63 ft<sup>3</sup>/s, July 10, 11, 1974.

(c) Release structure closed for trash rack cleaning and flume inspection.

(e) Estimated.

## 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 sea level.

REMARKS.--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 (station 04057813) 27 mi upstream 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. From 1973 to 1991 annual mean discharge and runoff figures adjusted for diversion and change in contents in Greenwood Reservoir (station 04057811). Several measurements of water temperature were made during the year.

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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	171	117	231	154	120	111	308	872	479	167	e96	117
2	158	114	318	155	120	110	305	853	473	141	e96	113
3	145	133	227	153	120	120	294	881	425	132	96	110
4	136	217	195	152	120	130	233	915	384	132	96	110
5	119	258	219	153	120	121	208	948	356	141	96	110
6	116	193	176	154	120	116	227	948	310	147	108	110
7	116	173	175	141	120	116	227	915	259	147	122	104
8	116	173	187	128	120	116	263	791	260	141	122	96
9	116	173	189	128	118	116	300	656	286	126	119	96
10	116	173	175	128	116	115	320	562	302	118	114	98
11	116	186	175	128	116	114	342	538	301	118	113	101
12	116	197	175	128	116	116	346	492	264	118	105	101
13	116	197	175	128	112	111	380	439	232	117	96	102
14	116	197	165	123	105	108	381	405	238	116	96	262
15	116	197	159	116	105	109	384	343	193	117	96	410
16	116	197	202	116	106	105	387	321	174	116	96	401
17	116	197	277	116	107	99	388	350	177	116	107	385
18	134	163	309	116	107	98	390	301	211	116	190	308
19	141	139	301	116	108	97	374	252	247	112	193	195
20	132	161	307	118	108	97	386	250	254	107	149	170
21	131	220	266	117	108	97	394	250	318	107	146	158
22	130	460	221	116	108	97	418	231	346	99	141	152
23	130	494	223	119	108	97	459	205	311	94	124	143
24	141	381	205	122	108	97	527	229	309	94	107	124
25	155	482	170	122	110	130	645	314	294	95	105	113
26	161	406	173	121	113	148	704	369	249	96	106	110
27	149	278	168	120	113	173	734	330	221	96	106	110
28	132	207	157	120	112	224	794	333	192	96	107	110
29	124	298	154	120	--	270	817	355	175	96	111	110
30	126	220	154	120	--	307	839	275	175	e96	118	110
31	126	--	154	120	--	306	--	450	--	e96	118	--
TOTAL	4033	7001	6382	3968	3164	4171	12774	15373	8415	3610	3595	4739
MEAN	130	233	206	128	113	135	426	496	280	116	116	158
MAX	171	494	318	155	120	307	839	948	479	167	193	410
MIN	116	114	154	116	105	97	208	205	174	94	96	96

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1993, BY WATER YEAR (WY)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	180	187	143	108	98.8	149	540	443	248	154	123	160																					
MAX	376	349	235	196	162	348	917	1056	518	318	216	566																					
(WY)	1973	1973	1992	1969	1969	1973	1976	1972	1968	1968	1978	1978																					
MIN	54.4	70.0	79.4	61.0	56.1	71.0	179	111	101	63.5	53.0	60.4																					
(WY)	1964	1977	1977	1964	1963	1964	1990	1977	1977	1965	1963	1963																					

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1961 - 1993
ANNUAL TOTAL	75553	77225	212
ANNUAL MEAN	206	212	296
HIGHEST ANNUAL MEAN			122
LOWEST ANNUAL MEAN			1977
HIGHEST DAILY MEAN	1780	948	2550
LOWEST DAILY MEAN	76	94	4.1
ANNUAL SEVEN-DAY MINIMUM	88	95	28
INSTANTANEOUS PEAK FLOW		980	2580
INSTANTANEOUS PEAK STAGE		4.80	8.37
INSTANTANEOUS LOW FLOW		11	(b)2.2
10 PERCENT EXCEEDS	370	387	416
50 PERCENT EXCEEDS	135	143	131
90 PERCENT EXCEEDS	103	105	70

(a) Nov. 30, Dec. 1.

(b) Recorded.

(c) Estimated.

## 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 sea level (Cleveland-Cliffs Iron Co. reference mark); gage readings have been converted to sea level elevations. 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 27 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 13.3 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, May 4, 5, elevation, 1,338.50 ft; minimum, 4,940 acre-ft, Mar. 23, elevation, 1,336.95 ft.

MONTHEND ELEVATION, IN FEET ABOVE SEA LEVEL, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

Date	Elevation (feet)	Contents (acre-feet)	Change in contents	
			(acre- feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 .....	1,337.3	5,050	--	--
Oct. 31 .....	1,338.0	5,300	+250	+4.1
Nov. 30 .....	1,338.0	5,300	0	0
Dec. 31 .....	1,337.9	5,260	-40	-0.6
CAL YR 1992 .....			+100	+0.1
Jan. 31 .....	1,337.8	5,230	-30	-0.5
Feb. 28 .....	1,338.2	5,380	+150	+2.7
Mar. 31 .....	1,338.0	5,300	-80	-1.3
Apr. 30 .....	1,338.2	5,380	+80	+1.3
May 31 .....	1,338.3	5,420	+40	+0.6
June 30 .....	1,337.7	5,190	-230	-3.9
July 31 .....	1,337.0	4,950	-240	-3.9
Aug. 31 .....	1,338.0	5,300	+350	+5.7
Sept. 30 .....	1,337.6	5,160	-140	-2.4
WTR YR 1993 .....			+110	+0.2



## 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 sea level (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug. 21, 1961, nonrecording gage at same site and datum.

REMARKS.--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 27 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.1	4.1	e5.6	4.2	4.0	3.9	13	43	53	4.5	4.1	7.7
2	4.0	4.6	4.8	4.3	4.0	4.1	10	39	30	4.5	4.2	6.6
3	4.0	7.3	4.5	4.2	4.0	4.6	5.8	66	20	4.4	4.5	6.6
4	4.1	17	4.4	4.2	4.0	4.3	4.5	99	14	4.5	4.4	6.4
5	4.0	16	4.2	4.1	4.0	4.1	4.5	110	11	4.6	4.5	6.3
6	4.0	9.2	4.2	4.0	4.0	4.1	4.5	78	7.7	4.5	4.7	6.3
7	e4.0	5.2	4.2	4.0	4.0	4.1	4.6	49	8.9	4.4	4.4	6.3
8	e4.0	4.2	4.2	e4.0	4.0	4.1	4.9	33	11	4.3	4.3	6.4
9	e4.0	4.2	4.2	e4.0	4.0	4.0	4.9	24	15	4.9	4.6	6.4
10	e4.0	4.6	4.2	e4.0	4.0	4.0	4.7	20	13	4.4	4.4	6.2
11	e4.0	4.6	4.2	4.0	4.0	4.0	5.9	18	12	4.5	4.3	6.1
12	e4.0	4.0	4.2	4.0	4.0	4.0	5.3	15	7.7	4.3	4.2	6.1
13	e4.0	4.8	4.2	4.1	4.0	e4.0	4.5	10	5.2	4.4	4.4	7.6
14	e4.0	4.0	4.3	4.0	4.0	e4.0	4.4	7.7	4.8	4.4	4.3	21
15	e4.0	3.9	4.6	4.0	4.0	e4.0	4.6	5.9	4.8	4.3	4.7	72
16	e4.0	3.7	5.0	4.0	e4.0	4.0	5.1	5.0	4.8	4.2	5.4	42
17	e4.0	3.5	4.5	4.0	e4.0	e4.0	4.6	4.9	5.1	4.2	5.5	18
18	e4.0	3.5	4.4	4.2	e4.0	e4.0	4.8	4.9	4.6	4.2	12	9.4
19	e4.0	3.5	4.3	4.0	e3.9	e4.0	5.0	4.8	4.7	4.6	11	6.6
20	e3.9	3.8	e4.3	4.0	e3.8	4.0	5.2	4.7	13	4.3	11	6.4
21	e3.9	8.9	e4.3	4.1	3.8	4.0	5.5	4.7	35	4.3	9.9	6.3
22	3.9	e7.0	e4.3	4.1	3.8	4.0	5.7	4.6	23	4.2	8.8	6.3
23	6.7	e9.0	e4.3	4.1	e3.8	4.1	11	5.0	11	4.2	9.2	6.3
24	9.8	e5.0	e4.2	4.0	e3.8	4.3	5.0	15	5.8	4.1	15	6.3
25	12	e3.3	e4.2	4.0	e3.8	4.8	110	30	7.3	4.2	12	6.2
26	13	e2.0	e4.2	4.0	e3.8	5.2	79	21	10	4.2	8.8	6.2
27	11	e1.4	e4.2	4.0	e3.9	5.3	49	17	6.2	4.2	13	6.3
28	7.0	e1.1	4.2	4.0	3.9	5.4	66	21	4.8	4.4	12	6.3
29	5.0	e8.5	4.2	e4.0	---	5.4	81	20	4.6	4.2	10	6.3
30	6.7	e6.7	4.3	e4.0	---	5.2	63	21	4.6	4.1	11	6.3
31	4.9	---	4.3	4.1	---	7.8	---	55	---	4.1	12	---
TOTAL	164.0	417.8	135.2	125.7	110.3	136.8	631.0	856.2	362.6	134.6	232.6	323.2
MEAN	5.29	13.9	4.36	4.05	3.94	4.41	21.0	27.6	12.1	4.34	7.50	10.8
MAX	13	80	5.6	4.3	4.0	7.8	110	110	53	4.9	15	72
MIN	3.9	3.5	4.2	4.0	3.8	3.9	4.4	4.6	4.6	4.1	4.1	6.1

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1993, BY WATER YEAR (WY)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	11.4	12.6	8.09	5.67	5.15	7.62	49.3	29.2	15.8	8.62	7.29	9.72																					
MAX	41.8	41.3	24.0	13.5	9.98	35.3	115	98.1	55.8	24.2	28.9	56.5																					
(WY)	1966	1989	1966	1966	1961	1966	1985	1972	1968	1979	1973	1978																					
MIN	3.48	3.59	3.59	2.15	1.92	2.40	1.45	1.69	4.11	3.96	3.46	3.62																					
(WY)	1964	1964	1990	1963	1963	1963	1963	1963	1977	1990	1963	1963																					

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1961 - 1993

ANNUAL TOTAL	2834.0	3630.0	
ANNUAL MEAN	7.20	9.95	
HIGHEST ANNUAL MEAN			14.2
LOWEST ANNUAL MEAN			26.4
HIGHEST DAILY MEAN	130	110	4.64
LOWEST DAILY MEAN	3.5	3.5	699
ANNUAL SEVEN-DAY MINIMUM	3.7	3.7	1.0
INSTANTANEOUS PEAK FLOW		118	860
INSTANTANEOUS PEAK STAGE		4.13	6.50
INSTANTANEOUS LOW FLOW			.40
10 PERCENT EXCEEDS	9.2	19	31
50 PERCENT EXCEEDS	4.2	4.5	5.6
90 PERCENT EXCEEDS	3.9	4.0	4.0

(a) Apr. 25, May 5.

(b) Nov. 17-19.

(c) Apr. 9-18, May 5, 6, 1963.

(e) Estimated.

## 04058940 ESCANABA RIVER NEAR ST. NICHOLAS. MI

**DRAINAGE AREA.**--Not determined.

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

**GAGE.**—Water-stage recorder. Datum of gage is 854.03 ft above sea level.

**EXTREMES FOR PERIOD OF RECORD.**--Maximum gage height recorded, 5.53 ft, Apr. 22, 1992, but may have been higher during period of no gage-height record, Apr. 8-14, 1988; minimum daily, 1.89 ft, Sept. 2, 1991.

**EXTREMES FOR CURRENT YEAR.**—Maximum gage height, 5.17 ft, Sept. 14-16; minimum daily, 2.12 ft, Mar. 21.

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.66	2.30	2.76	2.45	2.30	2.15	3.39	4.39	3.86	2.79	2.23	2.36
2	2.51	2.33	2.89	2.41	2.26	2.15	3.30	4.29	3.81	2.71	2.19	2.28
3	2.41	2.57	2.82	2.47	2.31	2.18	3.20	4.60	3.57	2.62	2.19	2.25
4	2.43	2.79	2.66	2.49	2.29	2.18	3.11	4.85	3.34	2.59	2.23	2.25
5	2.35	2.98	2.54	2.45	2.28	2.21	2.99	4.90	3.15	2.58	2.28	2.23
6	2.31	2.88	2.48	2.41	2.27	2.22	3.04	4.79	3.06	2.62	2.39	2.20
7	2.30	2.72	2.59	2.39	2.27	2.22	3.08	4.56	2.96	2.58	2.58	2.19
8	2.29	2.66	2.47	2.36	2.26	2.23	3.18	4.33	2.96	2.51	2.55	2.18
9	2.28	2.62	2.55	2.33	2.25	2.23	3.48	4.08	2.99	2.50	2.45	2.20
10	2.30	2.67	2.60	2.33	2.26	2.23	3.66	3.88	3.04	2.51	2.41	2.24
11	2.29	2.79	2.59	2.32	2.23	2.21	3.69	3.88	3.00	2.49	2.35	2.25
12	2.28	2.82	2.53	2.32	2.23	2.20	3.54	3.81	2.92	2.45	2.28	2.23
13	2.27	2.78	2.55	2.31	2.23	2.20	3.38	3.65	2.79	2.38	2.25	2.30
14	2.26	2.73	2.55	2.31	2.21	2.18	3.31	3.46	2.74	2.34	2.26	3.73
15	2.27	2.62	2.58	2.30	2.21	2.17	3.28	3.30	2.75	2.32	2.22	5.17
16	2.33	2.58	2.98	2.29	2.19	2.17	3.10	3.11	2.75	2.31	2.28	4.36
17	2.39	2.60	3.22	2.31	2.18	2.15	3.09	3.10	2.76	2.29	2.40	3.51
18	2.40	2.47	3.08	2.29	2.16	2.13	3.25	3.04	2.78	2.31	2.54	3.26
19	2.41	2.52	3.18	2.29	2.16	2.13	3.34	2.93	2.85	2.29	2.63	2.88
20	2.39	2.55	2.85	2.27	2.14	2.13	3.47	2.85	2.97	2.43	2.49	2.68
21	2.40	3.38	2.88	2.28	2.14	2.12	3.60	2.85	3.41	2.45	2.46	2.60
22	2.43	4.05	2.90	2.28	2.13	2.14	3.66	2.82	3.54	2.37	2.40	2.54
23	2.43	4.21	2.69	2.28	2.13	2.13	3.74	2.77	3.42	2.31	2.35	2.58
24	2.41	4.10	2.51	2.29	2.14	2.15	3.93	2.96	2.99	2.27	2.32	2.42
25	2.41	3.87	2.45	2.29	2.14	2.22	4.30	3.19	3.25	2.26	2.30	2.36
26	2.43	3.58	2.41	2.27	2.14	2.39	4.39	3.24	3.69	2.26	2.28	2.32
27	2.43	3.36	2.50	2.28	2.14	2.60	4.26	3.13	3.51	2.23	2.30	2.29
28	2.39	2.99	2.52	2.28	2.15	2.84	4.46	3.19	3.28	2.31	2.33	2.28
29	2.32	3.05	2.56	2.28	--	3.13	4.58	3.27	3.03	2.39	2.34	2.27
30	2.33	3.06	2.53	2.28	--	3.39	4.48	3.26	2.88	2.34	2.33	2.29
31	2.30	--	2.48	2.31	--	3.60	--	3.61	--	2.28	2.29	--
MEAN	2.37	2.95	2.67	2.33	2.21	2.33	3.58	3.62	3.13	2.42	2.35	2.62
MAX	2.66	4.21	3.22	2.49	2.31	3.60	4.58	4.90	3.86	2.79	2.63	5.17
MIN	2.26	2.30	2.41	2.27	2.13	2.12	2.99					

## 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-85-1: 1970 (M).

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

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	761	410	986	e580	e430	e330	1920	3290	2250	839	352	440
2	637	474	1020	e560	e430	e335	1750	3170	2120	773	328	388
3	525	738	1070	e580	e430	e360	1410	4310	1760	684	332	355
4	535	960	887	e580	e430	e360	1370	5310	1470	637	352	371
5	488	1090	e700	e570	e425	e365	1240	5410	1260	638	394	347
6	468	971	e610	e550	e420	e370	1220	4690	1130	717	509	334
7	460	875	e670	e530	e420	e380	1280	3950	1030	652	667	333
8	447	745	e580	e500	e415	e390	1470	3320	1070	580	614	319
9	456	703	e600	e475	e410	e390	1920	2710	1190	558	509	337
10	456	750	e680	e470	e400	e380	2100	2310	1260	557	470	355
11	446	863	e650	e460	e390	e375	2070	2360	1130	548	435	363
12	434	895	636	e460	e390	e370	1840	2300	1010	520	383	345
13	419	868	633	e450	e390	e360	1610	2020	847	481	360	425
14	421	803	620	e450	e380	e360	1500	1750	874	450	355	987
15	417	e750	670	e440	e370	e360	1490	1560	782	437	345	1780
16	462	e700	e1200	e430	e360	e340	1330	1320	688	413	367	1870
17	527	e620	e1550	e445	e360	e335	1260	1260	778	404	473	1700
18	527	e565	e1450	e440	e340	e330	1510	1190	963	476	580	1400
19	521	e580	e1350	e430	e335	e320	1710	1070	1010	461	653	979
20	518	629	e1170	e420	e330	e315	1840	988	1190	558	528	780
21	523	1810	e1180	e420	e330	e310	1920	982	1680	555	501	700
22	539	2870	e1150	e420	e330	e320	1950	928	1760	486	460	634
23	535	2980	e900	e425	e330	e325	2020	862	1550	416	432	579
24	532	2880	e680	e430	e330	e330	2320	1090	1150	385	396	528
25	525	2250	e600	e430	e330	e400	3160	1350	1390	374	376	468
26	535	1830	e560	e430	e330	e540	3310	1380	1920	369	370	442
27	521	1720	e590	e430	e330	e660	3020	1280	1640	356	380	413
28	498	1290	e620	e430	e330	e900	3650	1330	1410	404	405	407
29	458	1340	e640	e430	---	e1200	3950	1400	1120	462	418	412
30	440	1270	e620	e430	---	e1550	3710	1400	961	432	417	416
31	428	---	e600	e430	---	e2150	---	1980	---	394	407	---
TOTAL	15459	35029	25872	14525	10485	15780	60850	68248	38393	15996	13568	19207
MEAN	499	1168	835	469	374	509	2028	2202	1280	516	438	640
MAX	761	2980	1550	580	430	2150	3950	5410	2250	839	667	1870
MIN	417	410	560	420	330	310	1220	862	688	356	328	319
CFSM	.57	1.34	.96	.54	.43	.59	2.33	2.53	1.47	.59	.50	.74
IN.	.66	1.50	1.11	.62	.45	.67	2.60	2.92	1.64	.68	.58	.82

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1903 - 1993, BY WATER YEAR (WY)

	MEAN	725	804	559	379	348	574	2624	1712	965	617	502	640
MAX	1690	2230	945	720	959	1663	4329	4388	2172	1859	2014	1874	
(WY)	1986	1989	1907	1969	1984	1973	1951	1907	1968	1951	1911	1978	
MIN	196	218	230	190	185	227	830	481	255	222	194	194	
(WY)	1964	1977	1977	1964	1959	1964	1990	1977	1988	1988	1963	1976	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1903 - 1993
ANNUAL TOTAL	306611	333412	
ANNUAL MEAN	838	913	(b)845
HIGHEST ANNUAL MEAN			1385
LOWEST ANNUAL MEAN			506
HIGHEST DAILY MEAN	6610	5410	10400
LOWEST DAILY MEAN	278	310	(c)90
ANNUAL SEVEN-DAY MINIMUM	291	321	159
INSTANTANEOUS PEAK FLOW		5630	10700
INSTANTANEOUS PEAK STAGE		3.89	(a)
INSTANTANEOUS LOW FLOW		272	(d)6.40
ANNUAL RUNOFF (CFSM)	.96	1.05	(c)90
ANNUAL RUNOFF (INCHES)	13.11	14.26	.97
10 PERCENT EXCEEDS	1800	1890	13.19
50 PERCENT EXCEEDS	535	560	1920
90 PERCENT EXCEEDS	339	352	527
			259

(a) May 4, 5.

(b) Does not include water years 1904-12.

(c) Observed; 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.

(d) Backwater from ice.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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.--Five 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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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-TOCOCCHI, KF AGAR (COLS. PER 100 ML) (31673)
NOV 05...	1345	1080	190	8.3	1.5	2.0	13.8	101	38	29
JAN 20...	1345	422	247	8.0	0.0	2.0	13.2	91	K2	K4
APR 27...	1330	2490	116	8.0	4.0	2.1	13.7	107	K12	110
JUL 12...	1400	539	224	8.5	23.0	1.6	8.8	106	K3	K18
SEP 21...	1130	700	159	7.8	12.0	1.6	10.8	103	29	K30

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 05...	91	6	22	8.8	3.4	0.80	104	--	86	6.2
JAN 20...	100	0	25	10	12	1.4	131	--	107	12
APR 27...	55	10	13	5.5	3.7	0.90	55	--	45	6.6
JUL 12...	110	11	26	9.9	10	1.1	113	1	95	11
SEP 21...	82	8	19	8.3	2.6	0.80	90	--	74	4.6

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) (00613)	NITRO-GEN, NO2-NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)
NOV 05...	3.4	<0.10	6.8	126	0.17	367	0.020	0.120	0.020	0.40
JAN 20...	6.7	<0.10	9.9	152	0.21	173	0.010	0.280	0.060	0.20
APR 27...	3.2	<0.10	5.1	85	0.12	571	<0.010	0.150	0.030	0.40
JUL 12...	5.2	0.20	8.1	168	0.23	244	<0.010	0.130	0.040	0.60
SEP 21...	2.4	0.10	8.7	117	0.16	221	<0.010	0.078	0.030	0.70



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)
NOV 05...	0.010	<0.010	<0.010	20	13	<3	370	<4	13
JAN 20...	<0.010	<0.010	<0.010	30	16	<3	440	<4	7
APR 27...	0.020	<0.010	<0.010	50	15	<3	330	<4	9
JUL 12...	0.010	0.020	<0.010	40	9	<3	1000	<4	29
SEP 21...	0.010	<0.010	<0.010	--	--	--	--	--	--

	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)	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 05...	<10	1	<1	<1.0	34	<6	8	23	93
JAN 20...	<10	<1	<1	<1.0	46	<6	4	4.6	94
APR 27...	<10	<1	<1	<1.0	27	<6	4	27	82
JUL 12...	<10	<1	<1	<1.0	52	<6	11	16	86
SEP 21...	--	--	--	--	--	--	11	21	77

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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 sea level.

REMARKS.--Water-discharge records good except for estimated daily discharges, which are fair.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	490	193	695	e310	e155	e92	1180	1700	1060	505	113	114
2	425	302	637	e310	e155	e93	1120	1690	1020	393	100	110
3	366	566	504	e300	e150	e94	1060	2240	961	328	95	112
4	318	662	461	e290	e150	e94	943	2900	873	284	115	105
5	275	702	374	e275	e145	e97	885	3030	725	266	125	101
6	250	698	e360	e265	e140	e100	828	2810	590	376	327	95
7	263	603	e350	e250	e140	e105	754	2440	513	341	387	92
8	247	531	e350	e240	e140	e105	895	2070	509	285	378	89
9	257	e470	e350	e230	e135	e105	1230	1720	629	284	329	88
10	275	e450	e360	e225	e135	e105	1350	1420	704	272	277	88
11	277	483	e360	e215	e135	e100	1250	1330	667	227	231	89
12	274	498	e350	e205	e130	e100	1160	1240	590	203	187	94
13	258	e470	336	e200	e125	e97	1050	1130	496	180	155	135
14	246	e430	322	e190	e125	e96	917	1030	481	164	133	532
15	239	e370	368	e185	e120	e94	840	921	437	149	120	889
16	265	e330	874	e180	e120	e93	798	774	362	133	114	891
17	299	e310	1160	e180	e115	e92	718	652	440	122	118	858
18	298	305	1090	e180	e110	e92	861	584	572	167	127	861
19	287	316	e900	e175	e110	e92	1100	545	602	338	130	799
20	288	422	e700	e170	e105	e92	1210	503	846	332	136	644
21	306	1570	e620	e170	e100	e92	1210	469	1080	237	125	522
22	308	2290	e540	e170	e98	e92	1180	433	1100	175	118	435
23	302	2090	e500	e170	e96	e94	1110	399	1030	143	122	356
24	301	1960	e460	e170	e94	e100	1120	436	954	122	111	299
25	281	1860	e420	e170	e92	e130	1410	557	950	117	102	258
26	279	1630	e400	e170	e92	e190	1400	586	931	112	93	229
27	260	1230	e380	e165	e92	e290	1310	558	895	106	92	203
28	243	1040	e350	e165	e91	e400	1820	599	872	104	94	181
29	229	904	e340	e165	---	e650	1990	573	821	116	98	171
30	215	814	e320	e165	---	e900	1860	599	656	126	103	164
31	205	---	e320	e160	---	e1300	---	983	---	124	115	---
TOTAL	8836	24499	15551	6415	3395	6176	34559	36951	22366	6831	4870	9604
MEAN	285	817	502	207	121	199	1152	1192	746	220	157	320
MAX	490	2290	1160	310	155	1300	1990	3030	1100	505	387	891
MIN	205	193	320	160	91	92	718	399	362	104	92	88
CFSM	.63	1.81	1.11	.46	.27	.44	2.56	2.65	1.66	.49	.35	.71
IN.	.73	2.03	1.29	.53	.28	.51	2.86	3.05	1.85	.56	.40	.79

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1955 - 1993, BY WATER YEAR (WY)

	307	400	217	120	104	257	1323	811	416	210	167	263
MEAN	307	400	217	120	104	257	1323	811	416	210	167	263
MAX	819	1246	589	346	493	1078	2353	2483	1006	793	713	1013
(WY)	1960	1986	1966	1966	1984	1973	1979	1960	1966	1968	1978	1978
MIN	39.9	42.5	27.7	26.5	29.6	48.5	345	204	52.4	34.7	38.8	26.2
(WY)	1977	1977	1977	1977	1977	1964	1990	1986	1988	1988	1970	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1955 - 1993

ANNUAL TOTAL	157055	180053	
ANNUAL MEAN	429	493	
HIGHEST ANNUAL MEAN			383
LOWEST ANNUAL MEAN			640
HIGHEST DAILY MEAN	3230	3030	183
LOWEST DAILY MEAN	69	88	6850
ANNUAL SEVEN-DAY MINIMUM	75	91	19
INSTANTANEOUS PEAK FLOW		3060	22
INSTANTANEOUS LOW FLOW		5.76	7590
ANNUAL RUNOFF (CFSM)	.95	1.10	8.27
ANNUAL RUNOFF (INCHES)	12.98	14.88	18
10 PERCENT EXCEEDS	1050	1120	.85
50 PERCENT EXCEEDS	257	305	11.56
90 PERCENT EXCEEDS	100	100	180
			54

(a) Sept. 8, 9.

(b) Aug. 30, 1976, July 7, 8, 1988.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to July 1993 (discontinued).

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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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...	1345	684	270	8.3	0.5	1.6	14.2	99	K21	26
JAN 22...	1200	170	342	7.8	0.0	0.70	10.1	71	K2	K3
APR 29...	1230	1920	213	8.2	7.0	2.2	11.8	99	K6	K26
JUL 26...	1230	120	351	8.4	21.5	0.40	8.5	100	27	26

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 06...	140	10	34	14	1.3	0.70	162	--	133	5.0
JAN 22...	180	10	42	18	1.5	0.60	206	--	169	8.8
APR 29...	120	17	30	11	1.1	0.80	126	--	103	5.1
JUL 26...	200	21	49	19	1.5	0.80	215	2	180	5.1

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) (00613)	NITRO-GEN, NO2-NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)
NOV 06...	2.7	<0.10	6.6	183	0.25	338	0.010	0.066	0.020	<0.20
JAN 22...	2.8	<0.10	9.1	192	0.26	88.1	0.010	0.190	0.030	0.20
APR 29...	2.1	0.10	4.0	145	0.20	752	<0.010	<0.050	0.020	0.50
JUL 26...	2.3	<0.10	6.9	225	0.31	72.9	0.020	0.050	0.020	0.60

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01066)
NOV 06...	0.020	<0.010	<0.010	<10	13	<3	110	<4	5
JAN 22...	<0.010	<0.010	<0.010	<10	16	<3	110	<4	7
APR 29...	0.020	<0.010	<0.010	20	15	<3	60	<4	5
JUL 26...	0.010	<0.010	<0.010	<10	11	<3	65	<4	26

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS ND) (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)	SEDI- MENT, SUS- PENDEd (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDEd (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 06...	<10	<1	<1	<1.0	39	<6	9	17	68
JAN 22...	<10	<1	<1	<1.0	50	<6	5	2.3	88
APR 29...	<10	<1	<1	<1.0	33	<6	44	228	19
JUL 26...	<10	<1	<1	<1.0	65	<6	--	--	--



## 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.--373 mi<sup>2</sup>.

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

REVISED RECORDS.--WSP 1387: 1914-16. WDR MI-92-1: Drainage area.

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

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	259	232	e310	e290	e247	e200	559	702	665	354	255	253
2	248	271	e300	e285	e247	e208	462	646	538	375	244	241
3	245	364	e290	e280	e245	e209	411	761	464	350	246	283
4	245	372	e290	e280	e240	e215	384	998	423	326	261	265
5	238	331	e260	e286	e235	e225	377	1190	390	335	267	251
6	230	300	e250	e280	e233	e230	394	1090	367	312	296	243
7	227	273	e260	e270	e233	e230	412	858	374	288	290	235
8	227	267	e270	e260	e233	e230	457	721	417	278	272	241
9	266	273	e280	e255	e233	e225	603	636	511	289	251	252
10	324	288	e280	e250	e225	e220	743	598	499	288	249	264
11	315	306	e290	e250	e220	e215	745	632	519	279	242	253
12	287	305	e290	e245	e215	e210	661	539	456	274	229	247
13	269	310	e300	e240	e215	e212	612	473	394	263	227	320
14	253	e300	e300	e235	e215	e210	618	438	365	271	233	708
15	249	e280	e310	e235	e210	e207	624	411	348	273	229	601
16	253	e275	e310	e235	e210	e208	583	388	333	252	245	431
17	254	e300	e310	e235	e205	e208	521	369	404	241	298	356
18	254	e310	e300	e230	e205	e208	552	406	513	239	254	322
19	248	e320	e290	e230	e200	e205	668	409	453	244	249	293
20	250	e380	e280	e230	e195	e205	719	385	632	242	236	278
21	266	e860	e280	e230	e195	e204	695	367	740	231	228	277
22	302	e860	e270	e235	e195	e202	648	356	571	224	219	276
23	295	e658	e260	e235	e195	e200	615	357	453	225	215	270
24	279	537	e260	e240	e193	e225	652	479	423	222	225	274
25	264	468	e250	e240	e193	e260	769	518	549	253	224	269
26	253	425	e250	e240	e191	e330	686	446	481	276	211	259
27	251	e400	e250	e240	e191	e390	590	407	409	256	247	252
28	241	e360	e260	e240	e190	e450	708	455	384	297	268	252
29	239	e340	e270	e245	---	e500	836	447	362	318	246	257
30	234	e330	e275	e245	---	e570	790	445	370	281	248	257
31	229	---	e290	e245	---	e600	---	687	---	259	277	---
TOTAL	7994	11295	8685	7736	6004	8211	18094	17614	13807	8615	7681	8980
MEAN	258	376	280	250	214	265	603	568	460	278	248	299
MAX	324	860	310	290	247	600	836	1190	740	375	298	708
MIN	227	232	250	230	190	200	377	356	333	222	211	235
CFSM	.66	.97	.72	.64	.55	.68	1.55	1.46	1.18	.71	.64	.77
IN.	.76	1.08	.83	.74	.57	.79	1.73	1.68	1.32	.82	.73	.86

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1914 - 1993, BY WATER YEAR (WY)

	MEAN	327	339	279	253	246	323	652	504	401	336	291	316
MAX	612	600	424	369	406	833	1235	1104	712	983	604	582	
(WY)	1986	1916	1986	1986	1984	1973	1967	1965	1981	1953	1972	1959	
MIN	179	202	175	176	174	178	235	251	194	185	186	182	
(WY)	1949	1990	1990	1959	1959	1965	1990	1988	1988	1989	1948	1948	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1914 - 1993

ANNUAL TOTAL	115682						124716						
ANNUAL MEAN	316						342						
HIGHEST ANNUAL MEAN										354			
LOWEST ANNUAL MEAN										512		1973	
HIGHEST DAILY MEAN	1380						1190	May 5	4420		Jul 2	1953	
LOWEST DAILY MEAN	188						190	Feb 28	130		Dec 2	1963	
ANNUAL SEVEN-DAY MINIMUM	198						193	Feb 22	151		Mar 26	1965	
INSTANTANEOUS PEAK FLOW							(a)1200	May 5	4700		Jul 2	1953	
INSTANTANEOUS PEAK STAGE							(b)6.60	Dec 2	(b)8.60		Dec 20	1983	
INSTANTANEOUS LOW FLOW									(c)118		Dec 2	1963	
ANNUAL RUNOFF (CFSM)	.81						.88		.91				
ANNUAL RUNOFF (INCHES)	11.06						11.93		12.36				
10 PERCENT EXCEEDS	461						602		560				
50 PERCENT EXCEEDS	262						275		291				
90 PERCENT EXCEEDS	221						217		205				

- (a) Gage height, 3.52 ft.  
(b) Backwater from ice.  
(c) Discharge measurement.  
(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04061500 PAINT RIVER AT CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'21", long 86°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 sea level (Wisconsin Electric Power Co. bench mark).

REMARKS.--Records good except for period of lagging intakes, Mar. 30 to July 15, 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	504	391	571	e390	e336	e290	1060	1750	1340	670	317	340
2	473	409	601	e390	e340	e295	1030	1570	1210	618	273	310
3	444	513	537	e390	e340	e300	950	1760	1040	602	295	319
4	396	626	518	e390	e340	e306	879	2270	902	539	301	326
5	382	641	443	e380	e340	e310	840	2660	814	521	334	312
6	354	601	431	e370	e340	302	868	2490	726	521	379	305
7	347	518	499	e360	e330	305	933	2100	681	496	361	290
8	340	522	480	e350	e330	e312	1050	1680	758	462	339	284
9	362	484	442	e340	e325	e318	1460	1340	893	446	328	300
10	393	497	471	e335	e320	314	2090	1200	947	447	306	331
11	418	571	478	e330	e320	e320	2260	1120	932	425	302	319
12	431	601	447	e330	e320	e315	2070	985	864	417	272	300
13	396	585	454	e330	e315	293	1880	886	794	399	278	370
14	397	538	446	e335	e315	302	1730	801	677	393	272	529
15	394	489	458	e340	e310	302	1490	719	627	386	268	585
16	399	442	538	e340	e300	301	1320	616	603	377	266	567
17	405	503	600	e335	e295	298	1180	575	679	362	273	488
18	420	460	549	e335	e290	298	1150	528	846	345	264	437
19	427	515	537	e330	e280	298	1290	510	874	341	275	393
20	424	516	492	e330	e280	298	1530	501	1250	333	259	380
21	437	972	430	e330	e285	296	1420	475	1830	300	258	355
22	444	1620	481	e325	e290	290	1310	471	1540	331	254	346
23	502	1640	474	e325	e295	290	1250	457	1190	303	245	336
24	552	1480	409	e330	e300	283	1300	635	992	242	261	325
25	534	1280	381	e330	e295	316	1470	881	1140	268	256	289
26	589	1110	e385	e335	e290	390	1440	855	1240	322	257	312
27	488	984	e390	e335	e287	485	1320	805	1140	313	291	275
28	465	861	e400	e335	e287	608	1510	892	981	339	326	300
29	444	732	e410	e335	---	714	1840	944	863	353	332	278
30	421	771	e400	e335	---	841	1850	892	781	346	318	288
31	404	---	e400	e385	---	1040	---	1170	---	313	325	---
TOTAL	13386	21872	14552	10680	8695	11630	41770	34538	29154	12530	9085	10589
MEAN	432	729	469	345	311	375	1392	1114	972	404	293	353
MAX	589	1640	601	390	340	1040	2260	2660	1830	670	379	585
MIN	340	391	381	325	280	283	840	457	603	242	245	275
CFSM	.72	1.22	.79	.58	.52	.63	2.33	1.87	1.63	.68	.49	.59
IN.	.83	1.36	.91	.67	.54	.72	2.60	2.15	1.82	.78	.57	.66

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1993, BY WATER YEAR (WY)

	MEAN	516	539	385	318	303	464	1570	1024	688	473	368	446
MAX	1516	1201	603	487	616	1818	2732	2549	1414	1657	811	1211	
(WY)	1986	1986	1984	1983	1984	1973	1967	1965	1983	1953	1972	1959	
MIN	172	230	222	208	202	210	521	371	220	185	181	163	
(WY)	1949	1977	1977	1964	1964	1964	1990	1988	1988	1988	1976	1948	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1944 - 1993

ANNUAL TOTAL	210449	218481	591
ANNUAL MEAN	576	599	882
HIGHEST ANNUAL MEAN			1973
LOWEST ANNUAL MEAN			344
HIGHEST DAILY MEAN	4240	2660	10500
LOWEST DAILY MEAN	219	242	81
ANNUAL SEVEN-DAY MINIMUM	231	256	145
INSTANTANEOUS PEAK FLOW		2730	10900
INSTANTANEOUS PEAK STAGE		4.89	9.82
INSTANTANEOUS LOW FLOW		91	7.7
ANNUAL RUNOFF (CFSM)	.96	1.00	.99
ANNUAL RUNOFF (INCHES)	13.11	13.61	13.46
10 PERCENT EXCEEDS	1100	1250	1130
50 PERCENT EXCEEDS	422	410	389
90 PERCENT EXCEEDS	275	291	236

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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.

REVISED RECORDS.--WDR MI-91-1: 1990(M).

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 1,130 ft above sea level, from topographic map.

REMARKS.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	413	322	396	411	320	306	735	1610	1530	328	397	322
2	330	325	381	348	334	303	468	1220	1390	464	339	312
3	294	482	438	303	382	329	583	1460	1220	485	346	359
4	322	455	402	351	348	319	462	1740	736	370	342	379
5	339	e550	262	438	324	324	462	2120	414	444	347	363
6	372	e550	251	364	326	359	461	1940	416	414	477	282
7	370	e410	331	331	327	353	589	1660	533	393	399	337
8	276	e500	421	338	340	320	506	1440	491	390	308	369
9	366	e520	314	339	344	313	665	1290	711	389	313	327
10	453	e600	396	284	344	300	1000	1280	571	390	400	322
11	444	e940	481	384	347	336	877	1420	602	393	393	343
12	384	e760	332	282	318	338	1140	1120	563	393	276	342
13	353	e440	390	316	315	266	1370	472	509	360	356	455
14	341	e350	452	366	317	279	1150	468	390	349	349	1010
15	337	e320	443	396	354	316	649	587	445	329	272	696
16	379	e400	473	273	330	312	698	492	415	368	325	531
17	313	e430	523	374	312	319	567	436	546	346	489	424
18	315	e510	431	313	319	285	752	443	568	311	285	384
19	318	e370	424	360	317	289	703	613	608	340	330	446
20	384	e470	327	327	318	313	978	456	848	347	331	318
21	395	e960	286	327	251	309	732	489	807	289	292	345
22	363	e960	405	345	248	301	821	450	949	332	299	390
23	412	e880	444	390	286	271	754	423	1190	338	351	415
24	382	1280	314	350	347	321	710	736	1040	319	339	334
25	356	965	255	317	303	396	949	571	819	329	337	353
26	386	570	293	337	280	388	870	567	1140	384	296	336
27	300	461	322	380	259	498	605	477	791	383	348	377
28	402	422	384	345	318	634	871	604	432	424	342	318
29	263	417	377	336	---	687	967	507	562	505	320	365
30	385	502	372	314	---	617	1350	570	444	359	385	302
31	361	---	418	369	---	787	---	1180	---	278	376	---
TOTAL	11108	17121	11738	10708	8928	11468	23444	28841	21680	11543	10759	11856
MEAN	358	571	379	345	319	370	781	930	723	372	347	395
MAX	453	1280	523	438	382	787	1370	2120	1530	505	489	1010
MIN	263	320	251	273	248	265	461	423	390	278	272	282

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 1993, BY WATER YEAR (WY)

	1990	1991	1992	1993
MEAN	424	398	337	306
MAX	712	571	416	345
(WY)	1991	1993	1992	1993
MIN	276	307	270	259
(WY)	1990	1990	1990	1991

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1990 - 1993

ANNUAL TOTAL	167081	179194	430
ANNUAL MEAN	457	491	491
HIGHEST ANNUAL MEAN			1993
LOWEST ANNUAL MEAN			1990
HIGHEST DAILY MEAN	2870	2120	3060
LOWEST DAILY MEAN	239	248	190
ANNUAL SEVEN-DAY MINIMUM	287	262	202
INSTANTANEOUS PEAK FLOW		2380	3430
INSTANTANEOUS PEAK STAGE		9.07	10.22
10 PERCENT EXCEEDS	601	873	657
50 PERCENT EXCEEDS	373	384	342
90 PERCENT EXCEEDS	294	303	257

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04062085 PESHEKEE RIVER NEAR MARTINS LANDING, MI  
(National water quality assessment program station)

LOCATION.--Lat 46°36'35", long 88°01'20", in SW 1/4 SE 1/4 sec. 26, T.49 N., R.30 W., Marquette County, Hydrologic Unit 04030107, at bridge on Huron Bay Peshekee Grade Road, 0.8 mi upstream from Van Riper Lakes outlet, 5.4 mi northwest of Martins Landing, and 6.4 mi northeast of Michigamme.

DRAINAGE AREA.--43.9 mi<sup>2</sup>.

PERIOD OF RECORD.--April to September 1993.

REMARKS.--Cross-sectional samples were collected at or near bridge. Concentration data for organic compounds are not rounded.

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	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)
APR 13...	1230	193	23	6.7	1.0	13.0	96	11	3.2
28...	1445	465	16	6.6	3.5	12.0	96	9	2.6
MAY 04...	1330	643	18	6.5	10.0	11.5	108	8	2.3
18...	1245	59	29	7.2	10.0	10.5	99	15	4.4
JUN 23...	1200	49	33	7.3	17.0	8.6	94	18	5.3
JUL 28...	1230	7.9	63	7.7	22.0	7.7	96	29	8.6
AUG 18...	1030	20	69	7.8	20.5	6.6	74	33	9.6
SEP 01...	1200	13	64	7.7	15.0	9.0	95	32	9.3
14...	1415	42	41	7.4	13.0	9.5	97	21	6.1
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)	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)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SiO2) (00955)
APR 13...	0.76	0.50	0.40	5	4	3.7	1.0	<0.10	5.5
28...	0.60	0.50	0.40	5	4	3.4	0.50	0.10	4.4
MAY 04...	0.55	0.60	0.30	5	4	2.9	0.40	<0.10	3.6
18...	1.0	0.60	0.40	12	10	2.3	0.70	0.10	3.4
JUN 23...	1.2	0.60	0.20	15	12	1.4	0.80	<0.10	3.0
JUL 28...	1.9	0.90	0.50	31	25	3.0	0.40	<0.10	5.6
AUG 18...	2.1	1.0	0.30	40	33	2.0	0.40	<0.10	5.8
SEP 01...	2.1	0.90	0.40	33	27	2.4	0.70	<0.10	6.0
14...	1.4	0.70	0.30	19	15	2.4	0.60	0.10	5.9
DATE	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)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	
APR 13...	42	<0.010	0.140	0.040	0.30	0.30	0.010	0.020	
28...	37	<0.010	0.110	0.040	0.50	<0.20	0.040	<0.010	
MAY 04...	27	<0.010	0.084	0.030	0.20	0.20	0.010	0.020	
18...	38	<0.010	<0.050	0.040	0.40	0.40	<0.010	0.020	
JUN 23...	47	<0.010	<0.050	0.050	0.40	0.40	0.030	<0.010	
JUL 28...	47	<0.010	<0.050	0.030	0.30	0.30	<0.010	0.030	
AUG 18...	57	<0.010	<0.050	0.040	0.40	0.30	<0.010	<0.010	
SEP 01...	57	<0.010	<0.050	0.020	0.30	0.30	0.020	0.010	
14...	56	<0.010	<0.050	0.050	0.50	0.50	<0.010	0.010	

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04062085 PESHEKEE RIVER NEAR MARTINS LANDING, MI--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	CARBON, ORGANIC DIS- SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS- PENDE TOTAL (MG/L AS C) (00689)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)			
APR 13...	<0.010	220	17	12	0.3	78	100			
28...	<0.010	150	19	8.8	0.2	7	44			
MAY 04...	<0.010	150	9	9.1	0.3	2	77			
18...	<0.010	310	18	11	0.2	2	84			
JUN 23...	0.020	330	14	15	0.5	4	88			
JUL 28...	<0.010	420	17	7.4	0.2	4	76			
AUG 18...	<0.010	330	11	9.5	0.2	3	92			
SEP 01...	<0.010	430	13	8.4	0.1	1	100			
14...	<0.010	350	11	16	0.2	3	91			
DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	PROP- CHLOR, WATER, DISS, REC (UG/L) (04024)	BUTYL- ATE, WATER, DISS, REC (UG/L) (04028)	SI- MAZINE, WATER, DISS, REC (UG/L) (04035)	PRO- METON, WATER, DISS, REC (UG/L) (04037)	DEETHYL ATRA- ZINE, WATER, DISS, REC (UG/L) (04040)	CYANA- ZINE, WATER, DISS, REC (UG/L) (04041)	FONOFOS WATER DISS REC (UG/L) (04095)	ALPHA BHC DIS- SOLVED (UG/L) (34253)
AUG 18...	1030	20	<0.01500	<0.00800	<0.01000	<0.00800	<0.02000	<0.01300	<0.00800	<0.00700
DATE	P.P' DDE DISSOLV (UG/L) (34653)	CHLOR- PYRIFOS DIS- SOLVED (UG/L) (38933)	LINDANE DIS- SOLVED (UG/L) (39341)	DI- ELDRIN DIS- SOLVED (UG/L) (39381)	METO- LACHLOR WATER DISSOLV (UG/L) (39415)	MALA- THION, DIS- SOLVED (UG/L) (39532)	PARA- THION, DIS- SOLVED (UG/L) (39542)	DI- AZINON, DIS- SOLVED (UG/L) (39572)	ATRA- ZINE, WATER, DISS, REC (UG/L) (39632)	ALA- CHLOR, WATER, DISS, REC, (UG/L) (46342)
AUG 18...	<0.01000	<0.00500	<0.01100	<0.02000	<0.00900	<0.01000	<0.02200	<0.00800	0.005000	<0.00900
DATE	METRI- BUZIN SENCOR WATER DISSOLV (UG/L) (82630)	2,6-DI- ETHYL ANALINE WAT FLT 0.7 U GF, REC (UG/L) (82660)	TRI- FLUR- ALIN WAT FLT 0.7 U GF, REC (UG/L) (82661)	DIMETH- OATE WATER FLTRD 0.7 U GG, REC (UG/L) (82662)	ETHAL- FLUR- ALIN WAT FLT 0.7 U GF, REC (UG/L) (82663)	PHORATE WATER FLTRD 0.7 U GF, REC (UG/L) (82664)	TER- BACIL WATER FLTRD 0.7 U GF, REC (UG/L) (82665)	LIN- URON WATER FLTRD 0.7 U GF, REC (UG/L) (82666)	METHYL PARA- THION WAT FLT 0.7 U GF, REC (UG/L) (82667)	EPTC WATER FLTRD 0.7 U GF, REC (UG/L) (82668)
AUG 18...	<0.01200	<0.00600	<0.01200	<0.02400	<0.01300	<0.02000	<0.03000	<0.03900	<0.03500	<0.00500
DATE	PEB- ULATE WATER FLTRD 0.7 U GF, REC (UG/L) (82669)	TEBU- THIURON WATER FLTRD 0.7 U GF, REC (UG/L) (82670)	MOL- INATE WATER FLTRD 0.7 U GF, REC (UG/L) (82671)	ETHO- PROP WATER FLTRD 0.7 U GF, REC (UG/L) (82672)	BEN- FLUR- ALIN WAT FLT 0.7 U GF, REC (UG/L) (82673)	CARBO- FURAN WATER FLTRD 0.7 U GF, REC (UG/L) (82674)	TER- BUFOS WATER FLTRD 0.7 U GF, REC (UG/L) (82675)	PRON- AMIDE WATER FLTRD 0.7 U GF, REC (UG/L) (82676)	DISUL- FOTON WATER FLTRD 0.7 U GF, REC (UG/L) (82677)	TRIAL- LATE WATER FLTRD 0.7 U GF, REC (UG/L) (82678)
AUG 18...	<0.00900	<0.01500	<0.00700	<0.01200	<0.01300	<0.01300	<0.01200	<0.00900	<0.02000	<0.00800
DATE	PRO- PANIL WATER FLTRD 0.7 U GF, REC (UG/L) (82679)	CAR- BARYL WATER FLTRD 0.7 U GF, REC (UG/L) (82680)	THIO- BENCARB WATER FLTRD 0.7 U GF, REC (UG/L) (82681)	DCPA WATER FLTRD 0.7 U GF, REC (UG/L) (82682)	PENDI- METH- ALIN WAT FLT 0.7 U GF, REC (UG/L) (82683)	NAPROP- AMIDE WATER FLTRD 0.7 U GF, REC (UG/L) (82684)	PRO- PARGITE WATER FLTRD 0.7 U GF, REC (UG/L) (82685)	METHYL AZIN- PHOS WAT FLT 0.7 U GF, REC (UG/L) (82686)	PER- METHRIN CIS WAT FLT 0.7 U GF, REC (UG/L) (82687)	
AUG 18...	<0.01600	<0.04600	<0.00800	<0.00400	<0.01800	<0.01000	<0.01000	<0.03800	<0.01600	

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04062100 PESHEKEE RIVER NEAR MICHIGAMME, MI

LOCATION.--Lat 46°34'55", long 87°59'51", in SW1/4 SE1/4 sec.1, T.48 N., R.30 W., Marquette County, Hydrologic Unit 04030107, on right bank 10 ft downstream from bridge on county highway, 0.2 mi downstream from Dishno Creek, 5 mi north of Champion, and 6 mi northeast of Michigamme.

DRAINAGE AREA.--66.5 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1961 to September 1968, May to September 1993.

GAGE.--Water-stage recorder. Datum of gage is 1,598.01 ft above sea level. Prior to Aug. 11, 1961, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	e660	236	54	12	13
2	---	---	---	---	---	---	---	e520	195	49	12	16
3	---	---	---	---	---	---	---	e630	150	43	10	19
4	---	---	---	---	---	---	---	e800	121	39	10	20
5	---	---	---	---	---	---	---	e940	102	40	9.8	18
6	---	---	---	---	---	---	---	e740	89	36	11	16
7	---	---	---	---	---	---	---	e500	101	31	12	14
8	---	---	---	---	---	---	---	e400	110	28	12	18
9	---	---	---	---	---	---	---	e320	112	27	12	28
10	---	---	---	---	---	---	---	e250	113	24	14	39
11	---	---	---	---	---	---	---	e190	106	22	13	38
12	---	---	---	---	---	---	---	e150	89	21	11	33
13	---	---	---	---	---	---	---	e130	73	19	10	32
14	---	---	---	---	---	---	---	e117	69	19	9.5	54
15	---	---	---	---	---	---	---	e105	66	16	8.8	76
16	---	---	---	---	---	---	---	e95	60	15	9.2	e62
17	---	---	---	---	---	---	---	e85	63	14	13	e48
18	---	---	---	---	---	---	---	e83	63	13	21	e38
19	---	---	---	---	---	---	---	e82	57	13	17	e29
20	---	---	---	---	---	---	---	e77	79	13	14	e24
21	---	---	---	---	---	---	---	e70	103	11	12	e25
22	---	---	---	---	---	---	---	e64	91	11	11	e23
23	---	---	---	---	---	---	---	e60	72	10	11	e22
24	---	---	---	---	---	---	---	e100	64	9.5	13	e22
25	---	---	---	---	---	---	---	e185	160	9.7	11	e22
26	---	---	---	---	---	---	---	e140	150	10	10	e15
27	---	---	---	---	---	---	---	e132	122	10	10	14
28	---	---	---	---	---	---	---	201	98	11	11	14
29	---	---	---	---	---	---	---	222	77	12	10	15
30	---	---	---	---	---	---	---	192	64	12	10	17
31	---	---	---	---	---	---	---	235	---	12	11	---
TOTAL	---	---	---	---	---	---	---	8475	3055	654.2	361.3	824
MEAN	---	---	---	---	---	---	---	273	102	21.1	11.7	27.5
MAX	---	---	---	---	---	---	---	940	236	54	21	76
MIN	---	---	---	---	---	---	---	60	57	9.5	8.8	13
CFSM	---	---	---	---	---	---	---	4.11	1.53	.32	.18	.41
IN.	---	---	---	---	---	---	---	4.74	1.71	.37	.20	.46

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1993, BY WATER YEAR (WY)

MEAN	88.4	95.8	65.6	35.6	28.0	66.8	430	282	122	47.3	27.5	60.9
MAX	173	160	92.8	56.5	44.6	212	622	695	233	184	68.7	266
(WY)	1968	1968	1963	1966	1966	1968	1967	1965	1967	1968	1964	1968
MIN	9.01	68.5	45.6	20.3	17.5	26.2	261	120	54.8	7.82	7.47	8.87
(WY)	1964	1962	1965	1962	1962	1962	1965	1968	1965	1966	1961	1967

## SUMMARY STATISTICS

## FOR 1993 WATER YEAR

## WATER YEARS 1961 - 1993

ANNUAL MEAN			115	
HIGHEST ANNUAL MEAN			145	1968
LOWEST ANNUAL MEAN			83.3	1962
HIGHEST DAILY MEAN	940	(a) May 5	2710	May 8 1965
LOWEST DAILY MEAN	8.8	(a) Aug 15	3.9	Sep 9 1961
ANNUAL SEVEN-DAY MINIMUM			4.3	Sep 4 1961
INSTANTANEOUS PEAK FLOW			3060	May 8 1965
INSTANTANEOUS PEAK STAGE			11.46	May 8 1965
INSTANTANEOUS LOW FLOW	8.4	(a) Aug 17	3.6	Sep 1 1961
ANNUAL RUNOFF (CFSM)			1.73	
ANNUAL RUNOFF (INCHES)			23.45	
10 PERCENT EXCEEDS			250	
50 PERCENT EXCEEDS			48	
90 PERCENT EXCEEDS			11	

(a) During period May to September.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1180	261	1150	1240	1110	593	203	250	1670	1110	234	219
2	1040	271	922	1240	1100	589	214	253	1640	1110	233	227
3	842	274	861	1240	1100	490	220	694	1640	1110	243	225
4	838	273	866	1220	1090	552	228	1130	1530	1100	401	223
5	836	275	862	1220	1100	634	235	1140	1230	995	742	221
6	834	272	861	1150	1150	532	238	1260	1020	863	487	222
7	475	270	861	1150	1140	449	225	1600	858	859	227	383
8	263	271	978	1140	1130	457	237	1610	873	857	225	766
9	268	272	953	1110	1130	441	245	1480	882	797	225	771
10	268	282	1190	1140	1120	442	231	1190	877	846	225	613
11	268	282	1180	1130	1110	444	233	1210	867	830	222	226
12	270	284	1180	1130	1110	437	230	1200	862	829	223	222
13	269	277	1180	1160	1140	431	230	1180	858	826	224	498
14	272	250	1180	1200	1140	429	230	1060	855	825	224	324
15	277	246	1180	1180	1140	425	232	902	810	821	225	270
16	282	247	614	1180	1130	622	233	896	778	821	450	257
17	276	246	239	1170	1120	847	232	892	856	782	771	249
18	275	245	236	1170	1110	797	239	895	973	818	675	245
19	275	245	236	1170	1100	730	244	891	867	823	238	238
20	279	438	232	1160	1090	568	245	890	1080	825	228	610
21	279	1030	817	1160	1070	611	242	888	1190	822	225	778
22	271	1430	1150	1160	1090	532	238	584	1170	821	223	576
23	256	1640	1160	1150	1100	416	218	292	1150	564	225	778
24	255	1370	1170	1150	1080	425	234	328	1140	222	463	775
25	257	1170	1170	1140	934	470	246	720	1140	229	767	774
26	257	923	1160	1140	1070	670	239	940	1130	286	319	773
27	258	1230	1160	1130	1060	659	241	934	1120	283	233	770
28	260	1340	1160	1130	906	737	258	709	1120	243	226	614
29	258	1280	1160	1120	---	799	258	317	1110	238	224	231
30	260	1150	1160	1120	---	877	254	765	1110	234	231	271
31	260	---	1190	1110	---	596	---	1380	---	235	226	---
TOTAL	12458	18044	29418	36010	30670	17701	7052	28480	32406	22024	10084	13249
MEAN	402	601	949	1162	1095	571	235	919	1080	710	325	442
MAX	1180	1640	1190	1240	1150	877	258	1610	1670	1110	771	778
MIN	255	245	232	1110	906	416	203	250	778	222	222	219

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1993, BY WATER YEAR (WY)

	MEAN	518	578	805	874	812	538	663	1079	818	673	598	517
MAX	1220	1432	1427	1274	1252	819	1662	2865	1650	1461	1035	1325	1325
(WY)	1952	1989	1989	1983	1983	1971	1973	1960	1983	1953	1987	1968	1968
MIN	151	88.3	238	390	350	160	142	130	257	261	292	157	157
(WY)	1970	1949	1949	1977	1948	1977	1987	1987	1987	1959	1977	1975	1975

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1944 - 1993

ANNUAL TOTAL	248442											
ANNUAL MEAN	679											
HIGHEST ANNUAL MEAN												1960
LOWEST ANNUAL MEAN												1977
HIGHEST DAILY MEAN	2340											Apr 27 1960
LOWEST DAILY MEAN	168											Nov 26 1950
ANNUAL SEVEN-DAY MINIMUM	181											Mar 21 1968
INSTANTANEOUS PEAK FLOW												Apr 28 1960
INSTANTANEOUS PEAK STAGE												Apr 28 1960
10 PERCENT EXCEEDS	1140											
50 PERCENT EXCEEDS	817											
90 PERCENT EXCEEDS	235											

(a) Nov. 22, 23, June 1.





## STREAMS TRIBUTARY TO LAKE MICHIGAN

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

LOCATION.--Lat 45°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 150 ft downstream from Wisconsin Electric Power Company powerhouse at Twin Falls Dam, 3.6 mi north of Iron Mountain, and at mile 106.6. Prior to July 15, 1993, at site 150 ft upstream in powerhouse.

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

PERIOD OF RECORD.--January 1914 to current year. Published as "near Florence, WI" October 1957 to September 1989.

REVISED RECORDS.--WDR MI-91-1: 1990(M). WDR MI-92-1: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 1,062 ft above sea level (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. October 1957 to September 1989, water-stage recorder at site 10.4 mi upstream at different datum.

REMARKS.--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; ratings 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2330	845	2480	2000	1980	1840	1730	4000	4230	2000	691	998
2	2010	1100	1950	1960	1970	1400	1940	3630	3910	1770	1050	1040
3	1600	1360	2210	2020	1510	1480	1850	3850	3760	1690	1110	981
4	1060	1370	1900	1940	1730	1890	1610	3950	3350	1620	1140	989
5	1300	1650	1850	1900	1800	1900	1590	4640	2550	1750	1190	996
6	1260	1760	1660	1920	1960	1900	1580	5190	2430	1890	1410	1070
7	1330	1580	1690	1920	2020	1900	1710	4940	2120	1770	1000	1060
8	1310	1180	2060	1940	1950	1930	1760	4590	1920	1610	935	984
9	1170	1410	2220	1830	2030	2010	1400	3840	2320	1840	1080	1100
10	678	1320	2390	1950	1750	1910	1260	3200	2710	1880	1170	1120
11	1000	1340	2220	1970	1690	1930	1840	3630	2670	1760	1110	1090
12	1130	1360	1850	1910	1760	1990	2530	3400	2440	1820	1110	1030
13	1430	1370	1720	1930	2040	1680	3620	2840	2380	1810	1060	1300
14	1310	1480	1880	1860	2000	1610	3370	2590	2370	1740	840	2340
15	1240	1550	2100	1900	2000	1800	3010	1870	2220	1690	806	2390
16	1470	1580	2130	1850	2010	1570	2690	1910	2150	1620	804	2250
17	1110	1140	2070	1860	2010	1460	2830	2050	2260	1620	1230	1450
18	866	1140	2140	1890	2020	1510	2600	1690	2630	1550	1200	1550
19	837	1040	2170	1960	2020	1350	2470	1700	2500	1510	824	1700
20	903	1300	2150	1920	2000	1290	2550	1770	3090	1620	1160	1320
21	980	2430	2240	1910	2050	1230	2820	1580	3560	1370	876	1340
22	1340	3580	2170	1900	1980	1020	3040	1600	3600	1350	884	1350
23	830	4160	1670	2000	2110	982	2830	1590	3700	1280	856	1310
24	976	4110	1790	1940	1970	1020	2220	1830	3680	714	843	1310
25	1280	3300	1930	1990	1910	1100	2100	2240	3330	812	912	843
26	1510	2930	1810	2000	1910	971	2400	2310	3770	846	884	854
27	1250	2920	1900	2060	1910	991	2220	2310	3130	774	988	1120
28	1240	2550	2070	2030	1910	765	2400	2320	2840	730	975	1340
29	1290	2560	2030	2050	--	947	3040	2200	2690	1050	975	1170
30	1220	2550	1960	2040	--	1120	3420	2050	2490	1070	993	1180
31	939	--	1950	2010	--	962	--	3140	--	983	964	--
TOTAL	38199	57965	62360	60360	54000	45468	70430	88450	86800	45539	31070	38575
MEAN	1232	1932	2012	1947	1929	1467	2348	2853	2893	1469	1002	1286
MAX	2330	4160	2480	2060	2110	2010	3620	5190	4230	2000	1410	2390
MIN	678	845	1660	1830	1510	765	1260	1580	1920	714	691	843

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1914 - 1993, BY WATER YEAR (WY)

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933
MEAN	1487	1628	1465	1398	1365	1596	3228	3065	2165	1601	1304	1416								
MAX	3537	3465	2640	2253	2514	3544	8159	6319	5035	4309	2359	3149								
(WY)	1986	1986	1984	1983	1984	1973	1916	1960	1916	1953	1972	1968								
MIN	726	725	765	691	647	692	707	595	799	721	545	718								
(WY)	1949	1964	1925	1924	1926	1914	1990	1987	1988	1925	1925	1925								

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1914 - 1993

ANNUAL TOTAL	639989		679216		1810	
ANNUAL MEAN	1749		1861		3069	1916
HIGHEST ANNUAL MEAN					922	1925
LOWEST ANNUAL MEAN					18100	Apr 26 1960
HIGHEST DAILY MEAN	5400	Apr 23	5190	May 6	57	Sep 26 1975
LOWEST DAILY MEAN	643	Sep 9	678	Oct 10	277	Oct 18 1975
ANNUAL SEVEN-DAY MINIMUM	909	Aug 15	857	Jul 24	19500	Apr 26 1960
INSTANTANEOUS PEAK FLOW			5800	May 5	(b)9.91	May 5 1993
INSTANTANEOUS PEAK STAGE			9.91	May 5	(a)	Aug 30 1992
INSTANTANEOUS LOW FLOW			503			
10 PERCENT EXCEEDS	2590		2920		3080	
50 PERCENT EXCEEDS	1600		1830		1470	
90 PERCENT EXCEEDS	983		982		848	

(a) Oct. 10, July 28, Aug. 1.

(b) Since October 1989.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04065106 MENOMINEE RIVER AT NIAGARA, WI

LOCATION.--Lat 45°46'04", long 87°58'50", in NE1/4 NE1/4 sec.15, T.38 N., R.20 E., Wisconsin Meridian, Marinette County, Hydrologic Unit 04030108, on right bank 0.7 mi downstream from Little Quinnesec Falls Dam at Niagara, WI.

DRAINAGE AREA.--2,470 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1992 to September 1993.

GAGE.--Water-stage recorder. Elevation of gage is 880 ft above sea level, from topographic map.

REMARKS.--Records good. 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 of gage. Gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e3000	e1200	2860	2350	2240	2060	2590	5520	5520	3020	1180	1350
2	e2500	e1500	2590	2410	2130	1790	2630	5340	5480	2280	1480	1370
3	e2100	e1800	2760	2370	1870	1470	2630	5630	5070	2270	1450	1460
4	e1400	e1800	2160	2290	1960	2120	2350	6290	4530	2270	1420	1440
5	e1600	e2100	2310	2380	2060	2020	2090	6840	3390	2350	1490	1490
6	e1600	2180	2070	2300	2170	2150	2300	7770	3150	2520	2230	1440
7	e1700	2080	2070	2300	2240	2030	2130	7440	2660	2250	1540	1440
8	e1700	1660	2460	2240	2240	2180	2340	6610	2750	2210	1310	1440
9	e1500	1680	2490	2180	2290	2200	2240	5650	3490	2130	1410	1440
10	e1200	1840	2710	2270	2110	2180	2020	5000	3800	2280	1570	1450
11	e1400	1980	2580	2240	1850	2140	2760	5190	3920	2270	1670	1430
12	e1500	1850	2230	2230	1970	2210	3340	5210	4140	2270	1340	1380
13	e1800	1890	2010	2240	2260	1980	4690	4120	3730	2170	1450	1590
14	e1700	1910	2170	2290	2230	1890	4730	3900	3400	1990	1120	3530
15	e1700	1850	2500	2190	2250	1900	4140	2520	2970	2030	1120	4300
16	e1800	1860	2780	2220	2200	1860	3950	2720	2820	2040	1160	4040
17	e1500	1590	2760	2210	2130	1630	3450	2710	3350	1810	1650	2930
18	e1300	1460	2730	2240	2010	1700	3710	2360	3660	1980	1690	2600
19	e1200	1420	2760	2230	2060	1550	3850	2480	3940	1980	1200	2390
20	e1200	1640	2580	2310	2040	1480	3920	2340	4950	1910	1380	2070
21	e1400	3380	2780	2170	2040	1430	4000	2180	5780	1710	1230	2040
22	e1600	e4600	2500	2280	2000	1280	4370	2180	5580	1710	1120	2060
23	e1400	e5400	2090	2140	2000	1220	4130	2160	5560	1540	1200	1980
24	e1400	e5400	2380	2230	1980	1230	3410	2530	5210	1120	1240	1870
25	e1600	e4700	2440	2280	1960	1310	3490	3030	5740	1060	1120	1270
26	e1900	e4000	2470	2220	2000	1350	3670	3020	5220	1110	1140	1310
27	e1800	e3700	2370	2200	2000	1400	3600	3100	4630	1160	1180	1490
28	e1600	3230	2430	2250	2000	1450	3720	3090	3840	1270	1290	1740
29	e1700	2990	2420	2250	---	1760	4660	2620	3870	1460	1350	1570
30	e1500	3250	2390	2240	---	1940	4940	2730	3360	1650	1280	1560
31	e1300	---	2340	2250	---	2200	---	4280	---	1280	1400	---
TOTAL	50600	75940	76190	70000	58290	55090	101850	126560	125510	59100	42410	57470
MEAN	1632	2531	2458	2258	2082	1777	3395	4083	4184	1908	1368	1916
MAX	3000	5400	2860	2410	2290	2210	4940	7770	5780	3020	2230	4300
MIN	1200	1200	2010	2140	1850	1220	2020	2160	2660	1060	1120	1270

## SUMMARY STATISTICS

## FOR 1993 WATER YEAR

ANNUAL TOTAL  
ANNUAL MEAN  
HIGHEST DAILY MEAN  
LOWEST DAILY MEAN  
ANNUAL SEVEN-DAY MINIMUM  
INSTANTANEOUS PEAK FLOW  
INSTANTANEOUS PEAK STAGE  
10 PERCENT EXCEEDS  
50 PERCENT EXCEEDS  
90 PERCENT EXCEEDS

899010  
2463  
7770 May 6  
1060 Jul 25  
1180 Aug 21  
8070 May 7  
11.02 May 7  
4140  
2180  
1350

(e) Estimated.

## 04065722 MENOMINEESTREAMS 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 1967 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 820 ft above sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3040	1390	3490	2610	2590	2330	3640	6310	6160	3750	1430	1700
2	2910	1740	3230	2770	2420	2020	3590	6230	6140	2930	1700	1620
3	2480	2140	3160	2710	2150	1640	3510	6680	5650	2850	1650	1770
4	1730	2430	2770	2650	2190	2320	3270	7760	5180	2800	1680	1670
5	2090	3000	2620	2640	2340	2230	2790	8310	4120	2730	1630	1760
6	1920	2750	2350	2630	2420	2370	3010	9210	3620	3020	2450	1680
7	1900	2700	2430	2560	2490	2340	2840	8840	3210	2820	2290	1640
8	1950	2110	2730	2530	2520	2400	2920	7830	3330	2670	1940	1700
9	1870	2150	2870	2410	2540	2440	3220	6800	3980	2480	1860	1610
10	1440	2270	3180	2530	2430	2410	2850	5840	4450	2630	1800	1670
11	1440	2480	2990	2540	2120	2360	3610	5970	4500	2660	2060	1680
12	2090	2170	2610	2460	2170	2490	3950	6400	4630	2590	1650	1670
13	2100	2430	2400	2460	2470	2160	5170	5100	4240	2500	1810	1760
14	1950	2370	2450	2530	2480	2130	5330	4820	3850	2330	1400	9660
15	1950	2220	2870	2430	2510	2090	4650	3470	3440	2250	1380	4940
16	1980	2250	3380	2460	2480	2120	4600	3440	3110	2380	1360	4780
17	1550	1890	3610	2430	2410	1630	3960	3390	3710	2060	1900	3820
18	1700	1880	3480	2480	2440	1940	4260	3020	4040	2230	1950	3340
19	1610	1750	3470	2470	2450	1830	4530	3100	4540	2370	1460	3180
20	1460	1920	3240	2560	2410	1760	4700	3010	5520	2280	1650	2710
21	1590	4040	3260	2410	2340	1690	4660	2840	6840	2040	1470	2570
22	2010	6370	3150	2560	2440	1460	5070	2830	6580	1960	1350	2550
23	1800	7380	2610	2410	2360	1500	4770	2700	6500	1860	1490	2380
24	1610	6740	2720	2500	2390	1470	4150	3040	5870	1420	1430	2290
25	1770	5960	2570	2560	2320	1590	4280	3690	6460	1260	1380	1710
26	2320	5050	2750	2460	2230	1690	4500	3660	5890	1410	1310	1600
27	1920	4420	2530	2520	2230	1810	4410	3630	5910	1330	1410	1870
28	1850	4250	2640	2580	2240	1980	4650	3610	4780	1440	1430	1930
29	1880	3590	2780	2590	---	2350	5580	3170	4660	1590	1590	1950
30	1810	3980	2630	2580	---	2750	5890	3300	4080	1930	1480	1820
31	1420	---	2760	2570	---	3150	---	4640	---	1520	1640	---
TOTAL	58940	95850	89730	78520	66580	64450	124360	152430	144970	70080	50990	68930
MEAN	1901	3195	2895	2533	2378	2079	4145	4917	4832	2261	1645	2298
MAX	3040	7380	3610	2770	2590	3150	5890	9210	6840	3750	2450	4940
MIN	1420	1380	2350	2410	2120	1460	2790	2630	3110	1260	1310	1570

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1988 - 1993, BY WATER YEAR (WY)

	1988	1989	1990	1991	1992	1993
MEAN	1775	2621	2418	2074	1929	2463
MAX	2510	4412	3008	2533	2378	2849
(WY)	1991	1989	1988	1993	1991	1992
MIN	1081	1382	1555	1688	1773	2079
(WY)	1990	1990	1990	1991	1990	1993

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1988 - 1993

ANNUAL TOTAL	965740	1065830	2478
ANNUAL MEAN	2639	2920	2920
HIGHEST ANNUAL MEAN			1864
LOWEST ANNUAL MEAN			10300
HIGHEST DAILY MEAN	9660	Apr 23	9210
LOWEST DAILY MEAN	1140	Jun 14	1260
ANNUAL SEVEN-DAY MINIMUM	1300	Aug 15	1400
INSTANTANEOUS PEAK FLOW			9570
INSTANTANEOUS PEAK STAGE			12.07
INSTANTANEOUS LOW FLOW			1050
10 PERCENT EXCEEDS	4240		4870
50 PERCENT EXCEEDS	2270		2480
90 PERCENT EXCEEDS	1460		1610



## 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" (04066000) 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 sea level, 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3260	1510	3760	e3000	e2700	e2600	3990	6680	6730	4080	1560	1840
2	3080	1810	3420	e2800	e2800	e2300	3900	6910	6750	3210	1600	1690
3	2880	2380	e3300	e3000	e2500	e1900	3920	7270	6190	3020	1690	1780
4	1890	2810	3110	e2800	e2400	e2300	3660	8700	5710	2990	1740	1820
5	2070	3360	e2800	e2900	e2500	e2600	3120	9410	4510	2940	1670	1790
6	2190	3000	e2500	e2900	e2700	e2600	3190	10400	3700	3250	2350	1770
7	1990	2950	e2600	e2800	e2800	e2600	3200	10000	3670	3100	2700	1750
8	1950	2370	e2900	e2700	e2800	e2700	3200	8780	3550	2860	2180	1680
9	2150	2290	e3000	e2600	e2800	e2700	3810	7530	4190	2690	1970	1650
10	1810	2460	e3300	e2700	e2800	e2700	3330	6350	4960	2760	1910	1640
11	1600	2610	e3200	e2700	e2500	e2700	4040	6190	4830	2850	2170	1620
12	2030	2470	3050	e2700	e2400	e2800	4130	6930	5050	2720	1840	1610
13	2290	2600	2650	e2700	e2600	e2500	5400	6710	4600	2660	1800	1650
14	2070	2610	2610	e2800	e2800	e2400	5710	5250	4120	2550	1630	3420
15	2100	2440	2990	e2700	e2700	e2300	4910	3970	3730	2310	1510	5080
16	2140	2450	3800	e2700	e2700	e2400	4970	3690	3180	2530	1450	5160
17	1900	2140	4010	e2700	e2700	e1800	4170	3640	3900	2280	1690	4170
18	1820	2040	3940	e2700	e2700	e2600	4720	3350	4330	2340	2090	3540
19	1820	1880	3850	e2700	e2700	e2600	4770	3290	5010	2510	1750	3280
20	1630	2040	e3400	e2800	e2700	e2000	5310	3310	5920	2450	1660	2850
21	1730	4360	e3500	e2600	e2600	e1900	5060	3120	7970	2220	1560	2640
22	1980	7080	e3500	e2700	e2700	e1700	5540	2860	7530	2040	1440	2600
23	2000	8370	e3000	e2700	e2800	e1700	5140	2930	7470	2080	1460	2470
24	1720	7720	e2900	e2700	e2700	e1700	4590	3190	6430	1750	1580	2350
25	1800	6770	e2900	e2800	e2500	e1800	4700	3890	7050	1450	1520	1810
26	2430	5630	e2800	e2700	e2500	1910	4880	4040	6240	1490	1390	1600
27	2140	4830	e2700	e2700	e2500	1970	4820	3750	6680	1460	1480	1770
28	1870	4620	e2800	e2800	e2500	2110	4990	3970	5240	1490	1480	1860
29	2040	3790	e3000	e2800	--	2520	6020	3420	4970	1560	1650	2070
30	1950	4300	e2900	e2800	--	3070	6410	3530	4330	1890	1540	1760
31	1740	--	e2900	e2800	--	3530	--	4670	--	1790	1670	--
TOTAL	64070	105690	97090	85500	74100	73010	135600	166730	158540	75320	53690	70720
MEAN	2067	3523	3132	2758	2646	2355	4520	5378	5285	2430	1732	2357
MAX	3260	8370	4010	3000	2800	3530	6410	10400	7970	4080	2700	5180
MIN	1600	1510	2500	2600	2400	1700	3120	2860	3180	1450	1390	1600

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1950 - 1993, BY WATER YEAR (WY)

MEAN	2513	2688	2339	2130	2075	2614	5658	4841	3450	2535	2107	2356
MAX	5659	5766	3939	3035	3810	7461	10000	12100	6118	6523	3505	5335
(WY)	1986	1986	1986	1986	1984	1973	1967	1960	1953	1953	1952	1968
MIN	1028	1043	1167	1080	1201	1461	1432	1341	1152	1201	1003	1009
(WY)	1977	1977	1977	1977	1964	1964	1990	1987	1988	1988	1977	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1950 - 1993

ANNUAL TOTAL	1051240	1160060	2942
ANNUAL MEAN	2872	3178	4318
HIGHEST ANNUAL MEAN			1960
LOWEST ANNUAL MEAN			1778
HIGHEST DAILY MEAN	11500	10400	26700
LOWEST DAILY MEAN	1190	1390	840
ANNUAL SEVEN-DAY MINIMUM	1450	1470	914
INSTANTANEOUS PEAK FLOW		(a)10700	26900
INSTANTANEOUS PEAK STAGE		(b)16.21	(c)13.90
10 PERCENT EXCEEDS	4630	5270	5000
50 PERCENT EXCEEDS	2410	2700	2310
90 PERCENT EXCEEDS	1600	1700	1450

(a) Gage height, 12.18 ft.

(b) Ice jam.

(c) Site and datum then in use.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04067500 MENOMINEE RIVER NEAR McALLISTER, WI  
(National water quality assessment program station)

LOCATION.--Lat 45°19'33", long 87°39'48", in SW1/4 SE1/4 sec.17, T.33 N., R.23 E., Wisconsin Meridian, Marinette County, Hydrologic Unit 04030108, on right bank 85 ft downstream from bridge on County Highway JJ, 2.9 mi downstream from Grand Rapids Dam, 2.6 mi east of McAllister, WI, 1.9 mi downstream from Little Cedar River, and at mile 22.6.

DRAINAGE AREA.--3,930 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1945 to September 1961, October 1961 to September 1979 (miscellaneous measurements and annual maximums only), October 1979 to September 1986, October 1986 to March 1987 (crest-stage partial-record station), April 1988 to September 1990, April to September 1993.

GAGE.--Water-stage recorder. Datum of gage is 622.20 ft above sea level (Michigan Department of Transportation reference mark). Prior to May 15, 1945, nonrecording gage 1,400 ft downstream at same datum, May 16, 1945, to September 1961, water-stage recorder 1,000 ft downstream at same datum, October 1961 to September 1979, crest-stage gage 1,100 ft downstream at same datum. October 1979 to September 1986, water-stage recorder at same site and datum; October 1986 to March 1987, crest-stage gage at same site and datum. April 1988 to September 1990, water-stage recorder at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	e5700	8120	6600	5400	2040	1980
2	---	---	---	---	---	---	e5600	8280	7920	4770	1960	2210
3	---	---	---	---	---	---	e4900	8920	7590	3760	1920	2020
4	---	---	---	---	---	---	e4700	10200	6980	3740	2070	1970
5	---	---	---	---	---	---	e4400	11700	6400	3590	2040	2160
6	---	---	---	---	---	---	e4000	12200	4910	4120	2240	1930
7	---	---	---	---	---	---	e4200	12600	4270	4570	3050	2060
8	---	---	---	---	---	---	e4200	e11700	4670	4100	3030	1960
9	---	---	---	---	---	---	e4400	e10400	5070	3850	2510	2330
10	---	---	---	---	---	---	e5500	e8900	6030	3520	2430	2190
11	---	---	---	---	---	---	e4300	e7000	6490	3590	2360	2200
12	---	---	---	---	---	---	e5500	e7200	5790	3640	2440	2430
13	---	---	---	---	---	---	e6100	e7600	5930	3240	2240	2120
14	---	---	---	---	---	---	e6700	e6700	5770	3320	1990	2650
15	---	---	---	---	---	---	e7100	e6300	5370	3090	1770	4710
16	---	---	---	---	---	---	e6600	e4500	4450	2750	1880	6440
17	---	---	---	---	---	---	e6100	e4500	4530	2980	1790	6130
18	---	---	---	---	---	---	e5600	e4400	5800	2760	2310	5180
19	---	---	---	---	---	---	e6700	e4200	6550	2960	2510	4020
20	---	---	---	---	---	---	e7100	e4000	8670	3180	1940	3870
21	---	---	---	---	---	---	e7200	3990	10600	3050	1820	3370
22	---	---	---	---	---	---	6950	3660	11700	2590	1800	3120
23	---	---	---	---	---	---	7080	3410	11100	2410	1830	3150
24	---	---	---	---	---	---	6720	3520	9800	2350	1790	2930
25	---	---	---	---	---	---	6110	4100	8830	2080	1690	2790
26	---	---	---	---	---	---	6240	4690	8840	1880	1790	2180
27	---	---	---	---	---	---	6550	4740	8030	1920	1640	2050
28	---	---	---	---	---	---	6940	4290	7580	1910	1910	2220
29	---	---	---	---	---	---	7080	4650	6460	1850	1690	2140
30	---	---	---	---	---	---	7980	3870	6040	2250	2010	2260
31	---	---	---	---	---	---	---	5030	---	2140	1990	---
TOTAL	---	---	---	---	---	---	178250	205370	208750	97360	64480	86770
MEAN	---	---	---	---	---	---	5942	6625	6958	3141	2080	2892
MAX	---	---	---	---	---	---	7980	12600	11700	5400	3050	6440
MIN	---	---	---	---	---	---	4000	3410	4270	1850	1640	1930

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1993, BY WATER YEAR (WY)

MEAN	3047	3425	2674	2441	2404	3004	6823	5500	4090	3232	2418	2724
MAX	6755	7332	4561	3777	4710	5687	12800	15930	6958	7127	4056	5952
(WY)	1986	1986	1986	1983	1984	1983	1951	1960	1993	1951	1952	1959
MIN	1195	1753	1532	1621	1245	1897	1869	2257	1296	1374	1377	1390
(WY)	1949	1990	1990	1949	1948	1956	1990	1988	1988	1988	1957	1989

## SUMMARY STATISTICS

## FOR 1993 WATER YEAR

## WATER YEARS 1945 - 1993

ANNUAL MEAN		3503
HIGHEST ANNUAL MEAN		5496
LOWEST ANNUAL MEAN		2118
HIGHEST DAILY MEAN	12600	(a) May 7
LOWEST DAILY MEAN	1640	(a) Aug 27
ANNUAL SEVEN-DAY MINIMUM		810
INSTANTANEOUS PEAK FLOW	12700	(a) May 6
INSTANTANEOUS PEAK STAGE	14.89	(a) May 6
INSTANTANEOUS LOW FLOW	1420	(a) Aug 29
10 PERCENT EXCEEDS		(c) 538
50 PERCENT EXCEEDS		6370
90 PERCENT EXCEEDS		2700
		1650

- (a) During period April to September.  
(b) From graph based on gage readings.  
(c) Observed.  
(e) Estimated.

STREAMS TRIBUTARY TO LAKE MICHIGAN  
04067500 MENOMINEE RIVER NEAR McALLISTER, WI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978-86, 1993.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: June 1979 to September 1980.

WATER TEMPERATURES: June 1979 to September 1980.

REMARKS.--Cross-sectional samples collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: Maximum daily, 250 microsiemens, Mar. 12, 1980; minimum daily, 105 microsiemens, June 4, 1980.

WATER TEMPERATURES: Maximum daily, 26.0°C, July 11, 1980; minimum daily, 0.0°C, on many days during winter periods.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 281 microsiemens was measured Sept. 8, 1993.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	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)
APR									
14...	0900	6510	220	8.1	5.0	12.8	102	110	24
30...	1245	8670	194	8.1	10.0	11.4	103	95	22
MAY									
07...	1130	13100	163	7.8	13.0	10.3	99	85	20
20...	1400	4050	199	8.1	14.5	9.7	98	92	21
JUN									
24...	1100	9580	188	7.9	19.5	8.0	89	98	23
30...	1200	6050	196	8.0	19.5	8.2	91	97	23
JUL									
27...	1145	2080	250	8.2	23.0	7.6	91	120	28
AUG									
23...	1000	1850	269	8.0	23.0	8.1	97	130	30
SEP									
08...	1145	2400	281	8.3	17.5	8.8	94	130	30
15...	1400	5090	273	8.1	16.5	9.3	96	130	29

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)	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)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)
APR									
14...	11	4.1	1.2	130	106	9.7	6.1	<0.10	8.0
30...	9.8	4.2	1.0	99	81	9.7	4.4	<0.10	6.4
MAY									
07...	8.5	2.9	1.0	89	73	7.2	3.4	<0.10	6.0
20...	9.5	5.1	1.1	110	90	9.2	5.3	<0.10	5.7
JUN									
24...	9.8	3.2	0.90	103	84	6.1	3.6	<0.10	7.1
30...	9.7	3.9	1.0	111	91	7.2	3.8	<0.10	7.0
JUL									
27...	12	5.7	1.2	146	120	11	5.6	0.10	6.7
AUG									
23...	13	7.8	1.3	145	119	13	7.9	0.10	6.6
SEP									
08...	14	9.1	1.5	151	124	18	8.4	<0.10	6.9
15...	13	7.6	1.4	142	116	14	7.4	<0.10	7.3

DATE	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)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN,AM- MONIA + ORGANIC DIS- SOLVED (MG/L AS N) (00623)	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)
APR								
14...	135	<0.010	0.170	0.020	0.40	0.30	0.020	<0.010
30...	112	<0.010	0.094	0.020	0.50	0.40	0.040	0.040
MAY								
07...	116	<0.010	0.082	0.020	0.70	0.40	0.030	0.010
20...	133	<0.010	0.100	0.020	0.50	0.50	0.030	0.020
JUN								
24...	105	<0.010	0.071	0.040	0.40	0.40	0.030	0.020
30...	136	<0.010	0.100	0.040	0.50	0.40	0.020	0.010
JUL								
27...	158	<0.010	0.061	0.050	0.30	0.50	<0.010	0.040
AUG								
23...	163	<0.010	<0.050	0.020	0.30	0.30	<0.010	<0.010
SEP								
08...	169	<0.010	<0.050	0.020	0.30	0.30	0.020	0.030
15...	165	<0.010	<0.050	0.030	0.50	0.30	0.030	<0.010

STREAMS TRIBUTARY TO LAKE MICHIGAN  
 04067500 MENOMINEE RIVER NEAR McALLISTER, WI--Continued  
 WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	CARBON, ORGANIC DIS- SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS- PENDED TOTAL (MG/L AS C) (00689)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
APR							
14...	<0.010	130	13	7.6	--	9	62
30...	<0.010	120	16	9.9	0.7	15	68
MAY							
07...	<0.010	120	19	12	0.4	18	58
20...	0.010	150	23	12	0.7	10	91
JUN							
24...	0.010	150	11	33	0.6	19	70
30...	<0.010	190	12	14	0.6	9	93
JUL							
27...	<0.010	65	14	9.2	0.3	3	92
AUG							
23...	<0.010	28	9	8.0	0.2	1	82
SEP							
08...	<0.010	25	13	7.9	0.3	2	100
15...	<0.010	27	15	8.2	0.6	9	82



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04096405 ST. JOSEPH RIVER AT BURLINGTON, MI

LOCATION.--Lat 42°06'11", long 85°04'48", in SE1/4 SE1/4 sec.23, T.4 S., R.7 W., Calhoun County, Hydrologic Unit 04050001, on right bank 10 ft downstream from bridge on Elevenmile Road in Burlington, 4.1 mi upstream from Burnett Creek, 6.7 mi downstream from Tekonsha Creek, and at mile 161.

DRAINAGE AREA.--206 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1962 to current year. Published as "near Burlington" prior to October 1991.

GAGE.--Water-stage recorder. Elevation of gage is 905 ft above sea level, from topographic map. October 1962 to September 1990 water-stage recorder and October 1990 to September 1991 nonrecording gage at site 2.7 mi upstream at different datum (station 04096400).

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	136	169	446	491	373	e190	641	349	172	201	97	141
2	131	222	421	413	337	e190	641	336	167	192	93	159
3	125	271	395	e390	e325	210	619	343	162	184	91	229
4	117	279	367	574	e310	220	589	369	158	175	97	231
5	108	276	344	755	295	225	556	383	180	163	96	210
6	104	278	303	782	284	227	521	360	185	153	93	188
7	101	282	e290	751	274	239	486	341	194	145	102	173
8	100	289	e280	e720	261	261	453	337	239	139	103	163
9	108	293	282	e690	250	286	434	337	327	178	98	153
10	113	294	276	e660	e240	298	426	329	347	198	96	141
11	122	293	273	e640	e235	299	406	313	331	183	92	134
12	125	334	266	e610	e230	293	392	290	325	165	94	130
13	121	430	267	e580	e225	286	378	262	322	150	90	124
14	128	455	270	e540	e220	248	363	245	333	146	93	124
15	184	425	274	e500	e215	251	361	225	325	142	92	156
16	235	415	296	e470	e210	281	360	206	292	144	87	173
17	251	418	306	e430	e200	281	351	198	266	138	84	175
18	264	423	301	e400	e170	278	337	194	244	133	81	166
19	263	418	297	e380	e190	270	330	193	227	143	80	151
20	264	407	299	e360	e190	261	371	188	238	148	88	140
21	265	392	280	e430	e190	257	406	181	272	138	82	136
22	261	387	e270	475	e180	276	388	175	284	129	77	131
23	250	482	e250	480	e190	353	370	173	279	121	73	127
24	236	535	e230	479	e190	479	351	177	259	116	86	122
25	225	499	e200	437	e190	500	345	174	235	122	88	118
26	211	482	e200	e420	e190	528	358	171	218	135	88	130
27	199	478	e205	e400	e190	575	338	170	221	130	86	140
28	190	460	e210	e390	e190	607	325	167	224	119	91	171
29	182	477	236	373	---	624	343	182	222	111	110	191
30	175	466	322	344	---	629	357	156	211	106	135	207
31	168	---	455	394	---	630	---	175	---	101	147	---
TOTAL	5462	11349	9111	15758	6554	10552	12596	7679	7459	4548	2908	4734
MEAN	176	378	294	508	234	340	420	248	249	147	93.8	158
MAX	265	535	455	782	373	630	641	383	347	201	147	231
MIN	100	169	200	344	170	190	325	156	158	101	73	118
CFSM	.86	1.84	1.43	2.47	1.14	1.65	2.04	1.20	1.21	.71	.46	.77
IN.	.99	2.05	1.65	2.85	1.18	1.91	2.27	1.39	1.35	.82	.53	.85

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1963 - 1993, BY WATER YEAR (WY)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	101	139	184	185	204	315	317	225	191	118	87.7	87.8																			
MAX	357	378	306	506	428	668	567	426	640	308	270	237																			
(WY)	1967	1993	1983	1993	1968	1982	1982	1983	1989	1968	1981	1981																			
MIN	16.4	26.3	26.7	34.6	36.0	74.0	140	96.4	48.9	23.8	16.2	14.5																			
(WY)	1964	1965	1964	1977	1963	1964	1964	1971	1964	1988	1964	1963																			

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1963 - 1993
ANNUAL TOTAL	68226	98710	
ANNUAL MEAN	186	270	179
HIGHEST ANNUAL MEAN			270
LOWEST ANNUAL MEAN			47.6
HIGHEST DAILY MEAN	535	782	1330
LOWEST DAILY MEAN	62	73	8.0
ANNUAL SEVEN-DAY MINIMUM	68	81	9.4
INSTANTANEOUS PEAK FLOW		797	1390
INSTANTANEOUS PEAK STAGE		6.21	(a)5.82
INSTANTANEOUS LOW FLOW		71	8.0
ANNUAL RUNOFF (CFSM)	.90	1.31	.87
ANNUAL RUNOFF (INCHES)	12.32	17.83	11.83
10 PERCENT EXCEEDS	289	477	356
50 PERCENT EXCEEDS	166	240	145
90 PERCENT EXCEEDS	96	111	44

(a) Site and datum then in use.

(b) Aug. 9, 10, 11, 1964.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level, from topographic map. Prior to May 23, 1970, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	35	98	210	72	e35	145	87	29	41	12	25
2	22	57	91	238	e66	e33	140	80	27	40	12	25
3	20	81	87	198	60	34	134	75	26	37	11	49
4	19	97	83	218	55	45	124	76	25	33	12	50
5	18	100	79	362	54	50	113	87	43	30	11	38
6	17	94	78	413	54	52	104	93	48	27	11	33
7	16	86	69	362	e51	54	97	89	41	25	13	40
8	16	78	64	300	49	67	91	82	65	24	13	36
9	23	72	61	e240	47	81	88	74	104	24	12	30
10	27	67	60	e200	47	87	91	65	133	23	11	28
11	27	66	61	e160	47	86	91	58	136	22	12	24
12	29	78	62	147	47	82	90	52	122	29	12	22
13	27	123	62	132	47	75	87	46	105	29	11	20
14	32	166	63	123	47	e70	81	41	94	27	11	19
15	54	164	64	113	45	e62	77	38	91	28	9.8	38
16	75	147	73	105	45	60	78	35	82	27	10	48
17	81	131	81	96	45	70	80	34	70	24	9.7	39
18	81	116	82	93	e40	74	78	32	58	22	9.0	32
19	76	103	80	e85	e38	71	76	32	53	25	9.2	28
20	70	93	79	e75	e39	64	88	30	61	25	15	25
21	67	86	79	81	e40	64	95	29	85	22	15	24
22	63	86	75	95	e41	73	93	27	87	19	13	23
23	58	120	70	e105	e41	96	86	27	76	18	11	22
24	53	176	66	113	e41	149	79	32	62	16	12	21
25	49	188	66	e115	e41	185	84	34	53	18	12	20
26	45	174	e60	e105	e40	193	97	31	52	21	11	25
27	43	155	e54	98	e40	198	97	28	51	19	14	34
28	40	135	49	87	e38	199	91	27	47	17	15	69
29	38	119	52	85	---	192	88	25	44	17	26	77
30	36	106	76	85	---	176	90	24	41	16	42	70
31	34	---	137	e78	---	158	---	29	---	14	33	---
TOTAL	1280	3299	2261	4917	1317	2935	2853	1519	2011	759	430.7	1034
MEAN	41.3	110	72.9	159	47.0	94.7	95.1	49.0	67.0	24.5	13.9	34.5
MAX	81	188	137	413	72	199	145	93	136	41	42	77
MIN	16	35	49	75	38	33	76	24	25	14	9.0	19
CFSM	.85	2.26	1.50	3.26	.97	1.94	1.95	1.01	1.38	.50	.29	.71
IN.	.98	2.52	1.73	3.76	1.01	2.24	2.18	1.16	1.54	.58	.33	.79

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1970 - 1993, BY WATER YEAR (WY)

	MEAN	20.8	34.2	45.3	46.9	52.3	90.2	83.1	53.0	46.9	22.7	17.5	17.5
MAX	75.0	110	80.2	159	112	220	163	114	159	62.4	67.9	60.3	
(WY)	1987	1993	1991	1993	1976	1982	1978	1983	1989	1981	1981	1981	
MIN	5.97	6.20	8.77	7.11	13.5	47.3	34.3	20.1	4.18	1.55	1.86	3.08	
(WY)	1972	1972	1977	1977	1972	1983	1971	1971	1988	1988	1988	1991	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1970 - 1993

ANNUAL TOTAL	17456.3		24615.7									
ANNUAL MEAN	47.7		67.4									
HIGHEST ANNUAL MEAN										44.1		
LOWEST ANNUAL MEAN										67.4		1993
HIGHEST DAILY MEAN	188									23.8		1977
LOWEST DAILY MEAN	7.1									629		Feb 25 1985
ANNUAL SEVEN-DAY MINIMUM	7.9									.58		Aug 4 1988
INSTANTANEOUS PEAK FLOW										.84		Aug 3 1988
INSTANTANEOUS PEAK STAGE										664		Feb 25 1985
INSTANTANEOUS LOW FLOW										6.20		Jun 1 1989
ANNUAL RUNOFF (CFSM)	.98									.48		Aug 5 1988
ANNUAL RUNOFF (INCHES)	13.33									.91		
10 PERCENT EXCEEDS	86									12.31		
50 PERCENT EXCEEDS	41									96		
90 PERCENT EXCEEDS	16									30		
										6.9		

(a) Aug. 18, 19.

(e) Estimated.

## 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 sea level, from topographic map.

REMARKS.--Records fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	93	98	199	438	217	e145	408	299	122	129	80	139
2	87	138	188	452	205	151	382	291	121	124	79	149
3	81	217	184	415	191	159	360	277	119	120	78	191
4	75	264	182	449	189	181	337	285	116	114	81	229
5	71	266	184	573	190	191	312	307	125	108	80	235
6	69	247	178	649	192	190	288	316	131	102	82	219
7	67	222	178	641	187	195	267	302	132	97	85	198
8	66	198	178	582	182	215	250	274	152	92	88	176
9	70	180	173	506	177	238	250	243	210	101	86	154
10	79	165	168	445	175	252	260	215	250	121	86	135
11	81	158	165	390	178	251	268	191	249	132	89	118
12	79	189	169	329	177	236	263	179	227	135	88	107
13	78	280	174	312	177	221	256	168	197	135	87	100
14	82	358	178	311	179	197	246	160	181	129	87	100
15	115	377	186	308	174	175	242	156	186	119	82	152
16	158	359	220	302	170	183	252	148	180	109	81	192
17	181	325	263	292	167	202	263	143	167	100	78	205
18	186	285	275	276	e165	220	257	139	154	96	77	200
19	180	246	267	e250	e155	211	248	136	144	100	82	185
20	173	214	252	e230	e160	201	308	133	152	109	100	165
21	162	196	225	240	e160	197	418	129	170	107	96	149
22	151	192	198	285	e160	209	456	125	181	101	91	130
23	138	232	186	328	e160	274	429	124	175	97	87	119
24	129	303	176	347	e160	394	379	129	158	96	99	109
25	119	329	e170	354	e160	477	341	127	148	102	99	103
26	113	319	e160	337	e155	502	313	123	135	103	97	112
27	107	299	151	299	e150	503	290	121	133	100	100	125
28	102	272	139	274	e150	494	270	119	137	94	100	141
29	99	244	144	258	---	481	264	116	137	90	118	162
30	96	221	197	e240	---	460	282	111	133	86	140	168
31	94	---	333	227	---	435	---	116	---	83	145	---
TOTAL	3381	7393	6040	11339	4862	8440	9159	5702	4822	3331	2848	4667
MEAN	109	246	195	366	174	272	305	184	161	107	91.9	156
MAX	186	377	333	649	217	503	456	316	250	135	145	235
MIN	66	98	139	227	150	145	242	111	116	83	77	100
CFSM	.67	1.52	1.20	2.26	1.07	1.68	1.88	1.14	.99	.66	.57	.96
IN.	.78	1.70	1.39	2.60	1.12	1.94	2.10	1.31	1.11	.76	.65	1.07

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

	MEAN	97.5	131	160	155	172	253	247	181	167	111	86.0	84.2
MAX	344	290	273	366	302	475	385	332	625	279	160	163	163
(WY)	1987	1989	1991	1993	1985	1982	1985	1983	1989	1986	1980	1980	1980
MIN	41.9	43.9	56.7	49.3	71.3	135	119	91.1	55.9	41.7	37.5	35.0	35.0
(WY)	1967	1972	1977	1977	1977	1970	1971	1971	1977	1977	1977	1976	1976

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1967 - 1993

ANNUAL TOTAL	54908	71984	153
ANNUAL MEAN	150	197	211
HIGHEST ANNUAL MEAN			80.0
LOWEST ANNUAL MEAN			1989
HIGHEST DAILY MEAN	377	Nov 15	2170
LOWEST DAILY MEAN	58	Jul 2	21
ANNUAL SEVEN-DAY MINIMUM	62	Jun 28	23
INSTANTANEOUS PEAK FLOW			2190
INSTANTANEOUS PEAK STAGE			7.85
INSTANTANEOUS LOW FLOW			21
ANNUAL RUNOFF (CFSM)	.93		.95
ANNUAL RUNOFF (INCHES)	12.61		12.87
10 PERCENT EXCEEDS	229		287
50 PERCENT EXCEEDS	150		120
90 PERCENT EXCEEDS	79		58

(a) July 28, 29, 30, Aug. 4, 6, 1977, Aug. 4, 1988.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04097500 ST. JOSEPH RIVER AT THREE RIVERS, MI

LOCATION.--Lat 41°56'25", long 85°37'58", in SW1/4 SE1/4 sec.18, T.6 S., R.11 W., St. Joseph County, Hydrologic Unit 04050001, on right bank in Scidmore Park at Three Rivers, 250 ft downstream from Rocky River, and at mile 112.

DRAINAGE AREA.--1,350 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1953 to September 1983, October 1992 to September 1993.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 781.34 ft above sea level (levels by Michigan Department of Natural Resources).

REMARKS.--Records good except for estimated daily discharges, which are fair. Flow regulated by powerplant upstream from station. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1918, 8,260 ft<sup>3</sup>/s, Apr. 27, 1950.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e1150	e1400	2590	3120	2310	1390	3360	2220	1100	1480	400	1230
2	e1140	e1500	2590	3570	2280	1500	3190	2240	1190	1320	548	1290
3	e1120	e1700	2510	3550	2150	1590	3030	2230	1160	1300	466	1630
4	e1050	e1900	2380	3820	2090	1550	3010	2210	1140	1270	895	1750
5	e1040	e2400	2270	4300	2010	1580	2780	2230	1170	1170	587	1820
6	e1030	e2350	2190	4970	2120	1620	2710	2390	1180	1100	671	1890
7	e1010	e2350	2090	5140	2040	1740	2530	2320	1150	1080	535	1640
8	e990	e2300	1950	5110	1890	1670	2340	2200	1340	1010	495	1270
9	e950	e2200	1940	4900	1860	1690	2260	2190	1870	965	778	1210
10	e950	e2100	1960	4440	1860	2020	2290	2040	2150	1070	649	1200
11	e1000	e2000	1950	3970	1850	2110	2250	2070	2260	1040	622	1120
12	e980	e2100	1900	3790	1790	2200	2220	1780	2360	1110	696	1130
13	e930	e2420	1850	3800	1650	2150	2130	1600	2110	1110	743	1030
14	e900	e2970	1850	3690	1540	1980	2140	1580	2110	1070	648	1000
15	e1200	3210	1900	3480	1610	1790	2110	1510	2120	928	562	1420
16	e1400	3280	1810	3390	1770	1860	1990	1450	1890	1070	692	1550
17	e1600	3280	2070	3220	1720	1870	2260	1450	2070	788	556	1490
18	e1900	3150	2200	3000	1690	1860	2150	1340	1830	716	491	1380
19	e2200	2980	2240	2550	1440	2050	2170	1270	1680	579	505	1280
20	e2100	2730	2230	2430	1650	2090	2320	1210	1630	815	724	1180
21	e2000	2660	2130	2730	1570	1960	2770	1170	1570	689	821	1200
22	e1900	2590	2070	2790	1540	1930	2900	1150	1640	730	631	1220
23	e1850	2680	1980	2970	1750	2270	2750	1140	1700	770	720	1180
24	e1800	2680	1910	3270	1560	2910	2590	1200	1750	736	752	1050
25	e1700	3070	1890	3320	1420	3350	2530	1130	1680	758	708	1110
26	e1600	3220	1770	3180	1380	3570	2290	1070	1620	963	648	1000
27	e1500	3210	1640	3070	1390	3790	2190	1140	1620	900	690	1120
28	e1400	3160	1660	2770	1460	3850	2180	1100	1480	834	650	1210
29	e1350	3010	1650	2700	---	3760	2240	1120	1500	561	844	1300
30	e1300	2860	1910	2630	---	3640	2250	1110	1530	751	1220	1430
31	e1300	---	2370	2610	---	3540	---	997	---	765	1230	---
TOTAL	42350	77460	63440	108280	49370	71080	73930	49777	49600	29428	21177	39330
MEAN	1366	2582	2046	3493	1763	2293	2464	1606	1653	949	683	1311
MAX	2200	3280	2590	5140	2310	3850	3360	2390	2360	1460	1230	1890
MIN	900	1400	1640	2430	1380	1390	1990	997	1100	561	400	1000
CFSM	1.01	1.91	1.52	2.59	1.31	1.70	1.83	1.19	1.22	.70	.51	.97
IN.	1.17	2.13	1.75	2.98	1.36	1.96	2.04	1.37	1.37	.81	.58	1.08

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1953 - 1993, BY WATER YEAR (WY)

	MEAN	706	889	1108	1176	1288	1975	2074	1613	1166	809	638	626
MAX	1701	2582	2053	3493	2716	3969	3320	2870	2587	1780	1639	1628	
(WY)	1982	1993	1983	1993	1968	1982	1982	1983	1980	1978	1981	1980	
MIN	218	293	286	328	328	486	793	650	286	243	187	199	
(WY)	1964	1965	1964	1963	1963	1964	1964	1964	1964	1964	1964	1964	

## SUMMARY STATISTICS

## FOR 1993 WATER YEAR

## WATER YEARS 1953 - 1993

ANNUAL TOTAL	675222		
ANNUAL MEAN	1850		1176
HIGHEST ANNUAL MEAN			1850
LOWEST ANNUAL MEAN			365
HIGHEST DAILY MEAN	5140	Jan 7	7810
LOWEST DAILY MEAN	400	Aug 1	78
ANNUAL SEVEN-DAY MINIMUM	586	Aug 1	126
INSTANTANEOUS PEAK FLOW	5240	Jan 6	8180
INSTANTANEOUS PEAK STAGE	8.51	Jan 6	10.69
INSTANTANEOUS LOW FLOW	261	Aug 5	
ANNUAL RUNOFF (CFSM)	1.37		.87
ANNUAL RUNOFF (INCHES)	18.61		11.84
10 PERCENT EXCEEDS	3090		2320
50 PERCENT EXCEEDS	1760		936
90 PERCENT EXCEEDS	784		388

(e) Estimated.



## 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 sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	95	124	212	280	171	e120	221	172	110	153	61	71
2	91	155	204	312	166	123	224	167	106	151	57	83
3	87	185	197	297	160	126	224	165	103	145	54	113
4	84	208	192	324	157	134	214	169	101	138	53	115
5	82	217	185	384	154	144	202	193	116	131	54	101
6	82	212	179	436	152	146	192	204	122	122	57	95
7	81	202	174	435	150	146	184	197	122	115	60	94
8	82	189	169	385	147	153	178	182	152	113	61	93
9	93	179	166	332	144	164	178	169	249	112	60	90
10	96	174	169	297	142	174	179	159	338	117	60	87
11	97	174	168	267	141	175	180	155	338	118	60	83
12	97	195	167	249	141	170	181	149	283	117	59	79
13	94	232	164	246	141	163	177	140	239	113	57	76
14	100	265	162	239	140	155	172	134	219	107	56	77
15	145	287	163	232	138	148	171	128	211	103	55	94
16	171	277	171	223	137	146	172	123	203	100	55	99
17	178	255	182	214	136	154	170	119	194	95	52	95
18	177	237	189	e205	e130	163	167	116	180	91	48	90
19	170	223	187	e195	e125	163	164	116	170	88	45	86
20	164	210	183	e180	e135	160	175	114	166	88	43	82
21	158	202	175	192	e135	158	182	111	173	85	44	80
22	152	201	170	211	e135	162	183	107	194	82	43	79
23	147	227	166	231	e135	196	176	107	201	79	43	77
24	143	260	162	241	e130	247	168	112	187	76	54	75
25	140	294	e155	235	e130	287	170	112	174	86	54	74
26	137	293	e145	e220	e125	284	176	109	167	86	53	81
27	133	273	e135	208	e125	270	180	105	160	83	52	86
28	130	253	e130	199	e125	257	175	103	155	78	54	83
29	127	235	e135	190	--	244	174	101	151	71	59	96
30	124	221	164	e180	--	230	175	99	150	66	66	96
31	122	--	222	174	--	220	--	110	--	62	72	--
TOTAL	3779	6659	5342	8013	3947	5582	5484	4247	5434	3171	1701	2640
MEAN	122	222	172	258	141	180	183	137	181	102	54.9	88.0
MAX	178	294	222	436	171	287	224	204	338	153	72	115
MIN	81	124	130	174	125	120	164	99	101	62	43	71
CFSM	1.15	2.09	1.63	2.44	1.33	1.70	1.72	1.29	1.71	.97	.52	.83
IN.	1.33	2.34	1.87	2.81	1.39	1.96	1.92	1.49	1.91	1.11	.60	.93

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1963 - 1993, BY WATER YEAR (WY)

MEAN	62.2	82.5	107	108	114	154	159	119	98.1	65.5	53.2	53.6
MAX	150	222	177	258	218	336	259	226	254	144	148	120
(WY)	1987	1993	1983	1993	1968	1982	1978	1983	1989	1986	1981	1980
MIN	17.2	22.9	25.2	28.7	29.1	47.2	75.6	58.7	32.9	13.3	15.8	14.1
(WY)	1965	1965	1964	1963	1963	1964	1964	1963	1964	1988	1964	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1963 - 1993

ANNUAL TOTAL	44119	55999	
ANNUAL MEAN	121	153	97.9
HIGHEST ANNUAL MEAN			153
LOWEST ANNUAL MEAN			33.5
HIGHEST DAILY MEAN	294	Nov 25	782
LOWEST DAILY MEAN	33	Jul 9	5.7
ANNUAL SEVEN-DAY MINIMUM	35	Jul 6	45
INSTANTANEOUS PEAK FLOW			448
INSTANTANEOUS PEAK STAGE			5.49
INSTANTANEOUS LOW FLOW			42
ANNUAL RUNOFF (CFSM)	1.14		1.45
ANNUAL RUNOFF (INCHES)	15.48		19.65
10 PERCENT EXCEEDS	185		236
50 PERCENT EXCEEDS	114		152
90 PERCENT EXCEEDS	66		75
			34

(a) Aug. 4, 5, 1988.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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 575 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 above sea level (Indiana Michigan Power Co. bench mark). Prior to Oct. 1, 1951, at site 0.4 mi upstream at datum 4.2 ft higher.

REMARKS.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1590	1820	3590	3820	3380	2120	4720	3260	1600	2490	818	1780
2	1550	2110	3470	4300	3210	2190	4560	3160	1790	2260	904	1890
3	1550	2270	3450	4490	3010	2290	4340	3210	1830	2220	828	2280
4	1430	2620	3310	4940	2980	2340	4290	3150	1810	2180	1200	2510
5	1430	3010	3170	5470	2810	2310	4120	3180	1890	2040	969	2480
6	1430	3080	3040	6050	2900	2300	3960	3330	1890	1920	1030	2600
7	1410	3020	2940	6420	2850	2450	3800	3340	1910	1850	1080	2430
8	1340	2870	2780	6400	2710	2420	3600	3220	2230	1780	866	2070
9	1320	2890	2710	6240	2630	2570	3420	3140	3000	1710	1150	1850
10	1280	2780	2720	5760	2630	2770	3440	3020	3120	1730	1050	1830
11	1390	2650	2690	5250	2620	2830	3300	3020	3520	1760	1070	1740
12	1330	2820	2610	5150	2580	2900	3300	2790	3600	1830	1160	1850
13	1260	3150	2590	5020	2450	2940	3210	2500	3460	1830	1120	1610
14	1200	3790	2550	4880	2300	2770	3190	2420	3520	1780	1180	1560
15	1670	4100	2690	4690	2270	2580	3210	2340	3530	1650	860	2060
16	1980	4170	2590	4520	2470	2570	3090	2300	3300	1690	1050	2220
17	2130	4170	2760	4370	2410	2700	3210	2170	3220	1570	999	2150
18	2340	4080	2840	4130	2390	2630	3230	2170	3060	1570	851	2060
19	2800	3910	2890	3780	2140	2740	3190	2010	2790	1210	842	1920
20	2660	3720	3020	3340	2260	2870	3420	1970	2740	1260	880	1810
21	2610	3530	2950	3650	2380	2800	3640	1890	2320	1290	1120	1720
22	2470	3500	2870	3820	2230	2710	4030	1810	2570	1240	998	1840
23	2440	3610	2780	3920	2490	3080	3790	1810	2560	1240	1030	1760
24	2350	3530	2660	4250	2340	3710	3730	1860	2830	1260	1230	1610
25	2210	3830	2360	4330	2070	4200	3650	1880	2780	1260	1200	1690
26	2150	4090	2470	4250	2030	4740	3370	1650	2620	1380	1000	1590
27	2090	4110	2300	4180	2090	5000	3190	1810	2610	1480	1090	1650
28	1950	4120	2320	3920	2180	5120	3010	1730	2450	1370	1150	1780
29	1840	4020	2420	3700	---	5050	3150	1740	2370	1030	1220	1850
30	1770	3870	2770	3600	---	4920	3270	1720	2480	964	1620	2000
31	1740	---	3220	3630	---	4870	---	1740	---	1190	1670	---
TOTAL	56710	101340	87780	142270	70810	97490	107430	75340	79400	49784	33325	57990
MEAN	1829	3378	2830	4589	2529	3145	3581	2430	2647	1606	1075	1833
MAX	2800	4170	3590	6420	3380	5120	4720	3340	3600	2490	1670	2600
MIN	1200	1820	2300	3340	2030	2120	3010	1650	1600	964	818	1560
CFSM	.98	1.81	1.52	2.46	1.36	1.69	1.92	1.30	1.42	.86	.58	1.04
IN.	1.13	2.02	1.75	2.84	1.41	1.94	2.14	1.50	1.58	.99	.66	1.16

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1924 - 1993, BY WATER YEAR (WY)

	MEAN	1090	1321	1564	1732	1854	2565	2705	2128	1676	1173	945	953
MAX	3290	3378	4065	4589	3451	5335	7646	5009	5004	2953	2413	2286	
(WY)	1987	1993	1928	1993	1968	1982	1950	1943	1989	1937	1981	1980	
MIN	372	483	507	531	505	751	904	786	509	407	335	357	
(WY)	1964	1965	1964	1963	1963	1964	1931	1931	1964	1988	1964	1964	

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1924 - 1993

	ANNUAL TOTAL	739420	ANNUAL MEAN	2020	959619	2629	(a)1643	2856	1950
HIGHEST ANNUAL MEAN							580	1984	
LOWEST ANNUAL MEAN							10700	Jun 4 1989	
HIGHEST DAILY MEAN	4170	Nov 16	6420	Jan 7	818	Aug 1	39	Oct 19 1963	
LOWEST DAILY MEAN	619	Jul 3	956	Aug 15	6580	Jan 8	11400	Jun 4 1989	
ANNUAL SEVEN-DAY MINIMUM	790	Jun 30	7.83	Aug 11	325	Aug 11	(b)10.76	Apr 27 1950	
INSTANTANEOUS PEAK FLOW			1.41		1.41		.88		
INSTANTANEOUS PEAK STAGE			19.13		19.13		11.97		
INSTANTANEOUS LOW FLOW									
ANNUAL RUNOFF (CFSM)	1.08								
ANNUAL RUNOFF (INCHES)	14.74								
10 PERCENT EXCEEDS	2850		4110		3020				
50 PERCENT EXCEEDS	1990		2550		1380				
90 PERCENT EXCEEDS	1160		1250		622				

(a) Does not include water year 1924.

(b) Present datum.

## 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. WDR IN-92-1: 1991.

GAGE.--Water-stage recorder. Datum of gage is 815.00 ft above sea level.

REMARKS.--Records good.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	273	228	786	1120	628	e345	1140	608	334	489	231	227
2	257	366	726	1190	582	e340	1170	564	290	482	231	268
3	247	548	670	1200	568	367	1110	560	295	468	221	333
4	244	575	618	1430	538	408	1050	609	306	446	228	287
5	236	533	572	1740	522	439	1010	705	385	421	219	263
6	230	534	526	1920	510	448	963	751	420	397	227	276
7	225	566	504	1850	493	470	909	674	436	380	246	296
8	223	545	486	1800	478	512	857	616	886	366	238	274
9	246	505	465	1710	468	554	816	574	1480	338	228	262
10	251	482	467	1640	458	585	790	543	1680	410	233	249
11	243	470	460	1590	453	600	755	521	1370	436	242	239
12	234	534	450	1520	452	599	719	507	1170	452	233	233
13	225	719	442	1450	450	595	686	475	1090	422	228	225
14	227	838	437	1350	443	567	651	449	1070	396	217	224
15	257	830	434	1240	432	537	639	428	1140	392	210	281
16	279	811	474	1130	429	530	650	406	1130	372	216	281
17	262	821	515	1030	424	589	630	389	927	348	213	263
18	252	831	501	930	e410	610	598	374	808	335	203	253
19	246	790	478	e840	582	585	585	367	713	333	198	246
20	251	741	517	e770	e395	581	665	357	703	319	200	238
21	258	682	520	e760	e400	595	692	347	790	303	206	238
22	255	646	518	878	e395	624	640	337	781	285	207	232
23	251	753	493	916	e390	756	596	340	690	278	205	228
24	260	888	470	878	e385	964	575	362	606	275	214	222
25	243	884	e440	859	e370	1090	616	363	558	297	208	220
26	245	876	e420	821	e365	1140	702	336	546	295	209	244
27	234	888	e390	796	e360	1200	661	320	503	272	215	248
28	227	897	e370	768	e355	1220	616	313	505	245	226	269
29	226	891	e375	744	---	1200	607	296	516	231	224	259
30	223	855	487	691	---	1170	627	298	493	235	234	266
31	222	---	792	666	---	1120	---	328	---	232	234	---
TOTAL	7552	20527	15803	36227	12553	21337	22725	14117	22621	10950	6844	7644
MEAN	244	684	510	1169	448	688	757	455	754	353	221	255
MAX	279	897	792	1920	628	1220	1170	751	1680	489	246	333
MIN	222	228	370	666	355	340	575	296	290	231	198	220
CFSM	.67	1.90	1.41	3.24	1.24	1.91	2.10	1.26	2.09	.98	.61	.71
IN.	.78	2.12	1.63	3.73	1.29	2.20	2.34	1.45	2.33	1.13	.71	.79

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1968 - 1993, BY WATER YEAR (WY)

	MEAN	227	309	384	407	433	617	614	450	380	270	213	209
MAX	575	684	719	1169	836	1389	1089	811	1103	654	516	538	
(WY)	1987	1993	1983	1993	1969	1982	1978	1983	1981	1981	1981	1981	
MIN	96.3	96.7	157	173	143	311	324	233	132	104	92.5	85.8	
(WY)	1972	1972	1972	1977	1972	1970	1971	1971	1988	1988	1988	1971	

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1968 - 1993

	128809	198900	
ANNUAL TOTAL	352	545	
ANNUAL MEAN			374
HIGHEST ANNUAL MEAN			545
LOWEST ANNUAL MEAN			207
HIGHEST DAILY MEAN	897	1920	2340
LOWEST DAILY MEAN	125	198	42
ANNUAL SEVEN-DAY MINIMUM	140	205	69
INSTANTANEOUS PEAK FLOW		1930	2370
INSTANTANEOUS PEAK STAGE		7.16	7.85
ANNUAL RUNOFF (CFSM)	.97	1.51	1.04
ANNUAL RUNOFF (INCHES)	13.27	20.50	14.08
10 PERCENT EXCEEDS	564	1020	696
50 PERCENT EXCEEDS	302	465	300
90 PERCENT EXCEEDS	208	228	148

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level (levels by Indiana Department of Natural Resources).

REMARKS.--Records good. Flow regulated at times by dam at Waldron Lake.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	156	80	354	445	310	e129	433	263	177	222	42	53
2	146	147	339	472	291	e128	435	254	175	214	41	62
3	137	196	326	488	275	135	430	254	169	210	38	96
4	128	209	312	606	261	150	422	262	171	199	46	96
5	117	214	294	757	248	161	411	279	198	188	42	88
6	107	214	281	821	237	164	397	281	211	176	40	92
7	99	212	286	837	223	173	383	276	241	164	44	97
8	94	206	252	832	213	191	369	267	343	156	42	90
9	94	201	239	806	202	213	361	256	408	151	39	82
10	94	197	232	774	195	232	355	244	419	147	46	74
11	92	197	223	736	190	239	344	231	411	133	49	68
12	89	239	215	693	184	245	331	219	397	124	44	65
13	85	313	208	656	178	246	318	205	382	130	43	61
14	86	349	201	620	173	236	305	191	377	135	41	59
15	89	361	197	583	168	231	294	178	369	131	39	89
16	91	362	211	546	165	234	286	168	355	120	39	94
17	93	360	219	511	161	264	277	157	338	109	38	85
18	93	354	218	478	e153	272	267	148	321	100	36	76
19	91	342	215	e445	e150	269	262	139	307	95	35	86
20	91	327	214	416	e147	266	272	130	305	89	38	106
21	91	312	209	413	150	269	274	123	312	83	42	92
22	91	315	202	430	147	283	266	116	304	78	41	81
23	90	362	197	431	e144	342	259	115	291	75	39	73
24	89	392	190	430	e142	393	251	113	274	71	40	67
25	87	402	180	419	e139	417	263	110	264	70	40	65
26	85	404	159	400	e135	428	276	105	259	65	38	65
27	83	403	163	385	e132	434	275	108	252	58	41	67
28	81	395	160	371	e130	434	270	125	246	54	41	71
29	79	382	160	356	---	432	266	142	237	49	43	72
30	77	367	214	334	---	426	267	157	229	47	47	71
31	75	---	373	321	---	422	---	174	---	44	52	---
TOTAL	3000	8814	7223	16812	5243	8458	9619	5790	8742	3687	1286	2343
MEAN	96.8	294	233	542	187	273	321	187	291	119	41.5	78.1
MAX	156	404	373	837	310	434	435	281	419	222	52	106
MIN	75	80	159	321	130	128	251	105	169	44	35	53
CFSM	.68	2.07	1.64	3.82	1.32	1.92	2.26	1.32	2.05	.84	.29	.55
IN.	.79	2.31	1.89	4.40	1.37	2.22	2.52	1.52	2.29	.97	.34	.61

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1972 - 1993, BY WATER YEAR (WY)

	MEAN	88.0	127	153	166	156	268	250	169	143	86.4	60.0	69.2
MAX	272	314	341	542	272	553	530	324	400	211	130	161	161
(WY)	1987	1973	1986	1993	1990	1985	1985	1981	1981	1981	1981	1972	1972
MIN	17.8	17.8	46.5	42.2	43.2	118	133	67.2	18.1	16.4	18.3	22.1	22.1
(WY)	1975	1972	1972	1977	1972	1989	1987	1988	1988	1988	1978	1974	1974

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1972 - 1993

ANNUAL TOTAL	51172	81017	145
ANNUAL MEAN	140	222	222
HIGHEST ANNUAL MEAN			85.7
LOWEST ANNUAL MEAN			1993
HIGHEST DAILY MEAN	404	837	916
LOWEST DAILY MEAN	13	35	(a)2.2
ANNUAL SEVEN-DAY MINIMUM	26	38	2.8
INSTANTANEOUS PEAK FLOW		839	919
INSTANTANEOUS PEAK STAGE		7.60	8.12
ANNUAL RUNOFF (CFSM)	.98	1.56	1.02
ANNUAL RUNOFF (INCHES)	13.41	21.22	13.83
10 PERCENT EXCEEDS	222	414	307
50 PERCENT EXCEEDS	121	199	113
90 PERCENT EXCEEDS	52	56	32

(a) Caused by regulation.

(e) Estimated.



## 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 sea level. Prior to Nov. 20, 1931, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Occasional low-flow regulation at Goshen Dam, 3.4 mi upstream.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	543	387	1000	3200	1140	e540	1800	999	589	865	265	289
2	559	423	1180	2130	1080	e560	2020	956	558	867	269	359
3	553	1100	1120	1740	1030	590	1630	972	542	933	264	494
4	533	1290	1050	2690	991	709	1430	1040	541	911	271	457
5	504	1070	969	4420	950	765	1340	1410	652	833	279	415
6	429	742	908	3600	927	738	1280	1460	663	783	292	443
7	284	612	862	3060	891	786	1220	1130	740	754	285	482
8	458	932	794	2760	866	974	1170	1020	2320	728	280	435
9	494	656	751	2550	833	1200	1160	956	4570	686	289	398
10	398	816	817	2410	820	1290	1180	935	3550	656	301	370
11	374	802	656	2300	800	1180	1130	896	2380	666	317	344
12	313	1040	636	2190	794	1100	1080	842	1900	740	307	332
13	261	1810	730	2150	778	1080	1030	801	1560	629	320	320
14	284	2080	736	2070	762	1010	995	767	1530	596	295	330
15	555	1580	736	1920	746	934	997	731	1570	577	278	450
16	368	1320	935	1780	e720	964	1020	686	1380	549	291	497
17	252	1270	1030	1860	e700	1370	1000	649	1230	518	283	430
18	270	1230	878	1540	e620	1330	941	607	1130	492	270	398
19	320	1190	829	1380	e585	1100	931	570	1060	481	259	370
20	461	1150	832	1310	e580	1030	1180	544	1030	443	254	358
21	430	1120	813	1490	e580	1040	1230	519	1160	408	236	380
22	358	1100	790	2020	e575	1140	1020	500	1190	386	229	358
23	276	1080	806	1980	e560	1740	951	518	1040	371	231	341
24	242	1520	e780	1750	e550	2300	895	546	956	361	232	324
25	257	1320	e740	1670	e550	1930	1040	508	914	384	229	324
26	264	1250	e710	1490	e550	1680	1300	483	872	379	224	373
27	357	1240	e700	1430	e550	1550	1040	466	839	350	210	410
28	400	1220	424	1380	e540	1490	967	457	832	324	213	537
29	315	1200	582	1330	---	1430	963	462	849	301	231	507
30	231	1180	968	1230	---	1370	1010	481	830	292	285	456
31	281	---	3240	1180	---	1360	---	582	---	274	295	---
TOTAL	11624	33710	28002	63810	21068	36280	34950	23493	38977	17537	8264	11981
MEAN	375	1124	903	2058	752	1170	1165	758	1299	566	267	399
MAX	559	2080	3240	4420	1140	2300	2020	1460	4570	933	320	537
MIN	231	387	424	1180	540	540	895	457	541	274	210	289
CFSM	.63	1.89	1.52	3.47	1.27	1.97	1.96	1.28	2.19	.95	.45	.67
IN.	.73	2.11	1.75	4.00	1.32	2.27	2.19	1.47	2.44	1.10	.52	.75

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1932 - 1993, BY WATER YEAR (WY)

	MEAN	315	394	501	595	695	948	947	703	494	355	268	254
MAX	1652	1132	1276	2058	1657	2497	2424	2354	1516	1079	712	784	
(WY)	1955	1973	1983	1993	1959	1982	1950	1943	1981	1951	1958	1958	
MIN	75.9	95.9	122	122	108	301	363	222	101	94.0	73.0	58.5	
(WY)	1965	1965	1964	1963	1963	1964	1946	1958	1934	1934	1941	1941	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1932 - 1993
ANNUAL TOTAL	215203	329696	
ANNUAL MEAN	588	903	538
HIGHEST ANNUAL MEAN			1005
LOWEST ANNUAL MEAN			197
HIGHEST DAILY MEAN	3240	4570	6010
LOWEST DAILY MEAN	20	210	(a)7.0
ANNUAL SEVEN-DAY MINIMUM	162	224	50
INSTANTANEOUS PEAK FLOW		4870	6360
INSTANTANEOUS PEAK STAGE		10.09	11.94
ANNUAL RUNOFF (CFSM)	.99	1.52	.91
ANNUAL RUNOFF (INCHES)	13.48	20.65	12.31
10 PERCENT EXCEEDS	969	1600	1110
50 PERCENT EXCEEDS	531	786	387
90 PERCENT EXCEEDS	265	290	154

(a) Caused by regulation.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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 from the Indiana District Office.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Flow regulated by Elkhart Hydroelectric Plant.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3070	3080	6270	9880	6440	3950	e9830	5860	3160	4720	1990	2890
2	3020	3780	6020	8700	5890	3950	e10000	5610	3200	4580	1830	3250
3	3030	4390	6050	8590	5670	4040	e9280	5630	3350	4520	1910	4020
4	2810	5060	5730	10100	5490	4310	e8270	5790	3270	4430	2110	3970
5	2800	5170	5530	13900	5280	4430	e7450	6160	3650	4090	1940	3930
6	2730	5040	5240	14000	5230	4390	e7240	6520	3610	3900	2000	4100
7	2560	4750	5040	13600	5200	4540	e7100	6300	4300	3750	2360	4020
8	2530	4950	4810	13100	5020	4970	e7080	5940	6600	3640	2020	3690
9	2640	4680	4640	12400	4820	5320	e6860	5580	10700	3510	2060	3240
10	2620	4820	4620	11600	4790	e6170	e6640	5400	11600	3490	2170	3130
11	2510	4590	4720	10500	4730	e6450	e6520	5290	9710	3600	2180	3050
12	2550	5230	4350	10600	4720	e5930	e6270	5040	8670	3870	2230	2830
13	2390	6590	4450	10200	4570	e6060	e6240	4590	7780	3690	2200	2790
14	2280	7190	4340	9800	4430	e5700	e6080	4400	7630	3580	2330	2860
15	2930	7420	4580	9330	4260	e5420	e6240	4230	7790	3420	1930	3730
16	3440	7130	4820	8820	4440	e4880	e6370	4120	7390	3260	2000	3790
17	3250	7020	5080	8390	4410	e6280	e5940	3880	6610	3210	2050	3680
18	3580	6930	5080	7880	4220	e6480	e5950	3910	6600	2800	1840	3520
19	3930	6700	5080	7010	3870	e5900	e6120	3680	5780	2800	1780	3270
20	3880	6460	5140	6600	4170	e5690	e5980	3540	5770	2650	2010	3300
21	4130	6200	5030	7290	4500	e5950	e7190	3530	5280	2680	1980	2970
22	3690	6050	4880	8130	4220	e9050	e6970	3350	5550	2680	1990	3210
23	3690	6210	4770	8220	4290	e7310	e550	3340	5470	2550	1840	2810
24	3450	6590	4720	8200	4330	e9560	e290	3410	5320	2520	2270	2880
25	3260	6530	4230	8080	3750	e9560	e430	3440	5440	2570	2140	2860
26	3380	6870	4170	7630	3880	e9370	e570	3160	5020	2550	1990	3000
27	3240	6820	4110	7680	3840	e9280	e6010	3170	4890	2850	2030	3090
28	3250	6870	4250	7310	3960	e9280	e5730	3200	4810	2520	2160	3430
29	3050	6770	4010	6960	---	e9190	e5750	3100	4530	2330	2220	3440
30	2830	6590	5080	6350	---	e8960	e5810	3100	4640	1950	2630	3440
31	2760	---	8150	6630	---	e8900	---	3270	---	2120	2890	---
TOTAL	95280	176480	154990	287380	130420	198270	205760	137540	178020	100830	65080	100090
MEAN	3074	5683	5000	9270	4658	6396	6859	4437	5934	3253	2099	3336
MAX	4130	7420	8150	14000	6440	9560	10000	6520	11600	4720	2890	4100
MIN	2280	3080	4010	6350	3750	3950	5730	3100	3160	1950	1780	2790
CFSM	.91	1.75	1.48	2.75	1.38	1.90	2.04	1.32	1.76	.97	.62	.99
IN.	1.05	1.95	1.71	3.17	1.44	2.19	2.27	1.52	1.97	1.11	.72	1.10

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1948 - 1993, BY WATER YEAR (WY)

	MEAN	2183	2619	3231	3615	3865	5169	5289	4113	3237	2396	1946	1897
MAX	5752	5883	5795	9270	7039	10760	12690	7725	7535	4409	4180	3855	
(WY)	1987	1993	1991	1993	1968	1982	1950	1956	1989	1968	1981	1981	
MIN	791	856	958	1127	1120	1679	2633	1911	1280	898	737	721	
(WY)	1964	1965	1964	1964	1963	1964	1958	1958	1988	1988	1964	1964	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1948 - 1993

ANNUAL TOTAL	1333370												
ANNUAL MEAN	3643												
HIGHEST ANNUAL MEAN													
LOWEST ANNUAL MEAN													
HIGHEST DAILY MEAN	8150												
LOWEST DAILY MEAN	1400												
ANNUAL SEVEN-DAY MINIMUM	1570												
INSTANTANEOUS PEAK FLOW													
INSTANTANEOUS PEAK STAGE													
ANNUAL RUNOFF (CFSM)	1.08												
ANNUAL RUNOFF (INCHES)	14.72												
10 PERCENT EXCEEDS	5020												
50 PERCENT EXCEEDS	3640												
90 PERCENT EXCEEDS	2170												

(e) Estimated.

## 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 sea level. 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 sea level datum). 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.--Water-discharge records good. Flow regulated by powerplants upstream from station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3590	3300	7080	12000	7110	4460	10700	6710	3680	5100	2430	3120
2	3430	4850	6370	10200	6270	4270	10900	6290	3640	5030	1750	3740
3	3310	5700	6700	9400	6290	4540	10100	6230	3840	5060	2000	4500
4	3290	5710	6480	11700	6000	4830	9000	6580	3930	4700	2170	4450
5	3130	5770	6000	16100	5520	5160	8110	7030	3890	4730	2380	4170
6	3040	5870	5860	16000	5610	5040	7880	7240	4140	4100	2110	4370
7	3070	5490	5480	14200	5550	5010	7730	7220	4770	4020	2260	4540
8	2800	5130	5370	13600	5500	5440	7700	6710	8710	4100	2370	4130
9	3110	5490	5060	12900	5370	6440	7460	6300	13600	3790	2150	3390
10	2880	5110	5100	12200	5140	6710	7230	6300	14900	3720	2520	3300
11	3030	5350	5220	11000	5240	7020	7100	5840	11400	4010	2320	3070
12	2700	5830	5020	10800	5230	6450	6820	5850	9960	4100	2360	3300
13	2880	8070	4850	10800	5080	6590	6790	5300	9070	4070	2390	2830
14	2690	8320	4950	10500	4930	6200	6620	5040	8410	3780	2350	3260
15	3020	8030	4900	9960	4910	5900	6790	4870	9020	3830	2480	4460
16	3970	7940	5430	9490	4700	5310	6930	4710	8280	3480	2120	4210
17	3900	7690	5790	9020	5060	6840	6460	4550	7510	3430	2220	3980
18	3730	7510	5630	8440	4680	7050	6470	4470	7300	3340	2090	3960
19	4110	7450	5490	7060	4340	6420	6660	4480	7000	2780	1990	3610
20	4570	6920	5610	6530	4800	6190	7600	4340	6030	2990	1810	3280
21	4260	6740	5750	6620	4760	6470	7820	3960	6160	2790	2220	3550
22	4370	6760	5350	8080	4980	6580	7580	3910	5850	2860	2200	3110
23	4010	7070	5350	8090	4740	7950	7520	3970	5940	2760	2120	3610
24	4080	6840	5180	7970	4830	10400	7030	4080	5790	2730	2120	2770
25	3640	7360	5060	7860	4510	10400	7170	3900	6030	2750	2390	3040
26	3630	7340	4270	7570	4300	10200	7440	3980	5500	2860	2280	3380
27	3660	7470	4460	7290	4360	10100	7010	3320	5290	2700	2280	3450
28	3530	7310	4540	7520	4380	10100	6450	3750	5520	3220	2140	4000
29	3500	7480	4650	7500	---	10000	6470	3510	5110	2380	2690	3690
30	3210	7030	5360	6620	---	9750	6510	3800	5010	2300	2690	3910
31	3170	---	9940	7090	---	9680	---	3790	---	2100	3010	---
TOTAL	107310	196930	172300	304110	144190	217500	226050	158030	205280	109610	70330	110180
MEAN	3462	6564	5558	9810	5150	7016	7535	5098	6843	3536	2269	3673
MAX	4570	8320	9940	16100	7110	10400	10900	7240	14900	5100	3010	4540
MIN	2690	3300	4270	6530	4300	4270	6450	3320	3640	2100	1750	2770
CFSM	.94	1.79	1.52	2.68	1.40	1.91	2.06	1.39	1.87	.96	.62	1.00
IN.	1.09	2.00	1.75	3.09	1.46	2.21	2.29	1.60	2.08	1.11	.71	1.12

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	2315	2710	3152	3568	3894	5261	5484	4383	3442	2529	2087	2042
MAX	6217	6564	6689	9810	7371	11560	13590	10760	8176	4989	4497	4103	
(WY)	1987	1993	1991	1993	1968	1962	1950	1943	1969	1981	1981	1981	
MIN	1056	932	1131	1239	1196	1857	2164	1579	1254	1033	828	885	
(WY)	1964	1965	1964	1964	1964	1964	1931	1931	1934	1934	1941	1941	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1931 - 1993

ANNUAL TOTAL	1511200												
ANNUAL MEAN	4129						2021820						
HIGHEST ANNUAL MEAN							5539						
LOWEST ANNUAL MEAN										3402			
HIGHEST DAILY MEAN										5718			1950
LOWEST DAILY MEAN										1464			1964
ANNUAL SEVEN-DAY MINIMUM				9940		Dec 31	16100		Jan 5	19800		Mar 21	1982
INSTANTANEOUS PEAK FLOW				1680		Jul 1	1750		Aug 2	420		Aug 30	1931
INSTANTANEOUS PEAK STAGE				1870		Jul 4	2080		Aug 18	728		Aug 26	1941
ANNUAL RUNOFF (CFSM)							17100		Jan 5	20200		Apr 5	1950
ANNUAL RUNOFF (INCHES)							13.77		Jan 5	(a)15.10		Apr 5	1950
10 PERCENT EXCEEDS							1.51			.93			
50 PERCENT EXCEEDS							20.52			12.61			
90 PERCENT EXCEEDS													

(a) Present datum.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

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.--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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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, (PER-0.7 UM-MF (COLS./100 ML) (31625)
JAN 05...	1650	16800	372	8.1	5.0	64	13.6	108	K1800
MAR 30...	1440	9750	481	8.3	10.5	4.9	11.7	108	1100
MAY 11...	1500	6020	539	8.4	21.5	5.0	--	--	K200
JUL 07...	1430	3920	547	8.4	25.0	1.2	8.6	107	780
AUG 24...	1230	1920	566	8.4	25.0	2.1	8.2	102	K1300

DATE	STREP-TOCOCOI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	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)
JAN 05...	>10000	170	39	48	12	6.7	3.7	159	--
MAR 30...	K1100	240	57	67	17	9.3	2.2	220	--
MAY 11...	K54	270	45	74	20	11	1.8	261	5
JUL 07...	680	280	61	76	21	13	1.9	259	2
AUG 24...	200	280	47	69	22	17	2.0	--	--

DATE	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)	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) (00613)
JAN 05...	130	29	15	0.10	6.0	225	0.31	10200	0.030
MAR 30...	180	38	17	0.10	5.4	290	0.39	7630	0.030
MAY 11...	222	40	21	0.20	4.7	308	0.42	5010	0.020
JUL 07...	216	41	23	0.20	8.6	337	0.46	3570	0.010
AUG 24...	216	46	32	0.20	6.9	332	0.45	1720	0.020



## STREAMS TRIBUTARY TO LAKE MICHIGAN

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	NITRO- GEN, NO <sub>2</sub> +NO <sub>3</sub> DIS- SOLVED (MG/L AS N) (00631)	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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)
JAN 05...	1.90	0.120	1.2	0.270	0.070	0.070	<10
MAR 30...	1.80	0.040	0.60	0.040	0.040	<0.010	<10
MAY 11...	1.30	0.020	0.60	0.050	<0.010	<0.010	--
JUL 07...	1.40	0.020	0.40	0.040	<0.010	<0.010	20
AUG 24...	1.40	0.030	0.30	0.020	0.010	<0.010	<10

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)
JAN 05...	33	<3	25	<4	9	<10	<1
MAR 30...	43	<3	22	<4	11	<10	<1
MAY 11...	--	--	--	--	--	--	--
JUL 07...	60	<3	3	<4	<1	<10	1
AUG 24...	59	<3	3	<4	3	<10	<1

DATE	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)	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)
JAN 05...	<1	<1.0	81	<6	169	7670	87
MAR 30...	<1	<1.0	110	<6	18	474	78
MAY 11...	--	--	--	--	29	471	67
JUL 07...	<1	<1.0	140	<6	21	222	87
AUG 24...	<1	<1.0	120	<6	17	88	89

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level.

REMARKS.--Records good. Flow regulated by millpond and lake-level control dam upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	301	296	362	748	399	341	569	545	302	362	188	466
2	286	597	365	586	378	353	552	491	293	350	188	456
3	274	694	385	555	367	365	519	489	290	341	182	564
4	263	577	371	635	364	419	488	498	288	322	183	498
5	254	504	363	1030	365	433	471	516	329	302	181	408
6	250	490	352	820	368	422	456	486	313	286	201	374
7	248	469	350	666	360	435	442	454	309	273	241	355
8	245	432	346	586	358	448	437	432	430	267	224	394
9	268	414	340	531	357	495	453	408	703	271	218	331
10	276	421	351	497	359	500	462	394	585	299	226	306
11	272	462	360	482	369	470	448	378	450	285	229	287
12	266	583	375	475	364	438	469	362	393	278	220	281
13	259	757	374	544	360	413	460	347	357	261	216	273
14	262	643	375	539	356	382	438	337	492	266	209	304
15	356	557	378	513	352	369	483	329	554	265	204	630
16	449	509	523	490	353	406	552	319	440	252	232	532
17	441	484	489	472	350	529	498	313	387	243	223	432
18	403	452	441	451	336	493	455	310	385	239	214	384
19	378	429	415	422	339	444	466	308	401	260	210	355
20	366	418	419	416	349	430	1170	302	510	247	210	334
21	375	415	380	479	350	427	1120	300	493	233	199	339
22	350	416	366	611	355	455	788	292	433	221	193	334
23	334	449	364	575	357	699	650	304	389	220	192	319
24	323	426	357	573	353	860	578	317	358	220	316	305
25	313	409	344	527	340	840	538	303	351	228	287	302
26	308	410	330	469	353	785	503	295	348	232	259	428
27	301	401	319	445	329	724	478	287	361	217	243	480
28	296	387	319	443	342	659	466	283	366	208	257	557
29	293	375	381	428	---	602	522	280	365	201	416	504
30	288	367	571	398	---	557	629	279	353	197	526	556
31	284	---	944	391	---	533	---	311	---	192	546	---
TOTAL	9582	14243	12409	16997	9982	15726	16560	11269	12028	8038	7633	12028
MEAN	309	475	400	548	356	507	552	364	401	259	246	401
MAX	449	757	944	1030	399	860	1170	545	703	362	546	630
MIN	245	296	319	391	329	341	437	279	288	192	181	273
CFSM	1.21	1.86	1.57	2.15	1.40	1.99	2.16	1.43	1.57	1.02	.97	1.57
IN.	1.40	2.08	1.81	2.48	1.46	2.29	2.42	1.64	1.75	1.17	1.11	1.75

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1993, BY WATER YEAR (WY)

	MEAN	255	304	336	314	331	412	408	333	268	218	192	212
MAX	530	490	513	548	508	629	552	490	404	333	326	401	401
(WY)	1987	1991	1992	1993	1985	1985	1993	1981	1981	1978	1992	1993	1993
MIN	132	179	179	166	177	251	297	205	142	133	101	112	112
(WY)	1964	1965	1964	1963	1963	1964	1971	1964	1964	1988	1964	1964	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1961 - 1993

ANNUAL TOTAL	130932	146495	298
ANNUAL MEAN	358	401	401
HIGHEST ANNUAL MEAN			177
LOWEST ANNUAL MEAN			1993
HIGHEST DAILY MEAN	944	Dec 31	1550
LOWEST DAILY MEAN	155	Jul 11	87
ANNUAL SEVEN-DAY MINIMUM	179	Jul 6	89
INSTANTANEOUS PEAK FLOW			1590
INSTANTANEOUS PEAK STAGE		1290	Apr 20
INSTANTANEOUS LOW FLOW		8.21	Apr 20
ANNUAL RUNOFF (CFSM)	1.40	178	Aug 6
ANNUAL RUNOFF (INCHES)	19.10	1.57	1.17
10 PERCENT EXCEEDS	466	21.37	15.90
50 PERCENT EXCEEDS	361	560	461
90 PERCENT EXCEEDS	241	369	276
		243	162

## 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 sea level. May 10, 1966, to July 11, 1967, nonrecording gage at same site and datum.

REMARKS.--Records good. Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	388	385	540	1020	587	468	921	773	389	659	334	606
2	374	472	523	899	571	458	865	753	393	620	331	565
3	352	630	511	903	552	467	812	749	402	583	316	562
4	331	806	505	1180	535	503	767	762	398	534	302	596
5	314	723	492	1660	525	559	731	764	426	485	301	594
6	304	726	476	1510	520	595	698	718	433	448	366	571
7	295	794	466	1380	508	628	666	676	435	411	429	564
8	294	847	458	1510	499	664	632	646	471	390	438	563
9	304	830	450	e1350	493	706	613	619	560	398	438	527
10	301	760	447	e1250	489	758	604	594	625	471	441	462
11	321	687	449	1190	488	761	596	560	587	539	405	409
12	338	676	457	960	493	746	596	525	548	578	366	390
13	335	784	469	853	495	728	623	491	528	633	373	374
14	332	938	481	810	487	690	630	467	528	705	361	402
15	368	823	494	787	483	644	621	451	516	708	348	518
16	399	791	535	766	480	607	640	436	508	618	349	630
17	450	825	624	756	476	654	683	424	483	519	335	613
18	460	863	635	745	469	743	671	417	477	477	327	595
19	462	825	625	e720	e470	709	656	413	517	471	324	610
20	484	730	633	e670	470	699	895	406	614	464	315	610
21	514	659	633	693	463	709	1320	400	740	459	304	581
22	525	630	602	733	469	711	1160	396	715	453	301	555
23	510	634	566	802	470	761	1290	398	658	423	293	524
24	485	634	535	799	469	1000	1430	398	631	395	358	498
25	459	616	503	829	e475	1050	1220	407	628	427	390	490
26	440	595	472	e820	477	1090	1030	413	597	457	384	536
27	426	590	e460	814	463	1250	878	408	566	467	367	620
28	410	594	437	764	473	1290	783	406	610	467	356	734
29	396	586	442	713	---	1180	732	393	645	445	351	797
30	388	565	524	656	---	1070	747	386	684	398	382	789
31	382	---	762	614	---	978	---	392	---	359	475	---
TOTAL	12141	21018	16206	29156	13849	23876	24510	16041	16312	15461	11160	16885
MEAN	392	701	523	941	495	770	817	517	544	499	360	563
MAX	525	938	762	1660	587	1290	1430	773	740	708	475	797
MIN	294	385	437	614	463	458	596	386	389	359	293	374
CFSM	1.00	1.80	1.34	2.41	1.27	1.97	2.09	1.33	1.39	1.28	.92	1.44
IN.	1.16	2.00	1.55	2.78	1.32	2.28	2.34	1.53	1.56	1.47	1.06	1.61

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

	MEAN	380	444	516	511	534	687	657	509	398	320	283	306
MAX	1217	826	906	1038	842	1234	961	799	686	581	557	569	
(WY)	1987	1989	1991	1952	1981	1979	1985	1974	1969	1982	1980	1975	
MIN	178	223	232	226	256	390	361	287	200	180	163	158	
(WY)	1964	1954	1959	1959	1963	1957	1958	1958	1964	1963	1964	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1952 - 1993

ANNUAL TOTAL	181961	216615	462
ANNUAL MEAN	497	593	606
HIGHEST ANNUAL MEAN			1991
LOWEST ANNUAL MEAN			1964
HIGHEST DAILY MEAN	938	1660	3460
LOWEST DAILY MEAN	272	293	120
ANNUAL SEVEN-DAY MINIMUM	283	305	134
INSTANTANEOUS PEAK FLOW		1750	3580
INSTANTANEOUS PEAK STAGE		9.22	10.90
INSTANTANEOUS LOW FLOW		290	99
ANNUAL RUNOFF (CFSM)	1.27	1.52	1.18
ANNUAL RUNOFF (INCHES)	17.36	20.66	16.08
10 PERCENT EXCEEDS	696	827	780
50 PERCENT EXCEEDS	491	536	401
90 PERCENT EXCEEDS	306	374	230

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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-81-1: 1973-75(M), 1979(M).

GAGE.--Water-stage recorder. Elevation of gage is 610 ft above sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	47	92	369	103	68	188	212	54	85	55	90
2	43	112	89	262	98	71	209	153	49	79	53	76
3	41	185	93	209	91	76	189	122	48	74	51	92
4	39	166	91	456	86	97	163	121	46	70	48	101
5	37	142	87	868	84	113	142	142	72	64	47	82
6	37	132	83	656	85	126	128	133	77	58	93	70
7	36	125	81	472	82	153	117	115	69	53	177	65
8	36	111	79	349	80	159	111	103	84	47	132	61
9	36	99	77	276	78	188	113	86	156	254	99	59
10	39	98	78	e210	77	186	113	93	154	448	83	57
11	39	104	79	e180	78	167	108	84	111	375	83	54
12	39	129	83	e150	77	143	122	78	91	234	74	54
13	38	235	84	155	77	125	118	71	78	139	66	55
14	40	216	88	175	76	108	108	66	81	120	61	79
15	57	165	95	167	75	e95	110	64	95	107	57	256
16	66	141	168	151	74	108	157	59	87	90	57	223
17	71	133	176	139	73	225	145	57	76	79	55	152
18	67	123	146	e120	e72	211	122	56	97	88	53	114
19	62	110	124	e115	e71	160	128	56	176	113	51	94
20	60	101	125	e125	e71	133	753	55	325	99	49	82
21	62	97	113	e140	72	125	816	53	450	83	48	79
22	60	102	99	195	72	143	518	51	318	72	46	79
23	58	148	96	221	72	290	350	52	212	65	45	74
24	55	152	93	226	72	498	276	58	153	73	60	69
25	54	131	e89	206	e71	479	235	58	111	123	59	66
26	52	125	e84	161	e69	405	180	55	97	152	53	98
27	50	131	e79	134	e68	343	142	52	104	108	49	171
28	49	121	e75	125	e67	293	128	53	103	83	48	260
29	48	108	83	118	---	247	130	52	103	70	50	207
30	48	98	175	106	---	207	225	50	91	64	55	211
31	47	---	374	100	---	171	---	54	---	59	83	---
TOTAL	1512	3887	3378	7336	2171	5913	6344	2514	3768	3628	2040	3230
MEAN	48.8	130	109	237	77.5	191	211	81.1	126	117	65.8	108
MAX	71	235	374	868	103	498	816	212	450	448	177	260
MIN	36	47	75	100	67	68	108	50	46	47	45	54
CFSM	.58	1.55	1.30	2.83	.93	2.28	2.53	.97	1.50	1.40	.79	1.29
IN.	.67	1.73	1.50	3.26	.97	2.63	2.82	1.12	1.68	1.61	.91	1.44

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1993, BY WATER YEAR (WY)

	MEAN	67.9	97.0	138	124	137	173	106	84.0	61.0	45.5	62.9
MAX	362	282	272	244	263	389	327	182	248	181	141	329
(WY)	1987	1991	1983	1973	1976	1979	1975	1975	1980	1986	1980	1986
MIN	33.8	46.7	44.5	42.8	74.4	104	68.9	44.4	31.7	28.4	27.9	29.7
(WY)	1975	1972	1977	1977	1987	1981	1971	1971	1971	1988	1988	1969

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1966 - 1993

ANNUAL TOTAL	31501	45721	
ANNUAL MEAN	86.1	125	108
HIGHEST ANNUAL MEAN			133
LOWEST ANNUAL MEAN			72.8
HIGHEST DAILY MEAN	374	Dec 31	868
LOWEST DAILY MEAN	30	Aug 23	36
ANNUAL SEVEN-DAY MINIMUM	31	Aug 20	37
INSTANTANEOUS PEAK FLOW			978
INSTANTANEOUS PEAK STAGE			10.88
INSTANTANEOUS LOW FLOW			35
ANNUAL RUNOFF (CFSM)	1.03		1.50
ANNUAL RUNOFF (INCHES)	14.02		20.34
10 PERCENT EXCEEDS	152		222
50 PERCENT EXCEEDS	75		93
90 PERCENT EXCEEDS	37		51

(a) From rating curve extended above 1,200 ft<sup>3</sup>/s.

(b) Oct. 8, 9.

(c) Sept. 28, 1966, Aug. 18, 19, 1984.

(e) Estimated.



## 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 sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	172	199	315	566	321	254	611	431	253	319	205	231
2	167	321	305	512	306	257	585	409	244	302	198	282
3	163	361	297	478	298	269	556	425	240	288	192	373
4	158	378	289	579	292	299	528	414	233	277	193	347
5	157	362	278	712	292	317	503	446	298	264	195	298
6	154	338	265	758	295	315	479	473	297	251	209	282
7	153	302	260	726	294	330	456	468	306	239	224	267
8	158	274	252	665	287	367	439	446	378	231	212	248
9	186	256	249	583	283	413	445	413	465	331	204	237
10	179	256	257	505	279	435	462	380	490	322	200	225
11	181	265	254	467	282	424	458	354	452	319	199	213
12	181	374	256	454	289	401	458	336	401	321	196	213
13	174	543	262	461	288	382	438	317	369	308	193	206
14	191	601	273	443	286	359	421	307	362	297	190	212
15	308	567	279	428	281	352	424	299	344	273	184	288
16	447	514	317	414	283	358	425	287	318	255	186	292
17	462	447	332	399	283	380	425	282	298	247	186	280
18	441	382	322	372	276	394	420	277	274	257	183	266
19	397	343	302	360	279	376	417	276	311	323	178	249
20	342	320	293	328	277	364	524	270	382	306	185	238
21	302	309	270	387	277	361	523	262	456	295	188	237
22	271	321	261	417	277	392	492	254	470	279	183	230
23	256	472	251	422	274	499	448	253	423	264	179	226
24	240	519	237	437	269	625	421	267	370	249	198	213
25	227	502	214	433	276	663	425	265	342	265	193	215
26	218	473	e200	391	269	680	450	261	359	276	189	255
27	210	424	e210	387	264	688	455	253	418	254	192	325
28	206	383	224	363	260	689	435	252	427	240	187	404
29	199	352	231	347	---	682	455	242	394	229	212	404
30	197	328	316	321	---	658	458	236	353	217	253	390
31	192	---	512	335	---	626	---	272	---	208	240	---
TOTAL	7288	11486	8583	14450	7937	13609	14036	10126	10727	8506	6126	8151
MEAN	235	383	277	466	283	439	468	327	358	274	198	272
MAX	462	601	512	758	321	689	611	473	490	331	253	404
MIN	153	199	200	321	260	254	417	236	233	208	178	206
CFSM	.88	1.43	1.04	1.75	1.06	1.64	1.75	1.22	1.34	1.03	.74	1.02
IN.	1.02	1.60	1.20	2.01	1.11	1.90	1.96	1.41	1.49	1.19	.85	1.14

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1987 - 1993, BY WATER YEAR (WY)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
MEAN	237	283	264	299	266	324	342	258	258	194	203
MAX	349	383	356	466	340	445	468	386	530	274	272
(WY)	1987	1988	1991	1993	1991	1990	1993	1990	1989	1993	1993
MIN	153	167	184	205	187	225	225	177	126	111	147
(WY)	1988	1988	1990	1987	1987	1987	1987	1987	1988	1988	1987

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1987 - 1993
ANNUAL TOTAL	87604	121025	
ANNUAL MEAN	239	332	259
HIGHEST ANNUAL MEAN			332
LOWEST ANNUAL MEAN			198
HIGHEST DAILY MEAN	601	758	1140
LOWEST DAILY MEAN	131	153	95
ANNUAL SEVEN-DAY MINIMUM	138	159	98
INSTANTANEOUS PEAK FLOW		762	1160
INSTANTANEOUS PEAK STAGE		9.05	10.18
INSTANTANEOUS LOW FLOW			88
ANNUAL RUNOFF (CFSM)	.90	1.24	.97
ANNUAL RUNOFF (INCHES)	12.21	16.86	13.18
10 PERCENT EXCEEDS	328	475	392
50 PERCENT EXCEEDS	221	299	237
90 PERCENT EXCEEDS	161	198	144

(e) Estimated.



## 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 sea level, 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.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	498	611	1090	1630	1000	725	2230	1330	717	874	507	626
2	470	850	1040	1690	910	748	2070	1230	672	788	498	668
3	461	1050	993	1910	864	790	1920	1210	648	739	475	846
4	453	1080	951	2100	852	848	1780	1250	632	690	468	885
5	440	1170	904	2370	844	890	1640	1300	739	593	461	803
6	440	1240	875	2730	859	909	1510	1300	779	570	553	745
7	434	1170	844	2810	838	929	1410	1310	790	551	607	703
8	442	1050	824	2540	839	1010	1320	1270	897	587	591	658
9	485	956	799	2050	814	1120	1300	1190	1180	728	562	616
10	504	913	782	1780	798	1210	1300	1080	1220	765	538	578
11	529	894	825	1570	798	1220	1300	978	1160	741	524	550
12	532	1100	796	1560	798	1200	1280	885	1090	688	511	535
13	510	1410	805	1530	792	1150	1270	841	976	651	489	532
14	568	1630	825	1410	785	1000	1220	791	997	624	478	632
15	737	1850	871	1350	790	947	1220	735	937	602	464	927
16	1060	1870	994	1290	786	997	1210	699	850	565	459	984
17	1090	1720	1080	1240	773	1070	1200	670	768	533	450	976
18	1120	1560	1060	1130	695	1060	1140	698	729	578	445	987
19	1180	1410	1060	1020	721	1070	1300	691	686	723	453	954
20	1190	1270	1040	993	756	1130	1810	634	887	746	457	862
21	1060	1170	939	1090	763	1080	2390	647	1010	722	442	794
22	984	1140	901	1220	768	1070	2990	636	1210	694	434	749
23	894	1360	859	1280	753	1320	2700	626	1340	642	431	701
24	841	1480	800	1370	722	1690	2220	672	1240	617	505	669
25	782	1550	689	1410	724	2010	1910	672	1050	621	475	652
26	735	1610	630	1370	749	2400	1700	671	937	664	483	735
27	701	1540	670	1320	725	2600	1530	641	925	655	529	782
28	677	1410	670	1270	720	2680	1410	622	965	637	531	928
29	645	1290	735	1160	---	2700	1370	604	999	612	598	1040
30	619	1170	1010	988	---	2610	1390	590	967	585	654	1110
31	600	---	1390	1080	---	2430	---	759	---	535	673	---
TOTAL	21681	38524	27791	48261	22236	42613	49040	27232	27997	20320	15745	23227
MEAN	699	1284	896	1557	794	1375	1635	878	933	655	508	774
MAX	1190	1870	1390	2810	1000	2700	2990	1330	1340	874	673	1110
MIN	434	611	630	988	695	725	1140	590	632	533	431	532
CFSM	.85	1.56	1.09	1.89	.96	1.67	1.98	1.07	1.13	.80	.62	.94
IN.	.98	1.74	1.25	2.18	1.00	1.92	2.21	1.23	1.26	.92	.71	1.05

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1937 - 1993, BY WATER YEAR (WY)

	484	581	653	675	764	1128	1115	846	678	484	412	432
MEAN	484	581	653	675	764	1128	1115	846	678	484	412	432
MAX	1446	1284	1248	1557	1500	2183	2834	1998	1703	1000	755	855
(WY)	1987	1993	1991	1993	1976	1948	1947	1943	1943	1943	1973	1975
MIN	173	204	215	229	218	317	441	336	238	186	189	167
(WY)	1964	1965	1964	1964	1964	1964	1946	1958	1964	1964	1964	1963

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1937 - 1993

ANNUAL TOTAL	295695											
ANNUAL MEAN	808											
HIGHEST ANNUAL MEAN												
LOWEST ANNUAL MEAN												
HIGHEST DAILY MEAN	1870											
LOWEST DAILY MEAN	395											
ANNUAL SEVEN-DAY MINIMUM	411											
INSTANTANEOUS PEAK FLOW												
INSTANTANEOUS PEAK STAGE												
INSTANTANEOUS LOW FLOW												
ANNUAL RUNOFF (CFSM)	.98											
ANNUAL RUNOFF (INCHES)	13.35											
10 PERCENT EXCEEDS	1180											
50 PERCENT EXCEEDS	758											
90 PERCENT EXCEEDS	461											

(a) Site and datum then in use.

(b) Oct. 8, Aug. 23.

(c) Site then in use.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level, from topographic map. Prior to June 15, 1965, nonrecording gage at same site and datum.

REMARKS.--Records good. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	38	51	90	50	45	85	67	44	68	39	45
2	38	65	50	74	45	46	83	63	43	63	37	48
3	36	71	51	71	46	48	78	62	45	59	36	55
4	34	63	49	93	45	53	72	66	45	55	36	54
5	32	58	49	114	46	52	67	69	56	52	35	50
6	33	55	48	107	48	50	63	65	53	47	47	48
7	33	50	47	89	45	52	61	61	55	42	62	46
8	33	47	46	75	45	55	60	58	68	41	61	44
9	39	45	46	66	44	57	68	55	75	50	57	45
10	39	45	48	58	44	57	73	50	69	54	51	47
11	39	46	49	61	46	56	69	48	60	52	47	44
12	43	64	49	59	45	54	67	46	52	49	44	43
13	41	76	49	63	45	52	64	44	48	45	42	45
14	43	73	50	64	45	47	60	43	58	49	44	51
15	68	69	51	63	45	47	63	43	62	49	45	74
16	76	65	67	62	45	52	65	42	57	47	43	69
17	68	63	67	60	45	60	64	42	52	45	41	62
18	63	61	62	54	42	56	63	43	49	53	40	56
19	56	57	58	52	46	52	66	43	59	56	39	50
20	52	54	57	53	45	51	131	42	85	51	39	47
21	51	53	51	60	45	51	157	42	92	47	37	48
22	47	56	50	68	47	54	134	41	81	45	35	48
23	44	75	48	65	46	79	103	43	67	42	35	46
24	42	75	46	64	43	101	86	51	57	42	41	45
25	40	68	42	61	44	95	81	51	53	46	40	44
26	39	65	42	52	47	95	76	40	57	47	43	57
27	38	61	41	57	41	97	71	39	67	44	44	60
28	37	57	41	53	45	97	67	39	74	43	42	61
29	37	55	47	51	---	95	69	38	76	41	42	58
30	36	52	70	46	---	92	71	38	73	39	44	54
31	36	---	92	50	---	86	---	46	---	37	45	---
TOTAL	1353	1782	1614	2055	1265	1984	2337	1520	1832	1500	1332	1544
MEAN	43.6	59.4	52.1	66.3	45.2	64.0	77.9	49.0	61.1	48.4	43.0	51.5
MAX	76	76	92	114	50	101	157	69	92	68	62	74
MIN	32	38	41	46	41	45	60	38	43	37	35	43
CFSM	1.12	1.53	1.34	1.70	1.16	1.65	2.00	1.26	1.57	1.24	1.10	1.32
IN.	1.29	1.70	1.54	1.97	1.21	1.90	2.23	1.45	1.75	1.43	1.27	1.48

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

	MEAN	40.8	46.2	48.8	44.1	46.3	58.1	60.6	48.2	43.6	35.9	33.6	37.5
MAX	85.2	67.3	65.3	66.3	66.3	81.3	86.9	81.8	73.2	51.4	53.8	70.7	
(WY)	1967	1966	1992	1993	1976	1985	1975	1975	1978	1986	1980	1986	
MIN	18.9	23.4	31.9	26.9	30.1	39.5	41.2	30.0	23.9	17.4	17.9	18.0	
(WY)	1965	1965	1965	1971	1970	1966	1971	1965	1968	1965	1984	1966	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1965 - 1993

ANNUAL TOTAL	17470	20118	45.3	
ANNUAL MEAN	47.7	55.1	57.5	1975
HIGHEST ANNUAL MEAN			30.3	1965
LOWEST ANNUAL MEAN			454	Jun 27 1978
HIGHEST DAILY MEAN	92	Dec 31	14	Aug 24 1984
LOWEST DAILY MEAN	24	Jul 11	14	Aug 21 1984
ANNUAL SEVEN-DAY MINIMUM	27	Jul 1	560	Jun 27 1978
INSTANTANEOUS PEAK FLOW			3.41	Jun 27 1978
INSTANTANEOUS PEAK STAGE			(a)8.9	Jan 26 1978
INSTANTANEOUS LOW FLOW			1.16	
ANNUAL RUNOFF (CFSM)	1.23	1.42	15.81	
ANNUAL RUNOFF (INCHES)	16.71	19.24	68	
10 PERCENT EXCEEDS	63	74	42	
50 PERCENT EXCEEDS	48	51	27	
90 PERCENT EXCEEDS	33	40		

(a) Result of freezeup.



## 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 sea level. Prior to Oct. 1, 1987, at datum 3.00 ft higher. Prior to November 1945, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	784	891	1560	1870	1290	1030	2970	1740	984	1410	722	989
2	745	909	1370	2000	1240	981	2630	1710	995	1320	775	1020
3	747	1240	1330	2040	1190	988	2480	1660	995	1230	780	1060
4	725	1580	1340	2570	1140	1060	2360	1600	986	1200	712	1220
5	532	1520	1330	2740	1150	1160	2130	1610	994	1100	713	1260
6	630	1480	1280	2810	1150	1180	1970	1710	1030	977	656	1170
7	642	1630	1250	3060	1160	1200	1780	1740	1080	962	787	1110
8	729	1530	1160	3380	1160	1280	1690	1650	1210	948	1000	1050
9	716	1470	1040	3250	1150	1390	1710	1610	1550	873	954	998
10	755	1320	1050	2440	1110	1510	1690	1370	1710	1220	875	967
11	773	1190	1090	2030	1080	1510	1670	1250	1650	1280	877	940
12	745	1380	1110	2030	1090	1510	1610	1270	1580	1100	780	831
13	773	1650	1110	2040	1080	1500	1610	1240	1430	1090	774	790
14	807	1800	1120	2000	1100	1460	1530	1120	1330	1060	690	872
15	969	1920	1210	1760	1100	1330	1520	1070	1420	1010	769	1100
16	1290	2240	1310	1650	1090	1220	1530	1050	1420	976	869	1420
17	1470	2280	1410	1650	1090	1340	1530	1010	1310	956	640	1450
18	1480	2200	1490	1560	1080	1430	1520	981	1060	849	568	1300
19	1470	2040	1450	1260	980	1400	1510	976	1080	982	654	1260
20	1540	1730	1430	1170	988	1400	2070	971	1290	1020	864	1280
21	1540	1570	1370	1570	1020	1420	2340	939	1460	1040	819	1240
22	1400	1580	1220	1680	1030	1410	2650	783	1560	1040	486	1170
23	1270	1600	1170	1590	1040	1540	3370	806	1690	1020	640	1090
24	1180	1760	1170	1610	1040	1840	3440	855	1780	1000	724	1080
25	1180	1870	1130	1640	1010	2160	2820	1030	1630	982	851	1030
26	1130	1860	1020	1660	1080	2350	2100	1060	1440	973	832	1030
27	1060	1900	844	1650	1090	2590	2130	1090	1380	972	646	1120
28	982	1900	877	1630	1060	3010	1980	965	1410	965	760	1230
29	977	1810	1020	1560	--	3190	1700	954	1490	954	946	1380
30	968	1700	1120	1440	--	3260	1690	926	1480	870	820	1490
31	954	--	1570	1350	--	3150	--	861	--	790	796	--
TOTAL	30963	49550	37951	60690	30788	51799	61730	37607	40424	32169	23779	33927
MEAN	999	1652	1224	1958	1100	1671	2058	1213	1347	1038	767	1131
MAX	1540	2280	1570	3380	1290	3260	3440	1740	1780	1410	1000	1490
MIN	532	891	844	1170	980	981	1510	783	984	790	486	790
CFSM	.99	1.64	1.21	1.94	1.09	1.65	2.04	1.20	1.33	1.03	.76	1.12
IN.	1.14	1.83	1.40	2.24	1.13	1.91	2.27	1.39	1.49	1.18	.88	1.25

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	670	783	857	914	972	1374	1363	1056	871	670	561	581
MAX	1990	1652	1674	1958	1758	2802	3018	2484	2063	1446	1050	1170	
(WY)	1987	1993	1991	1993	1976	1985	1950	1943	1989	1943	1942	1975	
MIN	268	285	347	371	370	461	617	405	302	269	235	278	
(WY)	1964	1964	1964	1964	1964	1964	1964	1931	1934	1934	1934	1963	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1931 - 1993
ANNUAL TOTAL	397361	491377	
ANNUAL MEAN	1086	1346	
HIGHEST ANNUAL MEAN			890
LOWEST ANNUAL MEAN			1387
HIGHEST DAILY MEAN	2280	Nov 17	368
LOWEST DAILY MEAN	442	Jul 3	185
ANNUAL SEVEN-DAY MINIMUM	544	Jul 2	217
INSTANTANEOUS PEAK FLOW			6910
INSTANTANEOUS PEAK STAGE			(a)7.94
INSTANTANEOUS LOW FLOW			119
ANNUAL RUNOFF (CFSM)	1.07		.88
ANNUAL RUNOFF (INCHES)	14.64		11.97
10 PERCENT EXCEEDS	1540		1530
50 PERCENT EXCEEDS	1040		740
90 PERCENT EXCEEDS	650		400

(a) Datum then in use.

## 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 sea level, from topographic map.

REMARKS.--Records good. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	18	18	23	19	17	22	23	21	20	17	20
2	16	30	18	20	18	18	21	22	20	20	17	25
3	15	26	18	21	18	19	20	23	20	20	17	26
4	15	21	18	36	18	20	20	24	20	19	16	21
5	15	20	18	33	18	19	19	23	24	19	16	19
6	15	19	17	25	18	19	19	22	21	18	18	19
7	15	18	17	21	18	19	19	21	22	18	18	19
8	15	17	17	20	18	19	19	21	27	18	17	18
9	16	17	17	20	18	19	22	21	32	28	17	18
10	16	18	18	20	18	20	21	21	25	23	20	18
11	16	19	18	19	18	19	20	20	22	21	18	17
12	15	30	17	19	18	18	21	20	21	20	17	18
13	15	30	18	22	18	18	20	20	20	19	19	17
14	17	23	18	21	18	17	19	20	26	21	19	23
15	23	21	18	21	18	17	20	20	24	20	18	32
16	27	20	23	20	18	19	20	19	21	19	17	23
17	21	20	20	20	18	21	19	19	21	18	17	20
18	19	20	19	19	18	19	19	20	21	19	16	19
19	18	19	18	18	17	18	22	20	22	19	17	18
20	18	18	19	18	17	19	61	19	26	19	17	18
21	18	19	18	21	18	18	34	19	23	18	16	19
22	17	20	17	23	18	19	26	19	21	18	16	18
23	17	24	17	21	18	31	23	20	20	18	16	18
24	16	21	17	21	17	30	22	21	19	18	21	18
25	16	19	17	20	17	28	22	20	20	18	18	18
26	16	19	16	19	17	29	21	19	20	18	17	22
27	16	19	16	19	17	29	21	19	22	17	18	23
28	16	18	16	19	17	28	21	20	21	17	20	22
29	16	18	19	19	---	25	24	19	21	17	25	22
30	16	18	28	18	---	23	25	20	20	17	23	21
31	16	---	32	19	---	22	---	23	---	17	24	---
TOTAL	523	619	577	655	498	656	682	637	663	591	562	609
MEAN	16.9	20.6	18.6	21.1	17.8	21.2	22.7	20.5	22.1	19.1	18.1	20.3
MAX	27	30	32	36	19	31	61	24	32	28	25	32
MIN	15	17	16	18	17	17	19	19	19	17	16	17
CFSM	1.02	1.25	1.13	1.28	1.08	1.28	1.38	1.25	1.34	1.16	1.10	1.23
IN.	1.18	1.40	1.30	1.48	1.12	1.48	1.54	1.44	1.49	1.33	1.27	1.37

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1983 - 1993, BY WATER YEAR (WY)

MEAN	18.9	20.7	20.0	19.0	18.9	21.4	21.7	20.2	18.1	17.1	16.3	17.1
MAX	25.7	25.5	23.6	21.4	21.5	28.1	26.6	24.1	24.9	21.4	18.2	20.3
(WY)	1992	1991	1991	1992	1985	1985	1985	1983	1989	1986	1989	1993
MIN	15.3	16.2	15.6	15.3	16.2	17.8	18.2	16.3	13.8	14.3	13.9	14.4
(WY)	1983	1988	1990	1984	1987	1984	1990	1987	1987	1987	1988	1985

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1983 - 1993

ANNUAL TOTAL	6747	7272	19.1
ANNUAL MEAN	18.4	19.9	21.2
HIGHEST ANNUAL MEAN			17.3
LOWEST ANNUAL MEAN			1991
HIGHEST DAILY MEAN	32	Dec 31	61
LOWEST DAILY MEAN	14	Jun 13	15
ANNUAL SEVEN-DAY MINIMUM	14	Aug 17	15
INSTANTANEOUS PEAK FLOW			71
INSTANTANEOUS PEAK STAGE			3.22
ANNUAL RUNOFF (CFSM)	1.12		1.21
ANNUAL RUNOFF (INCHES)	15.21		16.40
10 PERCENT EXCEEDS	22		24
50 PERCENT EXCEEDS	18		19
90 PERCENT EXCEEDS	15		17

(a) Oct. 3-8, 12, 13.

## 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 sea level.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	45	52	45	45	46	40	44	52	40	40	35	41
2	46	91	47	40	46	43	42	50	38	35	35	65
3	46	63	46	43	46	47	40	52	39	34	34	57
4	44	57	47	87	44	48	40	49	38	35	37	42
5	44	49	47	69	43	45	39	48	53	34	34	37
6	45	47	46	50	41	45	39	43	40	33	45	38
7	44	46	45	44	40	46	39	44	47	34	39	39
8	47	45	45	41	39	46	37	42	56	34	36	40
9	48	45	45	39	40	45	50	41	71	86	36	39
10	46	48	47	40	40	45	41	40	49	47	53	40
11	45	50	47	39	40	45	39	41	45	40	43	44
12	43	92	46	41	40	42	41	40	40	37	41	45
13	44	72	45	52	43	39	39	39	38	37	43	44
14	56	57	46	45	43	38	40	39	65	45	56	70
15	71	52	49	44	40	37	43	39	46	39	38	87
16	78	48	55	44	41	44	41	37	40	36	38	57
17	56	49	45	41	40	45	39	37	37	37	35	53
18	53	46	40	41	39	37	37	38	39	41	34	50
19	50	44	40	39	38	36	46	38	45	40	35	48
20	47	45	39	39	39	38	148	37	58	35	34	46
21	50	47	35	49	40	39	73	36	47	34	32	52
22	49	56	35	49	41	41	59	35	41	35	31	48
23	45	58	33	43	42	76	55	36	37	36	33	47
24	46	48	32	43	41	62	54	42	38	39	56	39
25	44	48	31	41	39	56	51	38	38	39	39	42
26	44	47	31	40	37	55	51	36	36	37	42	61
27	45	44	31	41	37	57	49	37	42	37	39	63
28	47	45	33	44	39	54	52	34	40	37	52	53
29	49	45	40	41	---	52	64	34	39	38	61	60
30	47	45	70	41	---	49	61	35	41	38	49	49
31	45	---	66	43	---	45	---	49	---	36	54	---
TOTAL	1509	1581	1349	1398	1144	1437	1493	1258	1323	1205	1269	1496
MEAN	48.7	52.7	43.5	45.1	40.9	46.4	49.8	40.6	44.1	38.9	40.9	49.9
MAX	78	92	70	87	46	76	148	52	71	86	61	87
MIN	43	44	31	39	37	36	37	34	36	33	31	37

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

MEAN	37.2	39.5	40.4	39.8	41.9	47.7	49.3	45.0	42.0	39.5	37.4	37.7
MAX	56.0	56.4	53.5	48.9	53.0	61.4	63.3	57.5	55.3	54.0	50.3	51.9
(WY)	1992	1991	1992	1988	1971	1985	1991	1991	1989	1991	1980	1992
MIN	25.3	26.5	27.1	29.3	25.7	34.6	35.5	30.4	24.7	26.1	26.8	27.2
(WY)	1965	1972	1977	1978	1972	1978	1977	1977	1988	1977	1977	1971

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR		FOR 1993 WATER YEAR		WATER YEARS 1965 - 1993	
ANNUAL TOTAL	17818		16462		41.4	
ANNUAL MEAN	48.7		45.1		51.5	
HIGHEST ANNUAL MEAN					32.0	
LOWEST ANNUAL MEAN					1991	
HIGHEST DAILY MEAN	92		148		257	
LOWEST DAILY MEAN	31		31		20	
ANNUAL SEVEN-DAY MINIMUM	32		32		22	
INSTANTANEOUS PEAK FLOW			212		407	
INSTANTANEOUS PEAK FLOW			2.24		4.49	
INSTANTANEOUS LOW FLOW			22		(a)8.0	
10 PERCENT EXCEEDS	57		56		54	
50 PERCENT EXCEEDS	47		43		40	
90 PERCENT EXCEEDS	41		36		29	

(a) Result of bridge construction upstream.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04106320 WEST FORK PORTAGE CREEK NEAR OSHTIMO, 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 Oshtimo.

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 above sea level (Kalamazoo County Road Commission bench mark).

REMARKS.--Records good. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.4	2.5	3.2	7.8	6.3	7.0	11	5.0	2.1	4.4	2.8	8.2
2	2.2	4.5	3.4	7.8	6.1	7.0	11	4.6	1.9	3.9	2.8	8.6
3	1.9	4.6	3.4	12	5.7	7.0	9.5	4.6	1.8	3.5	2.6	9.2
4	1.7	4.4	4.2	16	5.5	6.5	8.1	4.7	1.8	3.1	2.4	8.7
5	1.5	4.1	28	19	5.6	5.9	6.3	4.7	2.1	2.9	2.4	7.8
6	1.4	3.9	35	18	5.7	5.5	5.1	4.5	1.8	2.6	2.6	7.5
7	1.3	3.6	27	15	5.7	5.5	4.5	6.9	1.9	2.3	2.7	7.2
8	1.3	3.2	19	12	5.7	5.6	4.1	8.7	3.1	2.1	2.7	6.9
9	1.4	2.9	14	10	5.6	5.7	4.1	11	6.7	4.3	2.7	6.4
10	1.4	2.9	11	8.8	5.5	5.7	4.1	10	7.7	5.2	2.9	5.8
11	1.4	3.0	7.7	6.6	5.8	5.6	3.7	7.9	7.2	6.0	3.1	5.5
12	1.3	4.5	6.2	6.8	7.5	5.4	3.7	5.9	5.9	5.6	3.1	6.2
13	1.2	5.6	4.9	8.0	8.2	5.4	3.7	4.4	4.5	4.9	3.3	6.2
14	1.5	5.3	4.3	8.2	8.0	5.4	3.5	3.5	4.6	4.8	3.3	13
15	2.1	4.9	4.0	8.2	7.6	5.4	3.6	2.8	4.1	4.2	3.3	22
16	2.7	4.5	4.7	7.9	7.3	6.0	3.8	2.3	3.4	3.7	3.2	24
17	2.8	4.4	4.5	7.7	7.0	6.6	3.7	1.9	3.0	3.2	3.1	23
18	3.3	4.1	4.5	7.5	7.0	6.6	3.6	1.8	2.9	3.2	3.1	18
19	3.5	3.9	4.5	7.3	7.0	6.6	4.9	1.6	3.2	3.2	3.1	14
20	3.6	3.7	4.6	7.1	7.0	6.8	12	1.3	4.8	3.1	3.0	12
21	3.8	3.7	4.4	7.4	6.9	6.8	12	1.9	5.4	3.1	2.9	9.5
22	3.5	3.8	3.9	7.8	7.0	7.0	11	3.0	5.4	3.3	2.8	7.7
23	3.3	4.3	3.9	7.7	7.0	12	9.3	3.8	5.9	3.4	2.7	6.5
24	3.1	4.1	3.9	7.5	7.0	15	7.9	4.7	6.9	3.7	3.3	5.4
25	2.9	3.9	3.9	7.2	7.0	14	8.8	4.5	7.0	3.8	3.4	4.7
26	2.7	3.9	3.8	7.0	7.0	13	8.6	4.2	6.3	3.6	4.3	5.0
27	2.5	3.6	4.0	7.0	7.0	12	7.2	3.7	6.1	3.4	5.0	4.9
28	2.4	3.4	4.1	6.8	7.0	11	6.1	3.1	5.9	3.2	6.5	4.7
29	2.3	3.3	4.5	6.7	—	11	5.5	2.5	5.2	3.1	7.0	4.6
30	2.2	3.2	6.3	6.6	—	9.4	5.5	2.2	4.9	3.0	7.5	4.3
31	2.2	—	8.3	6.4	—	9.6	—	2.5	—	2.8	8.1	—
TOTAL	70.8	117.7	249.1	279.8	185.7	242.0	195.9	134.2	133.5	112.6	111.7	277.5
MEAN	2.28	3.92	8.04	9.03	6.63	7.81	6.53	4.33	4.45	3.63	3.60	9.25
MAX	3.8	5.6	35	19	8.2	15	12	11	7.7	6.0	8.1	24
MIN	1.2	2.5	3.2	6.4	5.5	5.4	3.5	1.3	1.8	2.1	2.4	4.3
CFSM	.18	.30	.62	.69	.51	.60	.50	.33	.34	.28	.28	.71
IN.	.20	.34	.71	.80	.53	.69	.56	.38	.38	.32	.32	.79

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1972 - 1993, BY WATER YEAR (WY)

	MEAN	6.33	7.08	7.25	6.82	6.87	7.61	7.39	6.18	5.37	4.97	5.32	6.11
MAX	9.74	11.0	11.8	9.79	9.63	10.4	11.2	12.5	11.4	10.7	11.8	12.6	
(WY)	1976	1986	1976	1973	1976	1973	1973	1973	1973	1973	1975	1975	
MIN	2.28	3.92	5.11	4.96	4.77	4.71	5.00	2.62	1.13	1.20	1.96	3.78	
(WY)	1993	1993	1982	1981	1982	1988	1988	1988	1988	1988	1988	1982	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1972 - 1993

ANNUAL TOTAL	2009.4	2110.5	6.40
ANNUAL MEAN	5.49	5.78	10.0
HIGHEST ANNUAL MEAN			3.87
LOWEST ANNUAL MEAN			1975
HIGHEST DAILY MEAN	35	Dec 6	35
LOWEST DAILY MEAN	1.2	Oct 13	.50
ANNUAL SEVEN-DAY MINIMUM	1.3	Oct 7	.63
INSTANTANEOUS PEAK FLOW			36
INSTANTANEOUS PEAK STAGE			2.47
INSTANTANEOUS LOW FLOW			.38
ANNUAL RUNOFF (CFSM)	.42	.44	.49
ANNUAL RUNOFF (INCHES)	5.75	6.04	6.69
10 PERCENT EXCEEDS	8.1	9.5	9.8
50 PERCENT EXCEEDS	4.9	4.7	6.0
90 PERCENT EXCEEDS	3.1	2.4	3.4

(a) July 14, 15, 1988.



## 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 sea level (levels by Michigan Department of Natural Resources).

REMARKS.--Records good. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.3	5.6	7.6	15	10	12	15	12	9.1	12	7.5	13
2	6.9	11	7.7	13	10	12	15	11	8.3	11	7.4	14
3	6.6	13	7.8	14	10	12	15	12	7.9	10	7.2	16
4	6.2	11	7.7	23	9.6	12	14	12	7.9	9.5	6.9	15
5	5.9	9.6	10	28	9.5	11	13	12	9.2	8.8	6.7	13
6	5.9	9.0	31	25	9.4	10	11	11	8.6	8.2	7.7	12
7	5.9	8.4	40	23	9.6	10	9.8	11	8.5	8.0	8.9	12
8	5.9	7.9	33	20	9.3	10	9.1	12	10	7.7	8.4	11
9	6.1	7.5	25	17	9.3	10	10	14	14	15	7.7	11
10	5.9	7.4	21	14	9.3	11	9.9	15	14	14	8.1	9.7
11	5.8	7.8	16	13	9.3	11	9.0	15	13	13	8.3	8.9
12	5.5	11	13	12	9.9	10	9.0	14	13	12	8.1	8.8
13	5.4	14	12	13	11	10	8.9	12	12	12	8.4	9.0
14	6.2	12	10	13	12	9.9	8.7	10	13	13	8.3	11
15	7.7	11	9.8	13	12	9.9	9.3	9.4	14	13	8.1	22
16	8.7	10	11	13	12	11	9.7	8.5	12	11	8.1	26
17	7.6	9.6	10	13	11	12	9.2	7.9	10	9.9	7.9	28
18	7.1	9.1	9.7	12	11	12	8.5	7.4	9.5	10	7.6	27
19	7.0	8.5	9.7	12	11	12	9.7	7.0	10	11	7.5	23
20	7.3	8.2	10	11	11	12	30	6.4	15	10	7.5	20
21	7.7	8.3	9.7	13	12	12	25	6.1	14	9.1	7.2	17
22	7.4	8.7	9.1	14	12	12	21	6.4	12	8.6	6.9	15
23	7.1	10	8.7	13	12	17	18	7.4	11	8.4	7.0	13
24	6.8	9.6	8.5	13	12	21	16	9.6	11	9.3	9.0	11
25	6.6	9.0	8.2	12	12	22	15	9.9	12	10	8.8	10
26	6.3	8.9	8.1	12	12	21	15	9.6	12	10	9.7	13
27	6.0	8.7	8.1	11	12	20	15	9.4	14	9.4	11	13
28	5.8	8.6	8.1	11	12	19	14	9.3	14	8.8	12	13
29	5.6	8.2	9.1	11	---	17	14	9.1	13	8.4	12	13
30	5.4	7.9	13	11	---	16	14	8.5	12	8.2	12	13
31	5.3	---	18	10	---	14	---	9.5	---	7.7	13	---
TOTAL	200.9	279.5	410.6	448	302.2	410.8	400.8	314.4	344.0	317.0	264.9	441.4
MEAN	6.48	9.32	13.2	14.5	10.8	13.3	13.4	10.1	11.5	10.2	8.55	14.7
MAX	8.7	14	40	28	12	22	30	15	15	15	13	28
MIN	5.3	5.6	7.6	10	9.3	9.9	8.5	6.1	7.9	7.7	6.7	8.8
CFSM	.35	.50	.71	.77	.58	.71	.71	.54	.61	.55	.46	.79
IN.	.40	.56	.82	.89	.60	.82	.80	.63	.68	.63	.53	.88

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1959 - 1993, BY WATER YEAR (WY)

	MEAN	9.68	10.3	10.5	9.84	10.2	11.8	11.6	9.96	8.84	7.97	7.79	9.02
MAX	15.2	16.8	16.8	14.5	15.9	18.0	18.2	15.2	14.9	12.7	13.9	18.8	18.8
(WY)	1970	1986	1992	1993	1971	1971	1975	1975	1969	1970	1975	1975	1975
MIN	3.39	3.54	5.04	5.16	6.25	7.43	7.32	4.18	2.36	2.35	2.49	3.17	3.17
(WY)	1965	1965	1965	1965	1965	1965	1963	1965	1988	1964	1964	1964	1964

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1959 - 1993

	ANNUAL TOTAL	3813.4	4134.5	9.80	
ANNUAL MEAN	10.4	11.3	14.1	1975	
HIGHEST ANNUAL MEAN			4.85	1966	
LOWEST ANNUAL MEAN			40	Dec 7 1992	
HIGHEST DAILY MEAN	40	Dec 7	40	Dec 7 1992	
LOWEST DAILY MEAN	5.3	Oct 31	5.3	Oct 31	
ANNUAL SEVEN-DAY MINIMUM	5.7	Oct 26	5.7	Oct 26	
INSTANTANEOUS PEAK FLOW			41	Dec 7	
INSTANTANEOUS PEAK STAGE			3.23	Dec 7	
INSTANTANEOUS LOW FLOW			5.1	(b)	
ANNUAL RUNOFF (CFSM)	.56	.61	.52		
ANNUAL RUNOFF (INCHES)	7.59	8.22	7.12		
10 PERCENT EXCEEDS	14	15	14		
50 PERCENT EXCEEDS	10	10	9.5		
90 PERCENT EXCEEDS	6.8	7.3	5.3		

(a) Apr. 19, 1975, Dec. 7, 1992.

(b) Oct. 31, Nov. 1.

(c) June 19, 20, 1988.

(e) Estimated

STREAMS TRIBUTARY TO LAKE MICHIGAN  
04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1987 to current year.

REMARKS.--Cross-sectional samples were collected at bridge.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATURATION) (00301)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)
NOV 23...	1330	2370	544	8.3	6.0	4.6	12.4	102	76
JAN 06...	1400	5540	426	8.2	2.5	26	12.9	96	K400
MAR 31...	1435	4610	462	8.2	9.0	4.5	11.8	106	K71
MAY 12...	1120	1940	520	8.5	21.0	4.5	11.0	128	K6
JUL 08...	1155	1230	519	8.4	26.0	2.0	9.8	124	K25
AUG 25...	1110	1430	589	8.4	25.5	3.4	9.2	114	70
DATE	STREP-TOCOCCEI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	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)	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)
NOV 23...	160	260	51	71	19	16	2.6	249	--
JAN 06...	K13000	180	24	49	13	12	2.5	185	--
MAR 31...	K33	210	38	58	16	12	2.2	210	--
MAY 12...	420	260	32	71	20	17	2.0	273	2
JUL 08...	4300	260	42	70	20	18	1.8	259	2
AUG 25...	1200	250	41	63	22	25	2.4	249	2
DATE	ALKALINITY WAT DIS TOT IT FIELD (MG/L AS CaCO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUORIDE, 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)	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)
NOV 23...	204	40	26	0.20	9.7	329	0.45	2110	0.030
JAN 06...	152	29	22	0.10	7.1	243	0.33	3630	0.040
MAR 31...	172	31	20	0.10	6.8	274	0.37	3410	0.010
MAY 12...	228	36	27	0.20	5.1	324	0.44	1700	0.020
JUL 08...	216	35	27	0.20	9.9	330	0.45	1100	0.030
AUG 25...	208	43	40	0.20	3.4	330	0.45	1270	0.020

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI-Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)
NOV 23...	1.40	0.090	0.70	0.080	0.040	<0.010	<10
JAN 06...	1.30	0.080	0.60	0.090	0.010	0.020	<10
MAR 31...	1.20	0.020	0.60	0.050	<0.010	0.010	--
MAY 12...	0.550	0.030	0.70	0.050	<0.010	<0.010	--
JUL 08...	0.740	0.090	0.60	0.040	<0.010	<0.010	20
AUG 25...	0.410	0.050	0.50	0.040	0.010	<0.010	<10

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)
NOV 23...	51	<3	65	<4	21	<10	<1
JAN 06...	40	<3	40	<4	26	<10	<1
MAR 31...	--	--	--	--	--	--	--
MAY 12...	--	--	--	--	--	--	--
JUL 08...	65	<3	6	5	2	<10	1
AUG 25...	61	<3	6	7	3	10	1

DATE	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)	SEDI- MENT, SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 23...	<1	<1.0	130	<6	12	77	81
JAN 06...	<1	<1.0	87	<6	52	778	52
MAR 31...	--	--	--	--	15	187	67
MAY 12...	--	--	--	--	21	110	80
JUL 08...	<1	<1.0	130	<6	22	73	89
AUG 25...	<1	<1.0	120	<6	30	116	81



## 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 sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	48	71	224	e69	e50	162	155	50	57	31	51
2	52	183	69	138	68	e55	164	116	51	56	32	44
3	48	231	71	129	68	59	162	106	53	65	31	47
4	44	194	69	479	66	71	131	110	68	57	30	48
5	41	158	68	646	66	69	118	119	60	51	30	41
6	39	141	65	335	66	72	107	105	62	47	39	38
7	38	113	64	232	58	98	99	93	101	44	51	36
8	39	94	63	168	62	105	94	85	122	45	43	35
9	61	85	62	128	58	123	98	78	175	60	38	37
10	54	85	62	113	58	106	100	73	131	54	36	37
11	48	98	64	e95	60	85	91	70	90	48	35	35
12	47	132	69	e90	57	74	96	66	74	45	34	35
13	45	215	72	e85	59	e65	88	62	65	42	32	37
14	44	172	76	e83	57	e60	82	60	77	44	34	56
15	121	142	84	e81	56	e69	84	59	89	44	32	122
16	159	123	165	e78	55	90	109	56	72	40	33	91
17	125	126	132	e76	54	191	105	54	64	38	32	68
18	96	111	99	e74	e53	140	91	54	68	38	31	56
19	86	95	85	e72	e52	100	99	53	109	41	30	50
20	78	85	83	e76	e50	80	686	52	293	39	32	53
21	85	85	68	e100	e49	77	435	51	301	36	30	171
22	75	93	67	157	e49	104	269	52	205	35	28	149
23	68	165	65	140	e48	239	191	55	118	34	28	107
24	64	151	59	138	e48	313	153	53	90	34	45	77
25	58	115	e55	118	e47	264	136	51	78	35	45	65
26	55	105	e52	91	e47	240	119	50	75	38	37	110
27	52	100	e48	87	e47	229	106	51	69	35	36	113
28	50	88	e55	82	e47	207	100	48	65	33	36	110
29	49	80	93	74	---	182	113	49	62	33	36	88
30	48	75	191	e72	---	155	187	58	58	32	48	83
31	48	---	285	e70	---	134	---	53	---	30	53	---
TOTAL	1974	3688	2631	4531	1574	3906	4575	2197	2995	1330	1108	2090
MEAN	63.7	123	84.9	146	56.2	126	152	70.9	99.8	42.9	35.7	69.7
MAX	159	231	285	646	69	313	686	155	301	65	53	171
MIN	38	48	48	70	47	50	82	48	50	30	28	35
CFSM	.89	1.72	1.19	2.05	.79	1.76	2.14	.99	1.40	.60	.50	.98
IN.	1.03	1.92	1.37	2.36	.82	2.04	2.38	1.14	1.56	.69	.58	1.09

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1993, BY WATER YEAR (WY)

	MEAN	39.2	57.7	74.9	65.4	74.1	111	97.5	61.3	51.9	32.2	27.1	34.7
MAX	119	171	131	146	152	227	152	124	138	99.0	64.9	123	123
(WY)	1987	1991	1976	1993	1976	1979	1993	1981	1986	1986	1987	1978	1978
MIN	15.0	19.1	21.7	19.8	25.7	46.1	49.4	25.1	16.4	13.6	12.5	11.9	11.9
(WY)	1969	1972	1977	1970	1970	1969	1968	1977	1987	1987	1970	1969	1969

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1966 - 1993

ANNUAL TOTAL	26526	32599	
ANNUAL MEAN	72.5	89.3	60.5
HIGHEST ANNUAL MEAN			89.3
LOWEST ANNUAL MEAN			32.5
HIGHEST DAILY MEAN	310	686	1530
LOWEST DAILY MEAN	26	28	9.2
ANNUAL SEVEN-DAY MINIMUM	27	30	9.8
INSTANTANEOUS PEAK FLOW		841	1860
INSTANTANEOUS PEAK STAGE		8.39	(b)9.57
INSTANTANEOUS LOW FLOW		27	
ANNUAL RUNOFF (CFSM)	1.02	1.25	.85
ANNUAL RUNOFF (INCHES)	13.82	16.98	11.51
10 PERCENT EXCEEDS	127	160	115
50 PERCENT EXCEEDS	64	68	42
90 PERCENT EXCEEDS	34	37	19

(a) Aug. 27, 28, 1970, Sept. 18, 1971, Aug. 7, 1987.

(b) From floodmark.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level (levels by Gove Associates, Inc.).

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	14	42	408	125	e19	221	93	26	16	8.7	36
2	12	470	46	128	60	e22	250	57	19	15	7.2	18
3	11	722	85	221	37	e29	252	50	17	14	6.0	65
4	9.6	605	57	1450	37	69	139	54	16	12	5.8	57
5	8.5	376	45	1620	37	79	110	101	38	11	5.9	23
6	8.0	277	40	666	36	140	74	54	28	12	169	15
7	8.0	110	42	287	e35	215	59	41	76	10	139	12
8	8.1	72	42	105	27	230	56	34	437	11	38	14
9	17	62	40	69	24	296	202	29	287	46	19	18
10	24	66	38	55	25	193	97	36	77	23	17	13
11	17	183	44	54	26	100	79	29	41	13	17	12
12	13	268	71	51	23	75	105	24	30	11	11	19
13	12	459	79	59	25	61	60	21	25	9.0	9.6	17
14	11	146	102	53	23	57	44	20	67	11	8.2	418
15	225	111	159	51	22	40	102	19	59	9.8	7.6	710
16	243	110	612	49	23	282	252	16	29	8.1	7.9	218
17	79	147	274	48	22	716	86	16	24	6.7	7.7	67
18	43	84	111	e45	e22	258	53	16	143	7.5	7.0	42
19	35	56	78	e42	24	91	102	17	215	8.0	6.5	32
20	32	46	98	e40	22	62	1720	15	531	7.2	6.5	66
21	50	75	51	153	21	97	881	14	148	6.0	5.7	671
22	32	105	42	511	e20	183	307	13	57	5.3	5.3	405
23	26	690	39	297	e19	724	94	16	37	5.1	5.3	179
24	24	437	35	351	e18	852	69	22	29	5.8	4.1	81
25	22	129	e32	156	e17	452	58	17	26	9.0	28	48
26	19	152	e29	83	e17	318	45	14	26	8.5	12	672
27	18	142	e27	61	e17	213	39	13	23	6.3	9.1	608
28	18	75	28	57	e17	165	39	14	21	5.8	7.7	471
29	16	56	235	46	---	115	220	12	18	5.1	34	176
30	15	47	606	e45	---	83	367	14	16	5.2	71	131
31	14	---	947	61	---	67	---	42	---	5.0	62	---
TOTAL	1083.2	6292	4176	7332	821	6303	6182	933	2586	328.4	780.7	5314
MEAN	34.9	210	135	237	29.3	203	206	30.1	86.2	10.6	25.2	177
MAX	243	722	947	1620	125	852	1720	101	631	46	169	710
MIN	8.0	14	27	40	17	19	39	12	16	5.0	5.3	12
CFSM	.53	3.19	2.05	3.59	.45	3.09	3.13	.46	1.31	.16	.38	2.69
IN.	.61	3.56	2.36	4.15	.46	3.56	3.49	.53	1.46	.19	.44	3.00

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1961 - 1993, BY WATER YEAR (WY)

	MEAN	30.1	76.6	105	79.5	107	178	110	57.8	37.6	21.9	15.3	35.3
MAX	152	333	328	278	398	499	206	288	217	185	89.2	252	252
(WY)	1987	1991	1983	1974	1985	1979	1993	1981	1980	1982	1987	1986	1986
MIN	2.56	2.98	3.99	2.89	6.71	37.6	21.2	8.89	3.10	1.94	2.03	2.09	2.09
(WY)	1964	1977	1977	1977	1963	1981	1986	1968	1987	1965	1962	1963	1963

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1961 - 1993

ANNUAL TOTAL	26194.8		42131.3		71.0	
ANNUAL MEAN	71.6		115		115	1993
HIGHEST ANNUAL MEAN					24.6	1977
LOWEST ANNUAL MEAN					4600	May 11 1981
HIGHEST DAILY MEAN	947	Dec 31	1720	Apr 20	1.2	Aug 2 1987
LOWEST DAILY MEAN	4.1	Aug 22	5.0	Jul 31	1.2	Aug 1 1987
ANNUAL SEVEN-DAY MINIMUM	4.3	Aug 20	6.1	Jul 28	15.81	May 11 1981
INSTANTANEOUS PEAK FLOW			2500	Jan 4	.83	May 11 1981
INSTANTANEOUS PEAK STAGE			12.55	Jan 4	1.08	Aug 3 1988
INSTANTANEOUS LOW FLOW			4.7	(a)	14.66	
ANNUAL RUNOFF (CFSM)	1.09		1.75			
ANNUAL RUNOFF (INCHES)	14.81		23.82			
10 PERCENT EXCEEDS	182		296		150	
50 PERCENT EXCEEDS	32		42		19	
90 PERCENT EXCEEDS	6.7		9.0		3.3	

(a) July 23, 31, Aug. 1.

(e) Estimated.

## 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 above sea level (Fargo Engineering Co. bench mark). Prior to Sept. 24, 1935, nonrecording gage at same site and datum.

REMARKS.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	161	183	273	247	258	188	466	193	106	231	117	132
2	152	264	254	223	174	164	479	232	105	214	109	201
3	146	265	246	252	149	167	471	253	107	195	92	168
4	136	275	239	348	136	169	460	259	112	174	86	159
5	137	270	229	438	136	174	447	274	167	160	82	144
6	107	271	210	456	201	179	431	268	133	151	101	148
7	97	273	214	465	216	187	414	282	162	142	87	139
8	100	268	199	475	213	199	393	281	179	127	77	145
9	119	265	189	476	207	211	363	269	235	151	76	106
10	99	266	185	460	201	247	343	261	236	108	81	95
11	96	259	183	440	197	259	335	252	235	115	77	93
12	95	345	216	435	164	258	328	237	232	108	78	95
13	95	343	232	452	159	257	318	217	221	104	73	80
14	139	334	234	432	157	236	309	172	219	130	69	118
15	207	317	239	407	159	243	306	159	177	116	66	183
16	266	315	243	353	160	258	327	143	157	115	73	156
17	274	317	245	319	161	254	303	137	148	112	67	141
18	280	316	241	291	143	250	283	117	140	176	66	135
19	283	310	239	279	158	248	287	104	166	233	66	130
20	294	301	237	276	159	247	314	98	246	255	66	130
21	325	297	222	295	161	245	309	94	243	256	62	131
22	333	330	228	319	165	246	290	90	228	218	58	126
23	338	348	183	326	195	277	281	85	231	195	60	122
24	292	360	155	304	188	284	278	97	251	184	86	95
25	264	363	138	279	184	300	298	115	291	196	70	99
26	255	353	133	267	202	328	286	117	266	176	69	110
27	249	346	139	281	185	348	278	120	290	163	72	199
28	237	336	142	277	188	359	275	121	270	155	73	255
29	221	329	153	267	---	382	286	115	275	147	110	266
30	187	320	227	242	---	391	235	110	252	132	103	264
31	171	---	250	258	---	408	---	116	---	123	137	---
TOTAL	6155	9139	6517	10639	4976	7963	10193	5388	6080	5062	2507	4365
MEAN	199	305	210	343	178	257	340	174	203	163	80.9	145
MAX	338	363	273	476	258	408	479	282	291	256	137	266
MIN	95	183	133	223	136	164	235	85	105	104	58	80
CFSM	1.14	1.75	1.21	1.97	1.02	1.48	1.95	1.00	1.16	.94	.46	.84
IN.	1.32	1.95	1.39	2.27	1.06	1.70	2.18	1.15	1.30	1.08	.54	.93

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1935 - 1993, BY WATER YEAR (WY)

	MEAN	76.4	102	113	121	143	223	227	165	126	84.5	63.7	65.2
MAX	214	305	210	343	301	501	589	484	433	349	164	222	
(WY)	1991	1993	1993	1993	1976	1976	1950	1943	1943	1968	1968	1975	
MIN	23.4	25.5	27.7	27.2	31.5	73.2	64.3	54.7	34.3	19.5	15.1	25.2	
(WY)	1964	1964	1964	1964	1964	1964	1935	1936	1936	1936	1936	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1935 - 1993

ANNUAL TOTAL	63729												
ANNUAL MEAN	174												
HIGHEST ANNUAL MEAN													1993
LOWEST ANNUAL MEAN													1964
HIGHEST DAILY MEAN													
LOWEST DAILY MEAN	363				Nov 25		479		Apr 2				Jun 3 1943
ANNUAL SEVEN-DAY MINIMUM	70				Aug 23		58		Aug 22				Aug 23 1936
INSTANTANEOUS PEAK FLOW	76				Aug 20		64		Aug 17				Aug 4 1936
INSTANTANEOUS PEAK STAGE							553		Jul 18				Jun 25 1937
INSTANTANEOUS LOW FLOW							12.51		Jul 18				Jun 25 1968
ANNUAL RUNOFF (CFSM)							51		Aug 23				Aug 22 1936
ANNUAL RUNOFF (INCHES)	1.00						1.24						
10 PERCENT EXCEEDS	13.62						16.89						
50 PERCENT EXCEEDS	269						337						
90 PERCENT EXCEEDS	157						216						
	97						97						

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level (levels by Michigan Department of Natural Resources).

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.3	10	20	78	15	e5.8	54	28	5.8	15	3.8	2.7
2	8.1	62	19	36	e13	e7.0	49	22	4.8	13	3.6	3.3
3	7.3	69	17	29	11	e13	36	20	4.5	11	3.1	8.5
4	6.4	33	16	149	12	e25	30	20	4.3	9.9	3.4	6.8
5	5.8	23	15	176	14	e18	27	26	10	8.3	3.0	4.3
6	5.5	21	13	92	18	e15	23	22	8.8	6.8	3.2	4.1
7	5.4	19	12	51	e15	e35	21	18	9.6	6.0	4.1	4.2
8	5.3	17	12	36	e12	e56	20	15	28	5.5	3.3	3.4
9	20	16	12	29	e10	e54	21	14	43	8.8	2.9	3.0
10	16	16	12	24	e9.4	e32	24	12	24	15	7.0	2.8
11	12	18	12	23	e8.6	22	22	11	15	9.1	7.6	2.4
12	10	97	13	20	e8.5	19	33	10	11	7.3	5.1	2.4
13	8.9	170	15	25	e8.4	16	25	9.0	8.8	6.0	4.0	2.3
14	8.9	92	17	25	e8.0	e15	21	8.6	10	15	3.4	3.1
15	74	57	19	23	e7.5	13	23	8.1	11	13	3.0	32
16	109	38	38	22	e7.2	17	24	7.4	8.4	7.8	3.0	17
17	66	34	28	20	e7.0	39	20	6.7	7.1	6.2	2.8	10
18	38	29	21	e18	e6.8	e26	18	6.6	6.3	5.4	2.6	7.6
19	29	24	19	16	e6.6	19	23	7.2	20	6.1	2.4	6.2
20	25	22	18	14	e6.4	15	240	6.6	125	5.4	2.4	5.3
21	26	21	e14	19	e6.8	23	133	6.1	108	4.5	2.1	e35
22	23	32	13	46	e6.5	38	73	5.7	50	3.8	1.9	e22
23	20	151	13	40	e6.2	84	45	5.6	28	3.2	1.8	e12
24	18	86	e12	42	e5.8	99	34	6.5	19	3.0	2.4	e6.4
25	15	52	9.8	32	e5.5	87	30	5.6	21	16	2.1	e5.3
26	14	40	8.4	30	e5.8	89	25	5.0	24	24	1.9	e6.2
27	13	32	7.8	20	e5.3	86	21	4.7	31	10	2.2	e22
28	12	27	7.9	19	e5.2	84	18	4.7	33	6.8	2.0	e62
29	11	23	14	16	---	73	25	4.2	27	5.2	3.2	e40
30	10	21	69	15	---	52	45	4.0	18	4.7	4.1	e25
31	9.6	---	162	13	---	37	---	6.3	---	3.8	3.0	---
TOTAL	641.5	1352	678.9	1198	251.5	1213.8	1203	336.6	724.4	265.6	100.4	367.3
MEAN	20.7	45.1	21.9	38.6	8.98	39.2	40.1	10.9	24.1	8.57	3.24	12.2
MAX	109	170	162	176	18	99	240	28	125	24	7.6	62
MIN	5.3	10	7.8	13	5.2	5.8	18	4.0	4.3	3.0	1.8	2.3
CFSM	1.27	2.76	1.34	2.37	.55	2.40	2.46	.67	1.48	.53	.20	.75
IN.	1.46	3.09	1.55	2.73	.57	2.77	2.75	.77	1.65	.61	.23	.84

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1954 - 1993, BY WATER YEAR (WY)

	MEAN	5.15	9.06	12.2	10.8	16.3	30.0	24.7	12.2	8.37	3.95	2.32	3.07
MAX	33.8	45.1	32.7	40.1	52.3	70.6	64.8	57.2	43.3	30.5	17.1	20.6	
(WY)	1960	1993	1973	1974	1985	1982	1975	1956	1968	1957	1992	1992	
MIN	.35	.65	.48	.88	1.65	3.00	5.93	2.58	1.03	.39	.19	.25	
(WY)	1964	1964	1964	1977	1963	1964	1963	1958	1988	1965	1971	1979	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1954 - 1993

ANNUAL TOTAL	7311.6	8333.0	11.4
ANNUAL MEAN	20.0	22.8	22.8
HIGHEST ANNUAL MEAN			1.86
LOWEST ANNUAL MEAN			1993
HIGHEST DAILY MEAN	178	240	720
LOWEST DAILY MEAN	1.2	1.8	.05
ANNUAL SEVEN-DAY MINIMUM	1.3	2.0	.09
INSTANTANEOUS PEAK FLOW		286	(a)962
INSTANTANEOUS PEAK STAGE		7.48	(b)12.18
INSTANTANEOUS LOW FLOW		1.7	.04
ANNUAL RUNOFF (CFSM)	1.23	1.40	.70
ANNUAL RUNOFF (INCHES)	16.69	19.02	9.53
10 PERCENT EXCEEDS	38	50	25
50 PERCENT EXCEEDS	13	15	4.5
90 PERCENT EXCEEDS	3.9	3.8	.68

(a) From rating curve extended above 610 ft<sup>3</sup>/s.

(b) From floodmark.

(c) Sept. 8, 9, 12, 1978.

(e) Estimated.



## 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 sea level (levels by Michigan Department of Natural Resources).

REMARKS.--Records good. At times, low flow is affected by pumpage for irrigation. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.4	3.5	7.9	33	6.1	2.3	34	8.4	1.6	4.7	1.0	1.2
2	2.2	32	7.4	20	4.9	2.7	28	7.0	1.4	4.1	.94	1.6
3	2.0	28	6.5	16	4.7	5.5	21	6.5	1.4	3.5	.73	2.5
4	1.7	17	6.2	89	5.2	9.9	16	6.8	1.3	3.1	.69	1.9
5	1.6	12	5.5	73	6.3	6.9	14	8.4	2.4	2.5	.66	1.4
6	1.5	9.7	5.0	38	7.1	6.1	11	7.1	2.1	2.2	.74	1.3
7	1.4	8.0	4.7	26	5.3	14	9.2	6.1	3.7	1.9	.84	1.2
8	1.4	7.1	4.3	19	4.4	28	8.4	5.2	12	1.8	.65	1.0
9	5.9	6.5	4.1	14	3.8	27	8.4	4.7	32	1.7	.57	.94
10	4.7	6.4	4.3	10	3.7	18	9.8	4.2	14	1.7	11	.83
11	3.6	7.2	4.1	9.2	3.4	10	12	3.8	7.7	1.8	7.6	.72
12	3.0	67	4.0	8.2	3.4	7.5	22	3.6	5.5	1.5	3.2	.70
13	2.6	71	4.9	8.8	3.4	6.0	14	3.2	4.3	1.3	2.0	.63
14	2.4	37	6.5	8.4	3.1	5.6	9.6	3.0	5.4	1.1	1.5	1.2
15	28	27	7.5	8.1	3.0	4.6	11	2.9	5.9	1.0	1.2	1.6
16	47	20	17	7.6	2.9	8.0	13	2.5	4.3	.87	1.2	6.7
17	28	17	11	7.2	2.7	23	9.7	2.4	3.5	.75	1.1	4.1
18	17	14	8.0	5.9	2.7	14	8.0	2.6	3.1	.77	.89	3.0
19	12	11	7.3	5.2	2.6	8.4	17	2.5	7.2	1.1	1.5	2.4
20	9.3	9.0	7.0	4.8	2.6	6.3	178	2.4	28	.85	4.1	2.0
21	9.8	8.8	5.7	7.4	2.7	13	61	2.2	37	.65	2.7	20
22	8.4	22	5.1	27	2.6	24	38	2.0	18	.56	1.5	9.8
23	7.5	82	4.8	22	2.5	47	26	2.0	9.8	.52	1.1	5.9
24	6.7	38	4.0	25	2.3	47	20	2.7	6.7	.50	1.2	4.2
25	5.8	27	3.8	16	2.2	44	16	2.4	6.8	14	.92	3.4
26	5.2	21	3.2	10	2.3	43	12	2.0	7.3	11	.78	21
27	4.6	16	3.0	8.2	2.1	41	8.9	1.8	7.1	3.9	.73	31
28	4.3	14	3.1	7.4	2.1	41	8.0	1.9	8.1	2.6	.68	38
29	3.9	10	6.2	5.9	---	35	7.9	1.6	7.2	2.0	1.8	19
30	3.6	8.7	4.2	5.4	---	27	10	1.7	5.4	1.4	1.8	12
31	3.4	---	74	5.8	---	20	---	2.1	---	1.0	1.3	---
TOTAL	240.9	657.9	288.1	551.5	100.1	595.8	661.9	115.7	260.2	76.37	56.62	215.62
MEAN	7.77	21.9	9.29	17.8	3.57	19.2	22.1	3.73	8.67	2.46	1.83	7.19
MAX	47	82	74	89	7.1	47	178	8.4	37	14	11	38
MIN	1.4	3.5	3.0	4.8	2.1	2.3	7.9	1.6	1.3	.50	.57	.63
CFSM	.83	2.35	1.00	1.90	.38	2.06	2.36	.40	.93	.26	.20	.77
IN.	.96	2.62	1.15	2.20	.40	2.37	2.64	.46	1.04	.30	.23	.86

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1954 - 1993, BY WATER YEAR (WY)

	MEAN	2.54	4.23	6.00	5.10	8.06	16.9	13.3	5.92	3.98	1.83	1.14	1.47
MAX	20.9	21.9	24.9	21.4	28.4	39.9	47.2	37.6	35.3	26.5	8.15	7.19	
(WY)	1960	1993	1973	1974	1985	1982	1975	1956	1968	1957	1980	1993	
MIN	.087	.13	.11	.11	.12	.78	1.45	.94	.25	.074	.10	.086	
(WY)	1964	1964	1964	1963	1963	1964	1963	1955	1988	1988	1987	1955	

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1954 - 1993

	ANNUAL TOTAL	3198.19	3820.71	5.87	
ANNUAL MEAN		8.74	10.5	10.5	(a)
HIGHEST ANNUAL MEAN				.72	1964
LOWEST ANNUAL MEAN					
HIGHEST DAILY MEAN	82	Nov 23	178	536	Apr 19 1975
LOWEST DAILY MEAN	.36	Jul 11	.50	.02	Aug 3 1988
ANNUAL SEVEN-DAY MINIMUM	.42	Jul 6	.70	.03	Jul 29 1988
INSTANTANEOUS PEAK FLOW			316	(b)1290	Apr 18 1975
INSTANTANEOUS PEAK STAGE			5.07	9.99	Apr 18 1975
INSTANTANEOUS LOW FLOW			.46	.01	(c)
ANNUAL RUNOFF (CFSM)	.94		1.12	.63	
ANNUAL RUNOFF (INCHES)	12.74		15.22	8.54	
10 PERCENT EXCEEDS	20		27	14	
50 PERCENT EXCEEDS	4.6		5.5	1.6	
90 PERCENT EXCEEDS	1.2		1.2	.18	

(a) 1973, 1993.

(b) From rating curve extended above 660 ft<sup>3</sup>/s on basis of computation of peak flow through culvert and over road embankment.

(c) Sept. 11, 1954, Jan. 18, 1957, Aug. 3, 1988.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level. 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.--Records good. 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.

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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	272	216	500	1120	366	159	1010	582	149	413	102	161
2	236	352	456	1020	305	172	1060	514	145	373	97	148
3	212	588	422	920	313	199	1030	468	138	331	91	175
4	188	704	390	1010	296	292	912	447	134	288	89	213
5	167	702	363	1510	277	336	806	516	169	247	86	203
6	154	642	331	1750	313	305	719	676	194	208	93	182
7	145	573	306	1590	282	329	644	728	223	179	93	165
8	150	505	286	1310	281	478	579	655	432	159	91	149
9	209	448	270	1050	243	652	542	545	625	153	84	135
10	270	408	267	822	225	687	540	450	667	155	166	123
11	278	386	264	665	217	592	531	381	556	191	231	110
12	263	513	254	619	211	494	582	329	422	181	173	103
13	245	1000	262	557	213	413	577	282	346	155	137	98
14	230	1240	282	530	206	322	528	253	313	148	113	128
15	332	1240	303	504	200	284	515	240	297	192	98	301
16	596	1120	370	477	196	328	520	220	240	162	95	423
17	747	992	454	458	191	445	516	203	202	135	89	345
18	731	871	445	e385	132	510	485	194	183	119	85	281
19	652	759	408	e320	156	445	500	194	263	115	112	231
20	584	654	391	e330	190	367	1450	191	581	110	297	186
21	536	579	355	419	181	330	2050	182	900	101	266	284
22	499	557	316	537	189	466	1970	173	1080	91	192	331
23	455	946	281	663	169	704	1570	167	1030	85	137	290
24	410	1190	261	716	157	1040	1230	177	897	80	140	243
25	370	1140	219	687	154	1170	986	172	740	209	136	208
26	333	981	180	e620	170	1220	805	161	637	452	119	296
27	301	840	191	575	157	1250	660	154	574	310	105	463
28	275	723	226	494	152	1270	559	147	529	193	98	682
29	254	629	241	428	---	1280	503	141	514	145	117	739
30	234	556	407	e415	---	1220	550	133	473	123	190	614
31	219	---	873	402	---	1090	---	139	---	108	189	---
TOTAL	10547	22054	10584	22903	6122	18839	24929	9814	13633	5911	4111	8010
MEAN	340	735	341	739	219	608	831	317	454	191	133	267
MAX	747	1240	873	1750	366	1280	2050	728	1060	452	297	739
MIN	145	216	180	320	132	159	485	133	134	80	84	98
CFSM	.96	2.07	.96	2.08	.62	1.71	2.34	.89	1.28	.54	.37	.75
IN.	1.11	2.31	1.11	2.40	.64	1.97	2.61	1.03	1.43	.62	.43	.84

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1902 - 1993, BY WATER YEAR (WY)

	MEAN	98.5	139	178	207	281	503	477	282	173	83.1	57.2	75.0
MAX	571	735	492	739	1024	1162	1494	1310	627	534	366	426	
(WY)	1982	1993	1976	1993	1938	1948	1947	1956	1968	1957	1992	1903	
MIN	14.8	21.2	20.5	29.0	28.6	58.6	62.3	52.9	20.4	5.70	9.24	14.6	
(WY)	1935	1964	1964	1940	1940	1934	1931	1931	1934	1934	1934	1939	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1902 - 1993

ANNUAL TOTAL	124223	157457	214
ANNUAL MEAN	339	431	431
HIGHEST ANNUAL MEAN			1993
LOWEST ANNUAL MEAN			1964
HIGHEST DAILY MEAN	1510	2050	5720
LOWEST DAILY MEAN	49	80	3.0
ANNUAL SEVEN-DAY MINIMUM	52	90	3.9
INSTANTANEOUS PEAK FLOW		2120	5940
INSTANTANEOUS PEAK STAGE		7.28	11.95
INSTANTANEOUS LOW FLOW		78	3.0
ANNUAL RUNOFF (CFSM)	.96	1.22	.60
ANNUAL RUNOFF (INCHES)	13.02	16.50	8.19
10 PERCENT EXCEEDS	653	930	501
50 PERCENT EXCEEDS	275	316	101
90 PERCENT EXCEEDS	105	135	28

(a) July 24, 25.

(e) Estimated.

## 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 sea level (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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1090	1090	2100	3310	1720	946	3490	2250	726	1690	606	618
2	988	1690	2060	2880	1300	1010	3450	2150	721	1570	506	582
3	887	2030	1870	2850	1490	1040	3380	2170	636	1450	523	673
4	744	2290	1870	3450	1450	1190	3190	1990	661	1320	522	891
5	736	2210	1740	4600	1360	1350	2920	2190	793	1230	456	859
6	703	2150	1680	5130	1400	1280	2760	2360	847	1060	474	913
7	626	1990	1300	4860	1240	1340	2640	2370	1050	969	494	903
8	632	1880	1570	4220	1340	1620	2410	2210	1580	902	494	875
9	913	1660	1340	3470	1110	2080	2380	2050	1980	874	488	757
10	821	1640	1330	2620	1180	2180	2280	1830	2190	988	718	635
11	895	1610	1380	2360	1060	2030	2370	1710	1900	1040	681	524
12	853	2160	1310	2570	1080	1790	2380	1550	1670	902	633	541
13	774	3290	1300	2690	1090	1670	2420	1430	1410	864	529	520
14	823	3730	1340	2630	1030	1260	2290	1370	1440	811	422	688
15	1340	3750	1390	2520	1020	1280	2260	1280	1410	763	463	1230
16	2140	3690	1550	2400	988	1580	2170	1070	1170	764	413	1540
17	2430	3180	1720	2230	973	1860	2210	1130	1070	684	363	1260
18	2340	2800	1780	1880	749	1930	2050	1010	1010	643	450	1180
19	2070	2570	1650	1480	702	1790	2260	1010	1220	789	367	979
20	2040	2320	1700	1570	790	1650	5130	916	2060	692	633	872
21	1970	2200	1500	2040	930	1590	5910	926	2530	763	532	1290
22	1760	2190	1400	2340	814	1700	5460	820	2840	771	494	1000
23	1760	2980	1410	2440	1000	2410	4620	788	2860	738	379	854
24	1640	3850	1140	2580	749	3240	3590	842	2580	675	511	774
25	1560	3780	899	2450	769	3640	3090	714	2290	1330	465	642
26	1510	3470	801	2080	836	3940	2620	691	2010	1630	402	1120
27	1370	3050	718	2250	732	4030	2280	673	1870	1270	418	1340
28	1310	2730	954	2060	914	4060	2200	668	1860	1020	439	1900
29	1290	2450	1390	1720	---	4080	2060	600	1860	819	541	2140
30	1090	2350	1700	1390	---	3890	2210	633	1760	674	597	2040
31	1120	---	2920	1660	---	3560	---	587	---	616	586	---
TOTAL	40175	76780	46812	82730	29816	67016	88480	41988	48004	30311	15599	30140
MEAN	1296	2559	1510	2669	1065	2162	2949	1354	1600	978	503	1005
MAX	2430	3850	2920	5130	1720	4080	5910	2370	2860	1690	718	2140
MIN	626	1090	718	1390	702	946	2050	587	636	616	363	520
CFSM	1.05	2.08	1.23	2.17	.87	1.76	2.40	1.10	1.30	.79	.41	.82
IN.	1.22	2.32	1.42	2.60	.90	2.03	2.68	1.27	1.45	.92	.47	.91

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 1993, BY WATER YEAR (WY)

MEAN	446	603	725	809	1009	1929	1796	1113	825	475	338	358
MAX	1880	2559	1666	2669	2550	7242	5113	3815	2800	2204	1178	1277
(WY)	1987	1993	1976	1993	1976	1904	1947	1956	1905	1902	1992	1903
MIN	88.5	138	124	150	158	348	488	330	168	98.3	61.1	93.6
(WY)	1964	1965	1964	1963	1963	1964	1935	1958	1936	1936	1936	1963

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1901 - 1993

ANNUAL TOTAL	477933	597851	866
ANNUAL MEAN	1306	1638	1993
HIGHEST ANNUAL MEAN			1638
LOWEST ANNUAL MEAN			232
HIGHEST DAILY MEAN	4030	5910	22700
LOWEST DAILY MEAN	261	363	20
ANNUAL SEVEN-DAY MINIMUM	359	430	44
INSTANTANEOUS PEAK FLOW		6020	(a)24500
INSTANTANEOUS PEAK STAGE		10.70	(b)18.60
INSTANTANEOUS LOW FLOW		228	2.8
ANNUAL RUNOFF (CFSM)	1.06	1.33	.70
ANNUAL RUNOFF (INCHES)	14.45	18.08	9.57
10 PERCENT EXCEEDS	2200	2920	1910
50 PERCENT EXCEEDS	1190	1400	534
90 PERCENT EXCEEDS	560	630	180

(a) From rating curve extended above 15,000 ft<sup>3</sup>/s.

(b) Datum then in use.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level (levels by Michigan Department of Natural Resources). Prior to July 6, 1953, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1140	1200	2390	3560	1800	1030	3890	2400	756	1820	754	725
2	1140	1620	2190	3460	1820	1090	3910	2400	882	1740	747	743
3	1020	2360	2100	2910	1460	1150	3820	2270	881	1620	632	753
4	946	2430	1940	3870	1590	1230	3690	2390	801	1510	661	840
5	852	2460	1940	5390	1490	1350	3430	2330	900	1350	644	981
6	830	2350	1700	5730	1520	1410	3120	2480	986	1310	592	968
7	821	2120	1800	5680	1500	1410	2940	2520	1080	1100	668	1000
8	750	2080	1380	4990	1360	1590	2750	2490	1640	1080	624	1010
9	947	1860	1610	4140	1420	1960	2560	2270	1930	1020	605	952
10	904	1730	1450	3320	1240	2330	2600	2060	2240	1060	614	855
11	977	1700	1470	2810	1280	2270	2470	1900	2160	1090	901	731
12	971	1860	1460	2630	1190	2050	2640	1750	1860	1120	812	635
13	945	3600	1430	2810	1220	1840	2570	1600	1630	990	758	660
14	896	3820	1440	2780	1220	1690	2530	1470	1460	983	655	648
15	1150	4080	1490	2690	1160	1290	2450	1470	1630	921	551	1100
16	1760	3960	1620	2550	1150	1430	2450	1350	1450	908	585	1460
17	2480	3700	1780	2410	1130	1870	2350	1190	1230	855	529	1560
18	2480	3230	1860	2300	1090	2080	2310	1240	1200	790	488	1290
19	2290	2840	1880	2020	903	2010	2200	1150	1220	857	537	1240
20	2080	2600	1750	1780	902	1820	5700	1140	2550	877	500	1080
21	2050	2360	1730	1800	926	1730	7500	1040	2910	847	732	1350
22	1910	2290	1600	2330	1040	1750	6830	1060	3090	876	629	1580
23	1810	2670	1500	2600	1010	2130	5930	963	3070	888	595	1190
24	1730	3390	e1400	2680	1140	3230	4750	942	2910	847	575	1030
25	1660	3970	e1200	2780	907	3930	3830	970	2670	963	651	942
26	1520	4000	e1000	2610	978	4360	3280	866	2700	2050	570	883
27	1500	3540	e800	2190	987	4620	2770	842	2220	1730	523	1200
28	1410	3110	e950	2320	890	4770	2480	813	2040	1270	530	1560
29	1300	2830	e1300	2090	---	4800	2410	816	2010	1060	565	1960
30	1390	2530	e1600	1890	---	4560	2410	743	1930	934	755	2190
31	1070	---	2910	1550	---	4200	---	803	---	806	762	---
TOTAL	42729	82290	50670	92670	34323	72980	102570	47728	54036	35272	19744	33116
MEAN	1378	2743	1635	2989	1226	2354	3419	1540	1801	1138	637	1104
MAX	2480	4080	2910	5730	1820	4800	7500	2520	3090	2050	901	2190
MIN	750	1200	800	1550	890	1030	2200	743	756	790	488	635
CFSM	1.00	1.98	1.18	2.16	.89	1.70	2.47	1.11	1.30	.82	.46	.80
IN.	1.15	2.21	1.36	2.49	.92	1.96	2.75	1.28	1.45	.96	.53	.89

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

	MEAN	523	760	906	944	1105	2056	2002	1280	819	545	411	430
MAX	1766	2743	1975	2989	2947	4202	3936	4676	2587	2268	1297	1433	
(WY)	1982	1993	1976	1993	1976	1974	1975	1956	1989	1968	1992	1975	
MIN	132	174	161	184	186	382	683	373	258	155	166	133	
(WY)	1964	1965	1964	1963	1963	1964	1964	1958	1988	1965	1965	1963	

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1952 - 1993

ANNUAL TOTAL	532558	668128	
ANNUAL MEAN	1455	1830	
HIGHEST ANNUAL MEAN			978
LOWEST ANNUAL MEAN			1830
HIGHEST DAILY MEAN	4570	7500	12200
LOWEST DAILY MEAN	332	488	58
ANNUAL SEVEN-DAY MINIMUM	397	549	85
INSTANTANEOUS PEAK FLOW		8270	12400
INSTANTANEOUS PEAK STAGE		11.17	12.98
INSTANTANEOUS LOW FLOW		372	38
ANNUAL RUNOFF (CFSM)	1.05	1.32	.71
ANNUAL RUNOFF (INCHES)	14.30	17.95	9.59
10 PERCENT EXCEEDS	2440	3900	2140
50 PERCENT EXCEEDS	1360	1550	605
90 PERCENT EXCEEDS	655	756	229

(e) Estimated.



## 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 sea level (levels by Michigan Department of Natural Resources). Prior to June 2, 1962, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	98	163	524	e385	e330	e130	986	840	124	233	142	125
2	98	328	515	e330	e310	e140	1020	750	121	214	126	122
3	87	344	493	319	e290	e150	1040	697	120	193	110	127
4	82	265	463	766	e260	e165	1020	690	117	174	101	126
5	76	242	428	972	e240	e180	982	830	134	153	89	119
6	72	247	e390	814	e230	e190	937	686	133	137	91	116
7	74	253	363	714	e225	199	890	587	172	123	95	122
8	68	266	330	e660	e220	261	843	527	381	113	86	110
9	83	281	303	e680	e210	326	822	488	333	104	79	101
10	98	293	284	e700	203	302	783	457	262	98	130	95
11	88	297	265	e690	195	e270	720	428	236	95	122	87
12	92	420	251	e660	e185	e255	707	396	232	91	95	84
13	96	631	242	e620	180	e245	637	357	233	86	86	82
14	102	495	234	e580	174	e235	577	324	275	96	80	87
15	149	416	231	e540	169	e260	554	300	280	87	77	190
16	262	384	261	e490	166	310	541	269	239	80	79	192
17	214	388	250	e450	160	381	505	241	214	77	78	161
18	184	405	242	e430	e155	e315	467	224	200	77	72	158
19	181	422	241	e415	e150	e280	469	209	245	77	69	162
20	191	440	247	e400	e150	279	1800	191	938	76	130	164
21	214	451	e245	385	e145	281	1400	177	492	72	124	268
22	223	455	243	394	332	332	1040	166	340	68	114	240
23	229	625	234	392	e140	464	875	160	284	66	112	202
24	232	597	e220	383	e135	588	880	157	264	64	125	182
25	228	538	e205	e375	e135	638	940	150	314	231	120	175
26	221	509	e200	e370	e130	691	963	152	355	387	106	246
27	211	497	e190	359	e130	769	961	140	331	250	99	298
28	201	502	e185	354	e125	884	946	134	300	185	94	343
29	190	515	186	e350	---	953	940	127	275	168	96	282
30	180	523	287	e345	---	954	926	123	252	163	114	276
31	170	---	504	e340	---	940	---	127	---	153	117	---
TOTAL	4689	12192	9256	15652	5282	12367	26171	11104	8196	4191	3158	5042
MEAN	151	406	299	505	189	399	872	358	273	135	102	168
MAX	262	631	524	972	330	954	1800	840	938	387	142	343
MIN	68	163	185	319	125	130	467	123	117	64	69	82
CFSM	.54	1.45	1.06	1.80	.67	1.42	3.10	1.27	.97	.48	.36	.60
IN.	.62	1.61	1.23	2.07	.70	1.64	3.46	1.47	1.09	.55	.42	.67

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1993, BY WATER YEAR (WY)

	MEAN	89.1	122	157	172	213	437	421	249	135	79.3	52.7	73.2
MAX	614	414	445	505	673	1058	1131	910	518	374	184	532	
(WY)	1987	1991	1976	1993	1976	1985	1947	1956	1986	1957	1975	1975	
MIN	15.3	25.0	21.6	24.0	24.3	47.0	85.9	64.8	31.3	13.6	16.9	15.3	
(WY)	1964	1964	1964	1963	1963	1964	1964	1958	1964	1965	1965	1963	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1944 - 1993
ANNUAL TOTAL	88189	117300	
ANNUAL MEAN	241	321	183
HIGHEST ANNUAL MEAN			321
LOWEST ANNUAL MEAN			35.7
HIGHEST DAILY MEAN	904	1800	2400
LOWEST DAILY MEAN	46	64	11
ANNUAL SEVEN-DAY MINIMUM	53	71	11
INSTANTANEOUS PEAK FLOW		2040	(a)2860
INSTANTANEOUS PEAK STAGE		6.63	(b)9.90
INSTANTANEOUS LOW FLOW		64	10
ANNUAL RUNOFF (CFSM)	.86	1.14	.65
ANNUAL RUNOFF (INCHES)	11.67	15.53	8.86
10 PERCENT EXCEEDS	431	703	431
50 PERCENT EXCEEDS	191	240	95
90 PERCENT EXCEEDS	89	93	32

(a) From rating curve extended above 1,900 ft<sup>3</sup>/s.

(b) From floodmark, backwater from ice.

(c) July 23, 24.

(e) Estimated.

## 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 sea level (levels by Michigan Department of Natural Resources). Prior to Oct. 4, 1968, nonrecording gage at same site and datum.

REMARKS.--Records fair. Several measurements of water temperature were made during the year.

**EXTREMES OUTSIDE PERIOD OF RECORD.**--Flood in March 1904 reached a stage of 13.8 ft, from information by local resident.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	172	249	728	692	e400	146	2460	817	e145	289	59	138
2	145	269	651	786	e380	149	2030	740	e140	265	54	134
3	125	365	587	788	e360	161	1740	677	e135	242	49	132
4	108	622	533	1030	e350	188	1570	649	e135	220	47	139
5	92	762	483	2100	e340	206	1530	693	e130	194	43	137
6	80	789	445	2390	e330	218	1470	e720	e135	163	46	122
7	73	757	414	e2350	e310	245	1350	e650	e135	132	58	104
8	70	698	386	e2100	e300	295	1190	e550	e140	109	58	91
9	81	638	360	e1800	e290	355	1060	e500	193	96	54	80
10	96	584	342	e1600	e280	421	1000	e450	238	93	51	75
11	112	542	327	e1400	e260	479	939	e400	260	85	50	69
12	115	526	313	e1200	e250	e480	894	e375	253	78	49	64
13	106	661	303	e1000	e240	872	872	e350	239	72	49	65
14	96	850	298	e900	e230	e380	838	e325	228	71	47	70
15	105	961	300	e800	e220	e350	783	e300	226	70	45	245
16	176	956	318	e700	219	e380	715	e280	218	66	89	290
17	263	893	350	e600	209	e450	671	e270	207	62	66	292
18	306	817	370	e500	206	e500	630	e260	199	58	54	280
19	337	744	375	e450	184	e550	603	e250	193	57	60	260
20	361	673	369	e400	171	e500	967	e230	267	56	211	238
21	365	607	358	e400	171	e450	1780	e220	361	54	209	234
22	369	573	345	e450	164	e420	2080	e210	407	50	178	231
23	372	663	331	e500	157	e600	2060	e200	429	46	141	224
24	385	906	312	e550	160	e800	1880	e190	419	44	147	212
25	370	1100	288	e600	157	e1100	1690	e180	400	74	169	196
26	351	1140	269	e580	153	e1500	1490	e170	380	169	135	214
27	334	1090	246	e550	150	1810	1230	e180	368	139	107	247
28	316	1000	230	e520	148	2120	1040	e180	356	109	98	308
29	299	904	233	e480	---	2520	912	e170	335	87	90	345
30	281	813	282	e450	---	2750	852	e160	312	76	116	365
31	262	---	458	e420	---	2720	---	e150	---	67	128	---
TOTAL	6723	22152	11604	29086	6789	23673	38326	11496	7583	3393	2757	5601
MEAN	217	738	374	938	242	764	1278	371	253	109	88.9	187
MAX	385	1140	728	2390	400	2750	2460	817	429	289	211	365
MIN	70	249	230	400	148	146	603	150	130	44	43	64
CFSM	.50	1.70	.86	2.16	.56	1.76	2.94	.85	.58	.25	.20	.43
IN.	.58	1.90	.99	2.49	.58	2.03	3.29	.99	.65	.29	.24	.43

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1993, BY WATER YEAR (WY)

MEAN	149	181	260	258	282	719	652	356	179	93.2	55.4	138
MAX	1461	837	813	1035	980	2049	1582	1812	874	552	239	1634
(WY)	1987	1991	1991	1973	1976	1985	1947	1956	1989	1957	1975	1986
MIN	9.77	21.8	20.9	17.3	16.9	103	139	74.1	24.6	10.6	8.47	11.4
(WY)	1967	1963	1963	1963	1963	1964	1945	1977	1977	1965	1965	1962

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1944 - 1993
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ANNUAL TOTAL	137475		169183			
ANNUAL MEAN	376		464		277	
HIGHEST ANNUAL MEAN					501	1976
LOWEST ANNUAL MEAN					65.1	1963
HIGHEST DAILY MEAN	1690	Apr 27	2750	Mar 30	6500	Mar 20 1948
LOWEST DAILY MEAN	34	Jul 8	43	Aug 5	4.8	Sep 10 1963
ANNUAL SEVEN-DAY MINIMUM	38	Jul 2	49	Aug 9	5.6	Sep 20 1979
INSTANTANEOUS PEAK FLOW			2780	Mar 30	(a)8770	Sep 12 1986
INSTANTANEOUS PEAK STAGE			9.26	Mar 30	(b)12.33	Sep 12 1986
INSTANTANEOUS LOW FLOW			41	Aug 5	4.4	Aug 13 1965
ANNUAL RUNOFF (CFSM)	.87		1.07		.64	
ANNUAL RUNOFF (INCHES)	11.78		14.50		8.67	
10 PERCENT EXCEEDS	781		1010		670	
50 PERCENT EXCEEDS	304		300		117	
90 PERCENT EXCEEDS	62		73		22	

(a) Caused by dam failure on Rainbow Lake (Pine Creek).

(b) From floodmark.

(e) Estimated.

## 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.--39.7 mi<sup>2</sup>.

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

REVISED RECORDS.--WDR MI-92-1: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 795 ft above sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	30	38	62	35	29	80	49	60	26	18	44
2	25	93	37	e43	e34	30	65	43	40	25	17	30
3	25	143	36	40	33	33	62	45	33	24	16	50
4	25	93	34	100	33	34	60	48	31	23	16	42
5	25	67	33	185	33	32	74	60	46	22	17	30
6	25	51	32	84	34	32	65	48	37	22	35	26
7	25	43	31	58	33	33	59	41	42	21	53	25
8	26	40	32	47	33	33	55	37	75	21	28	26
9	69	40	32	41	31	37	61	34	64	22	24	26
10	47	40	33	38	32	37	64	37	41	20	23	25
11	35	41	34	38	32	34	53	33	32	19	23	24
12	32	52	35	38	31	33	65	30	29	20	21	24
13	30	81	36	39	32	32	49	29	27	20	20	24
14	29	54	37	40	32	e31	42	29	38	22	20	45
15	42	43	37	40	31	e30	53	31	38	21	22	73
16	57	39	62	39	31	31	82	29	30	18	36	39
17	43	38	53	39	31	38	60	28	28	18	25	30
18	37	38	42	e36	e30	34	48	30	39	20	22	27
19	35	35	39	e35	e29	31	47	32	48	26	31	26
20	34	35	38	e37	e29	31	135	30	117	23	75	25
21	44	39	31	42	e29	30	108	29	95	19	31	32
22	41	41	32	50	e29	31	64	29	47	19	25	29
23	35	99	32	46	e28	40	51	32	36	17	36	27
24	33	92	31	43	e27	49	55	56	31	17	74	25
25	32	54	e30	40	e26	59	74	40	31	26	38	24
26	31	52	e27	e38	e27	71	53	33	31	27	33	34
27	30	48	27	38	e28	104	45	30	28	22	40	42
28	29	47	27	37	e29	137	45	32	26	25	28	62
29	29	39	41	35	---	175	49	29	26	22	28	38
30	29	38	70	e33	---	143	69	28	25	20	34	40
31	28	---	111	35	---	111	---	65	---	18	78	---
TOTAL	1053	1645	1210	1516	862	1605	1892	1146	1271	665	987	1014
MEAN	34.0	54.8	39.0	48.9	30.8	51.8	63.1	37.0	42.4	21.5	31.8	33.8
MAX	69	143	111	185	35	175	135	65	117	27	78	73
MIN	25	30	27	33	26	29	42	28	25	17	16	24
CFSM	.86	1.38	.98	1.23	.78	1.30	1.59	.93	1.07	.54	.80	.85
IN.	.99	1.54	1.13	1.42	.81	1.50	1.77	1.07	1.19	.62	.92	.95

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1988 - 1993, BY WATER YEAR (WY)

	1988	1989	1990	1991	1992	1993
MEAN	31.4	42.4	36.2	34.8	31.7	52.6
MAX	39.2	54.8	46.1	48.9	35.6	57.5
(WY)	1992	1993	1992	1993	1988	1989
MIN	20.1	33.0	19.8	28.8	25.7	42.6
(WY)	1990	1988	1990	1989	1989	1988

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1988 - 1993

	1992 CALENDAR YEAR	1993 WATER YEAR	1988 - 1993
ANNUAL TOTAL	13508	14866	
ANNUAL MEAN	36.9	40.7	34.4
HIGHEST ANNUAL MEAN			40.7
LOWEST ANNUAL MEAN			28.6
HIGHEST DAILY MEAN	143	Nov 3	185
LOWEST DAILY MEAN	16	Jul 7	16
ANNUAL SEVEN-DAY MINIMUM	16	Aug 20	17
INSTANTANEOUS PEAK FLOW			232
INSTANTANEOUS PEAK STAGE			4.68
INSTANTANEOUS LOW FLOW			15
ANNUAL RUNOFF (CFSM)	.93		1.03
ANNUAL RUNOFF (INCHES)	12.66		13.93
10 PERCENT EXCEEDS	54		65
50 PERCENT EXCEEDS	32		34
90 PERCENT EXCEEDS	20		24

(a) Not determined.

(b) Aug. 2, 3, 4.

(c) July 10, 14, 1988.

(e) Estimated.

## 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 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 sea level. Mar. 19 to Sept. 24, 1931, nonrecording gage at site 1.5 mi upstream at different datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1840	1950	4640	5770	3320	e1800	10100	5750	1490	3050	1410	1670
2	1930	2950	4370	5660	3200	e1900	9490	5370	1490	2820	1200	1400
3	1590	4900	4100	5400	2990	1970	9020	5120	1630	2610	1130	1510
4	1470	5090	3890	6100	2960	2120	8550	4960	1530	2570	1020	1570
5	1400	4830	3670	9550	3000	2200	8100	5070	1520	2290	1020	1570
6	1220	4710	3460	12000	2860	2330	7650	5270	1600	2050	1070	1680
7	1240	4510	3250	11900	2720	2480	7140	5190	1770	2010	1170	1640
8	1210	4160	3200	10800	2670	2930	6660	4910	2680	1480	1220	1540
9	1240	3970	2720	e9300	2520	3740	6220	4670	3510	1750	1090	1570
10	1500	3660	2970	e8000	2490	3980	6020	4250	3450	1440	1110	1400
11	1430	3450	2770	e6900	2350	4000	5740	3890	3400	1510	1100	1180
12	1390	3660	2670	e5900	2220	3560	5620	3680	3190	1560	1400	1110
13	1520	5140	2550	e5200	2190	3240	5590	3330	2800	1500	1200	1040
14	1380	6340	2540	e5400	2220	3090	5350	3140	2670	1470	1130	1230
15	1340	6360	2560	e5000	2150	2780	5100	2850	2780	1430	871	2370
16	2610	6250	2850	e4700	2070	2670	5000	2800	2720	1290	907	3300
17	3580	6050	3170	e4400	2000	3930	4860	2430	2280	1120	1060	2830
18	3730	5540	3170	e4100	1680	4030	4680	2430	2180	1280	963	2620
19	3450	4990	3210	e3700	1620	3850	4530	2290	2240	1290	887	2320
20	3220	4610	3160	3330	1530	3660	6980	2210	4210	1300	1090	2190
21	3190	4350	2910	3400	1830	3340	12700	2190	5990	1060	1450	2310
22	3080	4130	2900	4040	1600	3540	13900	1980	5520	1270	1410	3200
23	2900	4750	2760	4450	1660	4170	12400	1930	5160	1150	1320	2590
24	2770	5950	2550	4490	e1800	5740	10600	1840	4780	1180	1500	1930
25	2770	6440	2200	4580	e1650	6640	9180	1840	4500	2120	1610	1950
26	2730	6600	e1800	4410	e1600	7620	8060	1710	4560	5050	1250	2110
27	2540	6400	e1600	4140	e1600	8550	7160	1580	4180	4780	1220	3120
28	2480	5890	e1900	4000	e1650	9470	6410	1650	3590	3380	1060	3860
29	2120	5370	e2500	3960	---	10400	5980	1440	3310	2170	1020	4060
30	2090	4940	3280	3460	---	11000	5960	1470	3210	1690	1440	4040
31	2260	---	4890	3310	---	10800	---	1550	---	1480	1680	---
TOTAL	67220	147940	94210	177150	62150	141530	224750	98790	93940	61150	37008	64910
MEAN	2168	4931	3039	5715	2220	4565	7492	3187	3131	1973	1194	2164
MAX	3730	6600	4890	12000	3320	11000	13900	5750	5990	5050	1680	4060
MIN	1210	1950	1600	3310	1530	1800	4530	1440	1490	1060	871	1040
CFSM	.76	1.74	1.07	2.01	.78	1.61	2.64	1.12	1.10	.69	.42	.76
IN.	.88	1.94	1.23	2.32	.81	1.85	2.94	1.29	1.23	.80	.48	.85

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	1203	1571	1958	1992	2321	4408	4181	2513	1542	1001	736	948
MAX	7613	4931	4672	5715	6170	9398	7492	9715	4963	3810	1752	4613	
(WY)	1987	1993	1991	1993	1976	1985	1993	1956	1989	1968	1992	1975	
MIN	254	380	346	375	377	802	702	567	464	287	310	300	
(WY)	1964	1965	1964	1963	1963	1964	1931	1931	1988	1965	1965	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1931 - 1993

ANNUAL TOTAL	998991												
ANNUAL MEAN	2729												
HIGHEST ANNUAL MEAN													
LOWEST ANNUAL MEAN													
HIGHEST DAILY MEAN	9080												
LOWEST DAILY MEAN	503												
ANNUAL SEVEN-DAY MINIMUM	666												
INSTANTANEOUS PEAK FLOW													
INSTANTANEOUS PEAK STAGE													
INSTANTANEOUS LOW FLOW													
ANNUAL RUNOFF (CFSM)	.96												
ANNUAL RUNOFF (INCHES)	13.09												
10 PERCENT EXCEEDS	4660												
50 PERCENT EXCEEDS	2480												
90 PERCENT EXCEEDS	1090												

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04117500 THORNAPPLE RIVER NEAR HASTINGS, MI

LOCATION.--Lat 42°36'57", long 85°14'11", in SE1/4 sec.27, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, on right bank at downstream side of bridge on McKeown Road, 0.6 mi downstream from Cedar Creek, 2.0 mi downstream from Thornapple Lake, and 3.2 mi southeast of Hastings.

DRAINAGE AREA.--385 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Datum of gage is 786.71 ft above sea level (levels by Michigan Department of Natural Resources). Prior to Oct. 1, 1965, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	251	244	522	1020	399	248	1540	753	215	529	242	226
2	229	318	475	1080	374	249	1420	673	211	459	240	216
3	214	562	440	1150	355	e260	1300	611	208	405	226	221
4	202	821	412	1330	346	e300	1180	580	209	367	216	229
5	189	935	392	1780	338	e320	1060	591	246	328	205	227
6	180	944	367	2110	350	e330	945	592	282	294	223	215
7	175	890	344	2140	371	e380	827	585	290	268	301	205
8	174	789	327	1960	366	e420	716	552	343	247	317	197
9	191	667	315	1620	346	e520	662	505	423	260	292	188
10	208	564	313	1330	319	e640	662	451	473	263	263	185
11	217	501	313	1090	310	e760	678	406	457	259	253	178
12	210	487	315	922	302	e700	659	374	395	248	255	179
13	201	625	318	780	293	563	631	344	330	231	241	186
14	198	856	326	669	291	452	601	319	306	232	224	191
15	251	1010	341	616	289	391	572	303	352	248	212	275
16	383	1110	398	572	284	390	563	292	363	242	205	375
17	515	1120	497	537	279	478	589	279	331	223	202	436
18	604	1060	548	472	262	586	596	267	304	219	195	447
19	638	961	532	403	240	633	587	263	328	306	190	405
20	626	821	495	374	253	578	1290	258	629	392	188	348
21	582	684	444	406	269	499	2570	252	1050	439	183	371
22	524	801	403	482	260	474	3250	245	1210	424	178	434
23	469	645	371	550	260	614	3150	242	1180	359	173	492
24	420	753	341	623	251	1000	2660	250	1060	303	193	465
25	381	822	285	667	232	1290	2180	264	947	306	204	398
26	344	831	253	605	242	1450	1770	253	919	379	199	382
27	314	819	243	613	246	1620	1410	239	852	434	190	438
28	290	759	261	588	242	1730	1140	225	786	418	186	553
29	273	670	294	521	---	1770	939	220	696	356	189	649
30	260	586	392	432	---	1750	824	212	614	297	210	671
31	249	---	680	398	---	1640	---	213	---	256	227	---
TOTAL	9962	22455	11957	27840	8369	23035	36971	11613	16009	9991	6822	9982
MEAN	321	748	386	898	299	743	1232	375	534	322	220	333
MAX	638	1120	680	2140	399	1770	3250	753	1210	529	317	671
MIN	174	244	243	374	232	248	563	212	208	219	173	178
CFSM	.83	1.94	1.00	2.33	.78	1.93	3.20	.97	1.39	.84	.57	.86
IN.	.96	2.17	1.16	2.69	.81	2.23	3.57	1.12	1.55	.97	.66	.96

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1945 - 1993, BY WATER YEAR (WY)

	MEAN	200	260	330	354	389	701	661	397	269	160	125	149
MAX	1072	939	895	1049	959	1506	1914	1391	1011	410	385	357	
(WY)	1987	1991	1991	1973	1976	1948	1947	1956	1989	1968	1980	1992	
MIN	54.5	73.6	75.2	90.4	87.5	129	176	111	87.0	56.0	50.2	54.4	
(WY)	1964	1964	1964	1964	1963	1964	1946	1958	1964	1964	1946	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1945 - 1993

ANNUAL TOTAL	148079							195006					
ANNUAL MEAN	405							534					
HIGHEST ANNUAL MEAN										333			
LOWEST ANNUAL MEAN										534			1993
HIGHEST DAILY MEAN	1290							3250	Apr 22	6590		Apr 7 1947	
LOWEST DAILY MEAN	124							173	Aug 23	35		Jul 31 1964	
ANNUAL SEVEN-DAY MINIMUM	126							186	Aug 18	36		Aug 7 1964	
INSTANTANEOUS PEAK FLOW								3320	Apr 22	6810		Apr 7 1947	
INSTANTANEOUS PEAK STAGE								8.17	Apr 22	(a)10.20		Apr 7 1947	
INSTANTANEOUS LOW FLOW								164	Aug 23	33		Aug 10 1964	
ANNUAL RUNOFF (CFSM)	1.05							1.39		.86			
ANNUAL RUNOFF (INCHES)	14.31							18.84		11.74			
10 PERCENT EXCEEDS	723							1060		698			
50 PERCENT EXCEEDS	330							381		198			
90 PERCENT EXCEEDS	169							211		90			

(a) From graph based on gage readings.

(e) Estimated.



## 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 sea level (levels by Johnson and Anderson, Inc.). Prior to Aug. 30, 1952, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Slight regulation caused by mills upstream from station. Several measurements of water temperature were made during the year.

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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	170	174	307	547	275	e200	483	490	351	208	183	378
2	162	318	292	484	271	204	444	453	350	205	184	396
3	157	344	279	450	242	221	411	419	329	205	172	350
4	151	447	273	750	246	249	393	403	290	282	160	281
5	145	479	270	945	254	265	389	401	290	249	155	242
6	142	480	250	967	249	276	389	391	277	226	248	223
7	142	429	260	742	246	283	379	382	345	220	325	204
8	146	374	244	529	223	290	380	364	466	212	310	206
9	178	329	240	448	237	303	424	331	529	205	312	210
10	188	301	243	379	234	309	433	301	474	197	286	213
11	196	299	243	346	229	294	440	280	406	188	226	196
12	188	328	246	326	225	267	458	266	339	176	202	194
13	169	361	248	e310	221	245	432	252	282	169	186	189
14	163	380	248	e290	221	213	395	248	292	176	174	299
15	177	369	253	e280	216	205	412	254	280	179	168	350
16	198	362	322	e270	212	270	452	254	267	168	173	376
17	199	337	373	e260	210	342	471	252	244	154	182	362
18	210	306	382	e250	168	358	461	257	276	162	178	330
19	210	281	377	e245	188	369	457	258	313	221	173	277
20	214	268	356	e245	e200	351	772	255	433	244	170	246
21	215	279	275	281	e180	298	919	248	495	221	164	292
22	209	290	298	319	e170	280	791	241	495	181	155	295
23	208	394	280	346	e175	352	602	251	442	163	162	287
24	201	465	238	379	e180	472	489	310	358	157	202	272
25	194	486	220	373	e190	538	436	317	322	274	204	261
26	186	495	179	354	e195	556	385	319	290	311	187	311
27	181	441	223	291	e200	590	354	292	273	247	175	354
28	175	391	239	295	e200	632	345	257	252	222	178	405
29	175	357	311	291	---	645	391	253	225	229	196	430
30	172	330	410	288	---	597	478	269	211	244	207	392
31	171	---	549	238	---	528	---	363	---	196	295	---
TOTAL	5592	10894	8928	12518	6057	11002	14065	9631	10196	6491	6292	8821
MEAN	180	363	288	404	216	355	469	311	340	209	203	294
MAX	215	495	549	967	275	645	919	490	529	311	325	430
MIN	142	174	179	238	168	200	345	241	211	154	155	189
CFSM	.77	1.55	1.23	1.73	.92	1.52	2.00	1.33	1.45	.89	.87	1.26
IN.	.89	1.73	1.42	1.99	.96	1.75	2.24	1.53	1.62	1.03	1.00	1.40

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

MEAN	187	238	251	232	246	404	401	289	205	150	147	161
MAX	528	525	557	512	567	944	836	620	457	247	306	556
(WY)	1982	1991	1992	1973	1976	1976	1967	1956	1989	1982	1989	1975
MIN	100	118	126	116	107	223	175	122	108	83.8	83.2	93.7
(WY)	1965	1965	1963	1970	1963	1964	1958	1958	1964	1964	1971	1966

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1952 - 1993

ANNUAL TOTAL	103995	110487	
ANNUAL MEAN	284	303	
HIGHEST ANNUAL MEAN			242
LOWEST ANNUAL MEAN			360
HIGHEST DAILY MEAN	740	967	155
LOWEST DAILY MEAN	110	142	155
ANNUAL SEVEN-DAY MINIMUM	114	149	3290
INSTANTANEOUS PEAK FLOW		1120	49
INSTANTANEOUS PEAK STAGE		7.25	58
INSTANTANEOUS LOW FLOW		138	3540
ANNUAL RUNOFF (CFSM)	1.21	1.29	9.29
ANNUAL RUNOFF (INCHES)	16.53	17.56	28
10 PERCENT EXCEEDS	482	459	1.04
50 PERCENT EXCEEDS	250	275	14.07
90 PERCENT EXCEEDS	142	176	426
			190
			107

(a) 1976, 1991.

(b) Oct. 7, Feb. 18 (result of freezeup).

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 in Grand Rapids, 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 sea level (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.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4060	3970	7890	8940	5830	4020	15700	10400	3860	5360	3360	3880
2	3730	4910	7350	9180	5440	4030	15500	9750	3670	5140	3200	3780
3	3680	6510	6920	9240	5380	4430	14900	9140	3690	4910	2980	3750
4	3330	8070	6530	11000	5260	4670	14100	8610	3750	4700	2820	3790
5	3160	8440	6230	13300	5260	4520	13300	8350	3840	4500	2650	3540
6	3050	8500	5910	14500	5260	4580	12600	8280	3860	4250	3210	3540
7	2920	8260	5630	15800	5030	4770	11900	8270	4160	3860	3500	3470
8	2950	7870	5500	16700	4910	5040	11100	8120	5200	3690	3430	3450
9	3250	7290	5220	16400	4830	5670	10600	7730	6200	3300	3360	3380
10	3140	6900	5020	15200	4730	6390	10100	7300	6650	3390	3170	3320
11	3240	6530	5090	13300	4660	6630	9640	6720	6340	3170	3080	3130
12	2990	6350	4970	11900	4470	6500	9390	6190	5970	3210	3140	2990
13	2900	7020	4870	10500	4420	6070	9070	5730	5550	3170	3140	2990
14	3140	8000	4760	9370	4310	5510	8780	5370	5330	3260	2960	3690
15	3310	8770	4790	8810	4320	5200	8630	5120	5100	3200	2850	4570
16	3580	9110	5250	8220	4240	5270	8860	4840	5020	3010	2660	5360
17	4880	9220	5680	7670	4180	6190	8470	4690	4860	2990	2690	5630
18	5660	9150	5890	7200	3730	6920	8000	4410	4730	2860	2790	5370
19	5940	8760	5900	6180	3170	6840	7650	4290	4720	2980	2700	4900
20	5740	8100	5890	5690	3600	6620	10000	4230	6080	3090	2660	4630
21	5530	7520	5630	6050	3710	6290	12400	4100	8510	3120	2760	5300
22	5460	7110	5310	6520	2990	6010	14700	4070	9490	2990	3020	5770
23	5320	7610	5230	7090	2980	6760	17600	3970	9580	3040	3030	5940
24	5030	8450	4890	7360	3320	8340	18700	4100	9140	2980	3220	5180
25	4920	9110	4100	7440	3580	9550	18100	3880	8470	3290	3560	4540
26	4800	9570	3260	7160	3820	10500	16200	3930	7840	4340	3360	4950
27	4690	9760	3000	7090	3820	11400	14400	3820	7480	6180	3090	5410
28	4440	9650	3600	6810	3900	12500	12700	3610	6900	6130	3040	6340
29	4260	9280	4630	6560	---	13500	11600	3610	6210	5050	2920	6680
30	4020	8580	6360	6120	---	14500	11000	3440	5680	4020	3200	7000
31	3940	---	8110	5850	---	15300	---	3850	---	3380	3770	---
TOTAL	127040	238370	169410	293150	121150	224520	365690	179920	177880	118560	95320	136390
MEAN	4098	7946	5465	9456	4327	7243	12190	5804	5929	3825	3075	4546
MAX	5940	9760	8110	16700	5830	15300	18700	10400	9580	6180	3770	7000
MIN	2900	3970	3000	5690	2980	4020	7650	3440	3670	2860	2650	2990
CFSM	.84	1.62	1.12	1.93	.88	1.48	2.49	1.18	1.21	.78	.63	.93
IN.	.96	1.81	1.29	2.23	.92	1.70	2.78	1.37	1.35	.90	.72	1.04

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 1993, BY WATER YEAR (WY)

	MEAN	2370	2847	3364	3682	4220	7677	7119	4640	3299	2099	1662	1979
MAX	13630	7966	8794	12020	14720	21580	17900	15650	15670	6467	3359	7600	
(WY)	1987	1991	1991	1973	1938	1904	1947	1956	1905	1902	1992	1975	
MIN	906	1004	1080	1069	1079	1858	1759	1459	930	650	617	949	
(WY)	1965	1931	1964	1963	1963	1931	1931	1931	1934	1934	1934	1964	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1901 - 1993

ANNUAL TOTAL	1852850		2247400									
ANNUAL MEAN	5062		6157									
HIGHEST ANNUAL MEAN										3741		
LOWEST ANNUAL MEAN										6314		1943
HIGHEST DAILY MEAN	12700		18700							1264		1931
LOWEST DAILY MEAN	1760		2650							53300		Mar 27 1904
ANNUAL SEVEN-DAY MINIMUM	1970		2730							381		(a)
INSTANTANEOUS PEAK FLOW			18900							438		Aug 8 1936
INSTANTANEOUS PEAK STAGE			16.10							54000		Mar 28 1904
INSTANTANEOUS LOW FLOW			(b)2510							19.64		Mar 1 1986
ANNUAL RUNOFF (CFSM)	1.03		1.26							.76		
ANNUAL RUNOFF (INCHES)	14.07		17.06							10.37		
10 PERCENT EXCEEDS	8030		10200							7600		
50 PERCENT EXCEEDS	4570		5280							2500		
90 PERCENT EXCEEDS	2640		3130							1170		

(a) Aug. 9, 17, 1936.

(b) Result of freezeup.

(c) Estimated.



## 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.--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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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)
JAN 07...	1535	16700	411	8.1	1.0	37	12.3	88	5200
APR 01...	1445	17300	422	8.2	5.0	4.5	11.3	92	K41
MAY 13...	1405	6520	600	8.4	19.0	8.7	9.6	106	67
JUL 09...	1300	3570	651	8.6	26.0	2.0	9.6	122	85
AUG 26...	1145	3740	575	8.4	25.0	4.5	8.2	101	K380

DATE	STREP- TOCOCCEI FECAL KF AGAR (COLS. PER 100 ML) (31673)	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)
JAN 07...	K12000	170	29	47	13	11	3.9	173	--
APR 01...	K84	190	29	52	14	9.5	3.3	193	--
MAY 13...	120	290	50	78	22	19	2.7	283	2
JUL 09...	K730	290	57	81	22	24	2.7	278	5
AUG 26...	390	260	57	69	22	25	2.9	237	7

DATE	ALKA- LITY 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)	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) (00613)
JAN 07...	142	25	21	0.10	6.0	227	0.31	10200	0.050
APR 01...	158	25	20	0.10	5.0	239	0.33	11200	0.020
MAY 13...	236	40	33	0.20	3.6	360	0.49	6340	0.020
JUL 09...	236	45	44	0.20	9.5	399	0.54	3850	0.020
AUG 26...	206	47	44	0.20	7.3	360	0.49	3640	0.030

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04119300 GRAND RIVER AT EASTMANVILLE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	NITRO- GEN, NO <sub>2</sub> +NO <sub>3</sub> DIS- SOLVED (MG/L AS N) (00631)	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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)
JAN 07...	1.70	0.160	0.90	0.190	0.060	0.060	<10
APR 01...	1.50	0.180	0.80	0.070	0.030	0.030	<10
MAY 13...	0.720	0.190	1.2	0.110	0.020	0.010	--
JUL 09...	1.10	0.020	0.50	0.120	0.020	0.010	20
AUG 26...	0.950	0.090	0.50	0.030	0.010	<0.010	<10

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)
JAN 07...	29	<3	64	<4	13	<10	1
APR 01...	31	<3	53	<4	10	<10	<1
MAY 13...	--	--	--	--	--	--	--
JUL 09...	51	<3	5	5	2	<10	2
AUG 26...	46	<3	5	4	<1	<10	1

DATE	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)	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)
JAN 07...	<1	<1.0	110	<6	73	3290	58
APR 01...	<1	<1.0	120	<6	22	1030	43
MAY 13...	--	--	--	--	35	616	91
JUL 09...	<1	<1.0	280	<6	25	241	96
AUG 26...	<1	<1.0	260	<6	38	384	96

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	157	134	229	250	176	132	384	276	189	154	84	238
2	151	187	219	235	159	136	280	270	162	149	84	225
3	145	281	212	175	150	142	234	260	144	132	84	188
4	142	324	214	237	161	145	213	256	136	117	86	166
5	138	298	205	261	160	141	213	260	138	108	89	154
6	135	257	192	272	157	138	218	268	141	107	95	142
7	133	215	202	232	146	138	220	260	140	110	109	134
8	133	188	195	217	137	134	227	245	189	106	108	130
9	162	181	186	204	161	134	278	233	277	106	94	134
10	177	188	188	186	148	134	339	223	294	108	90	133
11	169	196	191	181	145	133	333	218	263	105	87	130
12	159	203	191	178	140	129	282	210	225	101	86	125
13	148	233	191	175	141	126	255	205	205	99	83	124
14	142	251	187	175	142	110	250	215	192	98	80	133
15	143	227	187	169	141	120	264	211	183	96	81	154
16	187	207	213	172	140	131	342	188	176	94	90	161
17	218	191	250	171	137	136	403	173	170	91	91	150
18	213	183	248	168	115	124	366	169	162	93	87	139
19	188	175	226	162	122	133	307	152	155	98	83	131
20	173	180	194	158	143	136	395	135	207	98	83	127
21	166	206	183	167	143	130	560	130	248	92	80	127
22	166	268	190	169	133	127	591	127	245	88	78	129
23	161	330	193	170	130	127	453	129	212	85	85	129
24	155	354	162	172	e131	142	347	151	205	85	92	127
25	148	349	161	175	132	194	312	151	202	90	88	125
26	143	319	152	161	e132	276	294	139	218	94	90	123
27	140	313	e165	140	e132	371	275	135	217	92	133	123
28	138	307	178	173	e132	505	264	135	197	89	146	125
29	136	274	185	161	---	599	272	130	180	89	118	128
30	136	245	210	158	---	590	276	130	169	88	105	126
31	136	---	245	164	---	506	---	173	---	86	167	---
TOTAL	4838	7264	6144	5788	3986	6219	9447	5957	5841	3148	2956	4280
MEAN	156	242	198	187	142	201	315	192	195	102	95.4	143
MAX	218	354	250	272	176	599	591	276	294	154	167	238
MIN	133	134	152	140	115	110	213	127	136	85	78	123
CFSM	.64	1.00	.82	.77	.59	.83	1.30	.79	.80	.42	.39	.59
IN.	.74	1.11	.94	.89	.61	.95	1.45	.91	.89	.48	.45	.66

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1993, BY WATER YEAR (WY)

MEAN	118	137	141	123	120	194	247	154	113	88.7	81.7	101
MAX	275	248	259	187	194	389	396	245	195	238	185	281
(WY)	1987	1986	1992	1993	1988	1976	1976	1976	1967	1969	1969	1985
MIN	62.3	70.3	64.5	62.7	63.5	100	109	67.9	57.0	53.0	58.1	59.9
(WY)	1967	1977	1977	1977	1977	1978	1987	1977	1977	1977	1978	1981

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1966 - 1993

	1992	1993	1966-1993
ANNUAL TOTAL	63361	65868	
ANNUAL MEAN	173	180	135
HIGHEST ANNUAL MEAN			185
LOWEST ANNUAL MEAN			81.2
HIGHEST DAILY MEAN	642	599	1680
LOWEST DAILY MEAN	75	78	47
ANNUAL SEVEN-DAY MINIMUM	80	84	50
INSTANTANEOUS PEAK FLOW		617	1710
INSTANTANEOUS PEAK STAGE		5.19	7.31
INSTANTANEOUS LOW FLOW		76	(c)29
ANNUAL RUNOFF (CFSM)	.71	.74	.56
ANNUAL RUNOFF (INCHES)	9.70	10.08	7.56
10 PERCENT EXCEEDS	273	275	226
50 PERCENT EXCEEDS	160	161	110
90 PERCENT EXCEEDS	84	94	66

(a) Mar. 29, Apr. 21.

(b) Aug. 15, 22, 23.

(c) Result of freezeup.

(e) Estimated.

## 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 Evert, 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 sea level. Prior to Nov. 7, 1956, nonrecording gages at sites 400 ft and 500 ft upstream at present datum.

REMARKS.--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. National Weather Service gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	928	942	2470	e1700	1220	867	3640	2450	1370	1520	638	1070
2	916	1290	2330	e1650	1170	e880	3610	2310	1330	1430	617	1110
3	886	1890	2200	1570	1130	901	3170	2190	1270	1370	600	1140
4	835	2180	2070	1850	1110	e910	2800	2160	1200	1290	617	1120
5	799	2320	1950	2010	1090	927	2570	2130	1190	1200	606	1100
6	767	2270	1810	1920	1050	e950	2410	2070	1180	1160	668	1090
7	741	2140	1760	e1700	1080	969	2290	2000	1140	1110	823	1070
8	728	2010	1670	e1550	1020	980	2230	1920	1300	1060	769	1030
9	881	2020	1560	e1450	1090	1020	2400	1840	1900	1020	721	1000
10	980	2110	1510	e1400	1000	1060	2530	1760	2260	994	689	1020
11	981	2090	1480	e1350	995	1040	2580	1670	2380	969	662	1010
12	952	2130	1460	e1300	e970	e1000	2590	1580	2160	972	637	972
13	943	2340	1440	e1270	950	e960	2470	1480	1840	937	622	949
14	915	2380	1420	e1250	929	918	2350	1380	1680	934	599	1070
15	893	2350	1400	1240	e900	e870	2420	1330	1580	902	591	1220
16	1220	2210	1550	1230	e880	830	2800	1270	1470	867	636	1170
17	1410	2080	1710	1220	e840	957	3010	1190	1370	843	660	1120
18	1400	1990	1740	1210	e800	996	3100	1140	1770	831	641	1080
19	1350	1900	1710	1160	760	969	3000	1110	1830	850	666	1050
20	1320	1810	1650	1110	e760	930	3690	1080	2060	833	686	1030
21	1320	1980	1530	1100	e765	930	4120	1040	2200	817	636	1040
22	1330	2210	1490	1250	e770	956	4490	1010	2210	796	602	1060
23	1340	2540	1510	1250	775	962	4470	1000	2040	778	938	1040
24	1310	2700	1370	1250	e780	1040	4170	1120	1810	759	1400	1010
25	1260	2720	e1300	1210	e800	1380	3700	1170	1960	761	1280	973
26	1200	2790	e1250	e1190	e810	1850	3280	1140	2250	773	1040	1030
27	1140	2800	1150	e1170	e820	2280	2960	1090	2170	752	931	1050
28	1100	2780	1070	e1150	e840	2680	2740	1060	1980	728	916	1060
29	1050	2730	1270	1130	---	2990	2580	1040	1770	702	907	1040
30	1010	2610	1550	1170	---	3250	2560	1020	1630	682	887	1020
31	969	---	1790	1160	---	3430	---	1260	---	659	963	---
TOTAL	32874	66312	50170	42170	26104	40682	90730	46010	52300	29299	23648	31744
MEAN	1060	2210	1618	1360	932	1312	3024	1484	1743	945	763	1058
MAX	1410	2800	2470	2010	1220	3430	4490	2450	2380	1520	1400	1220
MIN	728	942	1070	1100	760	830	2230	1000	1140	659	591	949
CFSM	.73	1.52	1.12	.94	.64	.91	2.09	1.02	1.20	.65	.53	.73
IN.	.84	1.70	1.29	1.08	.67	1.04	2.33	1.18	1.34	.75	.61	.81

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

MEAN	775	998	980	863	879	1577	2257	1355	980	678	539	640
MAX	2402	2656	2270	1700	2353	4115	3869	2709	2945	2901	1243	2289
(WY)	1987	1992	1992	1973	1938	1976	1971	1947	1945	1957	1969	1975
MIN	374	433	499	418	327	594	934	548	409	327	316	326
(WY)	1949	1950	1977	1936	1936	1940	1945	1977	1988	1934	1941	1948

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1931 - 1993

ANNUAL TOTAL	508325	532043	(a)1052
ANNUAL MEAN	1389	1458	1532
HIGHEST ANNUAL MEAN			1992
LOWEST ANNUAL MEAN			1936
HIGHEST DAILY MEAN	4630	4490	8770
LOWEST DAILY MEAN	481	591	252
ANNUAL SEVEN-DAY MINIMUM	497	627	274
INSTANTANEOUS PEAK FLOW		4580	9040
INSTANTANEOUS PEAK STAGE		11.52	14.99
INSTANTANEOUS LOW FLOW		581	(c)164
ANNUAL RUNOFF (CFSM)	.96	1.01	.73
ANNUAL RUNOFF (INCHES)	13.04	13.65	9.86
10 PERCENT EXCEEDS	2510	2470	1970
50 PERCENT EXCEEDS	1130	1190	796
90 PERCENT EXCEEDS	590	774	443

(a) Does not include water years 1931, 1934.

(b) Estimated 584 ft<sup>3</sup>/s, water year 1931.

(c) Result of freezeup.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	99	105	178	220	144	e115	318	203	213	109	60	121
2	92	238	175	197	147	114	258	184	173	104	59	105
3	90	309	175	172	133	121	222	179	147	102	58	107
4	87	346	170	292	131	129	211	196	134	98	66	113
5	74	298	167	349	131	125	235	203	133	92	63	104
6	72	242	160	300	129	126	238	171	131	90	90	94
7	72	191	160	232	130	138	235	157	131	82	112	86
8	76	171	158	199	127	139	240	146	151	78	88	90
9	132	167	154	e185	120	152	298	141	157	78	79	89
10	143	173	156	e170	121	158	310	135	141	75	74	89
11	119	180	158	167	120	146	288	130	123	75	72	82
12	105	205	158	163	116	134	275	126	113	74	67	85
13	97	261	157	e160	e117	e120	245	119	109	70	66	85
14	90	236	158	e160	117	e115	218	117	111	71	67	165
15	104	204	160	160	115	e120	239	122	114	69	76	200
16	189	179	217	157	114	130	290	116	106	66	94	148
17	190	174	219	156	110	163	278	110	101	64	83	120
18	188	175	196	155	e110	151	244	116	132	76	74	106
19	164	166	180	e115	139	224	127	253	253	132	85	103
20	153	162	171	e140	e105	133	366	115	378	91	157	99
21	163	190	168	165	104	128	385	109	351	76	111	105
22	156	216	150	178	113	130	329	107	275	70	93	104
23	156	357	148	172	120	154	260	115	192	67	131	107
24	148	350	140	168	e120	186	236	179	163	66	167	101
25	137	299	e130	160	e120	242	239	158	199	70	127	94
26	128	267	e125	e155	e115	319	218	134	207	75	123	116
27	122	236	e135	153	e115	377	198	119	175	67	136	124
28	116	211	145	149	e115	419	193	122	150	67	143	126
29	110	196	166	144	---	415	201	114	135	66	128	118
30	107	187	215	e144	---	396	237	115	117	62	117	116
31	104	---	264	144	---	369	---	192	---	59	135	---
TOTAL	3783	6691	5213	5581	3369	5803	7728	4377	5015	2441	3001	3302
MEAN	122	223	168	180	120	187	258	141	167	78.7	96.8	110
MAX	190	357	264	349	147	419	385	203	378	132	167	200
MIN	72	105	125	115	104	114	193	107	101	59	58	82
CFSM	.88	1.62	1.22	1.30	.87	1.36	1.87	1.02	1.21	.57	.70	.80
IN.	1.02	1.80	1.41	1.50	.91	1.56	2.08	1.18	1.35	.66	.81	.89

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

MEAN	121	140	143	124	123	199	210	149	120	83.9	80.5	107
MAX	363	274	265	206	200	438	344	286	198	212	170	455
(WY)	1987	1986	1983	1973	1976	1976	1967	1974	1989	1982	1972	1986
MIN	57.3	66.2	82.7	79.1	64.0	116	131	75.4	53.9	44.3	42.3	50.6
(WY)	1972	1972	1975	1970	1982	1978	1977	1977	1988	1988	1971	1971

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1967 - 1993
ANNUAL TOTAL	55465	56304	
ANNUAL MEAN	152	154	133
HIGHEST ANNUAL MEAN			196
LOWEST ANNUAL MEAN			96.5
HIGHEST DAILY MEAN	485	419	2190
LOWEST DAILY MEAN	58	58	36
ANNUAL SEVEN-DAY MINIMUM	60	61	37
INSTANTANEOUS PEAK FLOW		443	2300
INSTANTANEOUS PEAK STAGE		3.73	8.57
INSTANTANEOUS LOW FLOW		56	22
ANNUAL RUNOFF (CFSM)	1.10	1.12	.97
ANNUAL RUNOFF (INCHES)	14.95	15.18	13.14
10 PERCENT EXCEEDS	241	243	230
50 PERCENT EXCEEDS	145	135	109
90 PERCENT EXCEEDS	72	77	64

(e) Estimated.



## 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 sea level (Michigan Department of Natural Resources bench mark). Prior to Mar. 17, 1978, at different datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.4	9.8	21	30	21	e12	33	33	23	15	8.4	11
2	4.9	45	21	31	20	12	33	28	19	14	8.8	9.6
3	5.0	43	21	27	17	14	33	28	17	14	7.9	11
4	4.4	44	20	59	17	16	33	32	16	18	8.2	9.2
5	4.7	31	19	66	17	16	39	57	17	15	7.7	8.2
6	4.6	24	18	42	17	17	38	39	15	18	15	7.8
7	4.5	21	18	33	17	18	35	31	21	17	12	7.5
8	5.0	19	18	28	15	20	37	27	43	15	10	8.3
9	9.9	22	17	25	14	23	56	24	58	14	9.3	7.7
10	8.1	26	18	23	14	21	45	24	37	13	8.6	7.3
11	7.1	32	18	22	14	19	37	21	26	12	7.8	6.8
12	6.6	42	18	21	14	18	42	19	22	11	7.6	7.7
13	6.5	63	17	e20	14	18	34	17	19	11	7.5	7.5
14	6.5	38	17	e20	14	e19	30	18	20	11	7.0	14
15	8.5	29	19	e20	13	20	48	19	20	9.7	7.7	14
16	18	25	44	20	13	23	85	17	17	9.1	9.2	11
17	11	25	35	20	13	32	52	16	16	8.9	8.5	9.9
18	9.8	22	28	e18	e13	28	39	17	20	9.1	7.8	9.4
19	9.3	20	27	e17	e13	21	39	17	25	10	8.3	8.8
20	18	20	25	e15	e14	19	126	16	31	9.3	8.2	10
21	22	27	21	e21	14	19	82	15	25	8.2	7.5	18
22	14	29	20	e24	e15	22	48	14	21	7.9	7.1	14
23	13	63	20	e23	e14	39	38	16	18	8.0	6.9	12
24	12	52	18	e22	e14	47	38	21	16	7.8	6.6	10
25	11	35	18	e21	e13	46	36	19	31	13	6.4	9.6
26	11	37	e17	e21	e13	52	31	16	39	11	6.2	19
27	10	33	e16	21	e13	49	29	15	24	9.3	6.4	27
28	9.8	27	15	20	e13	47	32	17	19	11	6.5	26
29	9.2	24	23	19	---	41	36	15	17	9.6	6.9	22
30	8.8	22	34	e19	---	36	44	16	16	8.8	10	22
31	8.5	---	42	19	---	32	---	27	---	7.8	21	---
TOTAL	287.1	949.8	683	787	413	816	1328	691	708	356.5	267.0	366.3
MEAN	9.26	31.7	22.0	25.4	14.7	26.3	44.3	22.3	23.6	11.5	8.61	12.2
MAX	22	63	44	66	21	52	126	57	58	18	21	27
MIN	4.4	9.8	15	15	13	12	29	14	15	7.8	6.2	6.8
CFSM	.63	2.14	1.49	1.72	1.00	1.78	2.99	1.51	1.59	.78	.58	.82
IN.	.72	2.39	1.72	1.98	1.04	2.05	3.34	1.74	1.78	.90	.67	.92

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1993, BY WATER YEAR (WY)

MEAN	14.5	19.0	21.7	18.7	20.8	31.6	29.1	18.9	11.9	6.67	8.35	9.35
MAX	45.2	55.2	40.5	31.3	47.8	87.9	50.6	45.2	23.6	11.5	30.2	43.0
(WY)	1987	1986	1992	1986	1976	1976	1982	1974	1993	1993	1980	1986
MIN	3.48	4.54	4.98	6.15	7.43	12.2	14.5	6.84	4.32	3.17	2.29	3.09
(WY)	1972	1972	1977	1977	1977	1980	1968	1977	1977	1971	1971	1971

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1966 - 1993

ANNUAL TOTAL	6692.9	7652.7	17.5
ANNUAL MEAN	18.3	21.0	27.4
HIGHEST ANNUAL MEAN			8.36
LOWEST ANNUAL MEAN			1976
HIGHEST DAILY MEAN	67	126	720
LOWEST DAILY MEAN	4.1	4.4	1.6
ANNUAL SEVEN-DAY MINIMUM	4.5	4.7	2.0
INSTANTANEOUS PEAK FLOW		170	930
INSTANTANEOUS PEAK STAGE		14.49	(a)11.00
INSTANTANEOUS LOW FLOW		4.2	1.0
ANNUAL RUNOFF (CFSM)	1.24	1.42	1.19
ANNUAL RUNOFF (INCHES)	16.82	19.24	16.11
10 PERCENT EXCEEDS	35	39	33
50 PERCENT EXCEEDS	17	18	13
90 PERCENT EXCEEDS	5.3	7.8	4.5

(a) Datum then in use.

(b) Aug. 5, 17, 22, 1971.

(c) Estimated.

## 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-83-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 594.1 ft above sea level. Nov. 18, 1957 to Oct. 22, 1958, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	376	348	642	703	513	e390	988	752	644	625	395	440
2	353	453	583	719	487	e400	952	716	688	542	332	410
3	338	603	547	703	487	e410	885	672	683	505	324	381
4	328	791	524	707	476	e430	823	658	608	491	325	377
5	319	841	513	792	452	e440	768	711	544	462	345	373
6	316	829	501	954	443	453	740	833	510	451	359	362
7	317	790	485	922	437	454	733	775	495	458	492	357
8	315	737	476	834	425	469	724	684	559	456	554	355
9	337	659	466	746	422	482	735	612	743	450	524	358
10	389	577	463	679	411	509	865	561	926	443	463	355
11	401	545	461	625	410	e480	974	531	883	422	427	349
12	389	558	462	e580	407	e460	945	512	749	407	406	348
13	368	603	459	e560	404	e435	943	502	648	392	388	348
14	351	712	457	e550	402	e410	925	492	540	380	373	373
15	348	766	457	e550	399	e390	870	488	520	375	371	480
16	404	721	494	e550	395	446	935	489	497	363	408	535
17	477	674	605	541	391	544	1230	480	475	351	414	498
18	496	619	688	e470	371	621	1110	476	548	348	395	456
19	506	574	688	e400	e365	608	963	481	720	466	398	418
20	511	546	654	e350	e360	548	978	474	950	599	438	401
21	522	549	607	e450	e360	494	1390	460	1180	534	434	445
22	540	584	552	620	e355	466	1250	447	1160	446	413	501
23	501	675	513	725	e355	469	1040	447	1030	398	395	471
24	459	850	482	735	e350	556	963	523	931	376	383	434
25	426	1040	456	644	e355	664	888	603	859	388	391	406
26	405	968	e440	569	e360	729	821	603	812	468	384	403
27	392	891	480	551	e370	824	747	556	842	469	386	452
28	382	863	507	e520	e375	907	693	518	819	405	376	506
29	369	790	557	e500	---	979	670	512	756	377	367	518
30	360	712	621	487	---	1020	696	487	717	358	377	494
31	354	---	650	519	---	1010	---	538	---	343	417	---
TOTAL	12347	20868	16500	19255	11337	17497	27224	17593	22014	13548	12404	12614
MEAN	398	696	532	621	405	564	907	568	734	437	400	420
MAX	540	1040	698	954	513	1020	1390	833	1180	625	554	535
MIN	315	348	440	350	350	390	670	447	475	343	324	348
CFSM	.98	1.71	1.31	1.53	1.00	1.39	2.24	1.40	1.81	1.08	.99	1.04
IN.	1.13	1.91	1.51	1.76	1.04	1.60	2.49	1.61	2.02	1.24	1.14	1.16

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1957 - 1993, BY WATER YEAR (WY)

MEAN	391	466	493	454	458	649	683	497	410	311	301	358
MAX	912	906	896	641	760	1449	1224	936	747	523	484	1071
(WY)	1967	1966	1992	1973	1985	1976	1967	1974	1989	1982	1982	1986
MIN	226	269	286	252	240	382	315	259	230	202	186	212
(WY)	1972	1972	1959	1959	1959	1964	1958	1958	1958	1964	1958	1957

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1957 - 1993
ANNUAL TOTAL	189410	203201	
ANNUAL MEAN	518	557	456
HIGHEST ANNUAL MEAN			635
LOWEST ANNUAL MEAN			288
HIGHEST DAILY MEAN	1230	1390	4650
LOWEST DAILY MEAN	262	315	164
ANNUAL SEVEN-DAY MINIMUM	264	324	169
INSTANTANEOUS PEAK FLOW		1480	5400
INSTANTANEOUS PEAK STAGE		5.28	7.46
INSTANTANEOUS LOW FLOW		313	163
ANNUAL RUNOFF (CFSM)	1.27	1.37	1.12
ANNUAL RUNOFF (INCHES)	17.35	18.62	15.27
10 PERCENT EXCEEDS	789	861	712
50 PERCENT EXCEEDS	487	494	398
90 PERCENT EXCEEDS	291	360	250

(a) Oct. 8, 9.

(b) Aug. 18, 19, 1958.

(c) Estimated.



## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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-81-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 597.66 ft above sea level. Prior to June 12, 1943, nonrecording gage at bridge 4.5 mi upstream at different datum.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	611	625	e1230	e1200	791	e650	1900	1280	1060	1030	688	797
2	590	777	e1200	e1150	761	e660	1790	1290	1210	961	675	822
3	578	927	e1150	e1100	743	e670	1640	1250	1280	916	671	778
4	564	1070	e1050	e1300	754	e680	1480	1200	1200	885	677	737
5	555	1200	e1000	e1400	736	e700	1380	1200	1080	855	686	730
6	548	1260	e950	e1300	718	e710	1340	1340	988	857	737	709
7	542	1230	e900	e1150	691	e720	1330	1370	948	833	816	685
8	542	1140	e850	e1050	683	750	1340	1290	994	860	894	691
9	583	1060	e820	e1000	668	774	1390	1190	1160	850	874	677
10	630	1000	e800	e980	674	794	1490	1100	1420	827	786	674
11	678	985	e780	e950	667	795	1630	1020	1570	798	739	670
12	672	1020	e760	e920	665	769	1770	986	1510	775	715	667
13	646	1100	e750	e900	653	727	1700	959	1280	753	693	666
14	621	1160	e740	e880	651	671	1600	908	1100	739	673	746
15	611	1220	e770	e860	654	692	1630	897	995	727	660	818
16	696	1210	e850	e840	645	772	1890	894	922	716	668	901
17	747	1150	e900	e830	642	902	2040	895	891	696	726	935
18	819	1070	e900	e820	e610	894	2110	869	915	694	764	856
19	827	1010	e880	e800	e580	843	2040	846	979	698	758	764
20	800	980	e840	e760	e580	830	2160	837	1330	730	770	723
21	802	997	e800	e927	e570	787	2310	822	1720	740	837	717
22	790	1060	e790	e980	e580	752	2390	806	1940	706	842	739
23	786	1290	e770	932	e580	779	2380	813	2000	685	779	778
24	760	1460	e720	931	e590	895	2120	870	1840	672	773	768
25	731	1500	e680	922	e600	1040	1840	971	1690	699	810	730
26	708	1570	e640	888	e610	1180	1660	1080	1520	746	807	700
27	686	1530	e600	828	e620	1330	1550	1080	1440	777	766	709
28	667	1440	e580	811	e630	1520	1430	990	1430	766	754	755
29	650	1380	e850	828	---	1710	1330	919	1320	716	756	779
30	639	1310	e1100	e810	---	1870	1290	890	1150	696	739	782
31	629	---	e1250	799	---	1940	---	944	---	682	786	---
TOTAL	20708	34731	26900	29846	18346	28806	51950	31806	36882	24085	23319	22503
MEAN	668	1158	868	963	655	929	1732	1026	1296	777	752	750
MAX	827	1570	1250	1400	791	1940	2390	1370	2000	1030	894	935
MIN	542	625	580	760	570	650	1290	806	891	672	660	666
CFSM	.98	1.70	1.27	1.41	.96	1.36	2.54	1.51	1.90	1.14	1.10	1.10
IN.	1.13	1.90	1.47	1.63	1.00	1.57	2.84	1.74	2.12	1.32	1.27	1.23

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1939 - 1993, BY WATER YEAR (WY)

	604	707	737	697	703	965	1047	784	675	529	486	554
MEAN	604	707	737	697	703	965	1047	784	675	529	486	554
MAX	1507	1523	1311	1129	1301	1779	1732	1161	1296	1232	793	1880
(WY)	1987	1986	1992	1985	1984	1976	1993	1974	1993	1969	1985	1986
MIN	379	439	449	427	440	526	550	425	408	368	354	369
(WY)	1957	1945	1945	1945	1958	1940	1945	1958	1964	1963	1941	1948

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1939 - 1993

ANNUAL TOTAL	309380		351882									
ANNUAL MEAN	845		964									
HIGHEST ANNUAL MEAN										707		
LOWEST ANNUAL MEAN										1087		1986
HIGHEST DAILY MEAN	2090			Mar 10		2390		Apr 22		472		1958
LOWEST DAILY MEAN	458			Aug 23		542		Oct 7		6020		Sep 13 1986
ANNUAL SEVEN-DAY MINIMUM	466			Aug 19		559		Oct 3		310		Aug 9 1941
INSTANTANEOUS PEAK FLOW						2440		Apr 22		322		Aug 5 1941
INSTANTANEOUS LOW FLOW						5.18		Apr 22		6440		Sep 13 1986
ANNUAL RUNOFF (CFSM)	1.24					539		(a)		8.07		Sep 13 1986
ANNUAL RUNOFF (INCHES)	16.90					1.42				209		Dec 11 1962
10 PERCENT EXCEEDS	1260					19.22				1.04		
50 PERCENT EXCEEDS	784									14.10		
90 PERCENT EXCEEDS	508									1070		
										625		
										425		

(a) Oct. 7, 8.

(e) Estimated.

## 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-88-1: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 804 ft above sea level, from river-profile map. Prior to Apr. 13, 1934, at various datums. Apr. 14, 1934 to Oct. 25, 1990, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1080	993	1510	e1150	1180	e1100	2080	1570	1330	1170	952	1040
2	1030	1160	1450	e960	1030	e1180	2010	1510	1300	1150	935	1060
3	1000	1530	1400	e1100	1140	e1150	1770	1480	1250	1140	925	1020
4	970	1640	1360	1420	1140	e1080	1570	1480	1190	1120	940	967
5	946	1690	1340	1570	1100	e1080	1480	1490	1140	1100	961	929
6	934	1650	1300	1520	1080	1070	1450	1530	1110	1200	999	905
7	929	1530	1260	1460	1020	1040	1470	1530	1090	1190	1020	886
8	928	1400	1270	1390	1040	1040	1520	1470	1160	1150	1010	884
9	1020	1330	1280	1230	1030	1040	1690	1410	1320	1150	985	897
10	1140	1320	1270	1110	1070	1030	1850	1360	1380	1120	954	921
11	1170	1370	1270	e1080	1060	1030	1900	1310	1330	1080	936	920
12	1150	1440	1260	e1050	1040	1010	1890	1250	1270	1060	923	999
13	1100	1670	1240	e1150	1040	998	1760	1210	1190	1040	910	1100
14	1060	1720	1230	e1120	1030	962	1590	1190	1140	1020	894	1410
15	1030	1590	1230	e1120	1030	894	1670	1190	1090	1010	892	1330
16	1180	1490	1370	e1150	1020	1040	2260	1180	1070	991	920	1240
17	1320	1420	1550	e1160	1020	1080	2210	1170	1060	988	933	1240
18	1310	1370	1540	1160	960	972	2040	1140	1260	979	942	1250
19	1290	1320	1480	1060	e900	993	1950	1130	1340	1020	924	1150
20	1260	1280	1430	e1000	e880	1020	2080	1120	2060	1040	901	1070
21	1240	1450	1320	e1300	e1100	1000	2230	1110	2160	1060	883	1070
22	1200	1680	1240	e1250	e1080	987	2140	1100	2050	1070	868	1060
23	1190	1860	1240	1230	e1000	983	2020	1090	2010	1000	893	1040
24	1180	1960	1210	1180	e960	1010	1880	1170	1900	962	900	1010
25	1160	1920	1130	e1120	e940	1100	1780	1190	1690	988	885	982
26	1120	1890	e1050	1100	e850	1270	1680	1200	1520	1050	881	960
27	1080	1910	e1020	e1080	e1100	1480	1600	1180	1390	1060	886	945
28	1060	1800	e1300	e1060	e1120	1730	1580	1160	1310	1030	895	958
29	1040	1690	e1300	e1050	---	1890	1550	1130	1260	987	899	983
30	1020	1600	e1300	1050	---	1980	1580	1120	1210	969	895	1050
31	1010	---	e1350	1150	---	2050	---	1280	---	961	960	---
TOTAL	34147	46673	40500	36530	28960	36289	54280	39450	41580	32855	28701	31276
MEAN	1102	1556	1306	1178	1034	1171	1809	1273	1386	1060	926	1043
MAX	1320	1960	1550	1570	1180	2050	2260	1570	2160	1200	1020	1410
MIN	928	993	1020	960	850	894	1450	1090	1060	961	868	884
CFSM	1.29	1.82	1.52	1.38	1.21	1.37	2.11	1.48	1.62	1.24	1.08	1.22
IN.	1.48	2.03	1.76	1.59	1.26	1.58	2.36	1.71	1.80	1.43	1.25	1.36

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1903 - 1993, BY WATER YEAR (WY)

	MEAN	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
MEAN	981	1056	1043	1001	983	1202	1540	1206	1058	937	886	923
MAX	1803	1597	1417	1224	1458	1811	2198	1742	1603	1326	1200	1610
(WY)	1987	1989	1912	1916	1938	1913	1916	1904	1954	1969	1903	1986
MIN	773	780	848	754	604	808	1058	834	802	740	722	717
(WY)	1965	1982	1979	1936	1936	1940	1987	1958	1958	1936	1964	1966

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1903 - 1993
ANNUAL TOTAL	432721	451241	
ANNUAL MEAN	1182	1236	(a)1067
HIGHEST ANNUAL MEAN			1261
LOWEST ANNUAL MEAN			888
HIGHEST DAILY MEAN	2350	2260	3500
LOWEST DAILY MEAN	785	850	540
ANNUAL SEVEN-DAY MINIMUM	794	885	549
INSTANTANEOUS PEAK FLOW		2350	(b)3570
INSTANTANEOUS PEAK STAGE		14.28	
INSTANTANEOUS LOW FLOW		790	(c)770
ANNUAL RUNOFF (CFSM)	1.38	1.44	1.24
ANNUAL RUNOFF (INCHES)	18.78	19.59	16.92
10 PERCENT EXCEEDS	1610	1690	1420
50 PERCENT EXCEEDS	1100	1140	984
90 PERCENT EXCEEDS	860	940	823

(a) Does not include water years 1931, 1934.

(b) From graph based on gage readings.

(c) Does not include water years 1903-1990.

(d) Sept. 2, 3, 1991.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 04124500 EAST BRANCH PINE RIVER NEAR TUSTIN, MI

LOCATION.--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, on left bank 75 ft downstream from bridge on Marion Road, 3.0 mi west of Tustin.

DRAINAGE AREA.--60.0 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1952 to September 1963, October 1963 to September 1991 (operated as a crest-stage partial-record station), October 1991 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,077.65 ft above sea level (levels by Michigan Department of Natural Resources).

REMARKS.--Records good. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	26	71	63	27	16	133	75	62	33	14	95
2	23	91	62	52	25	18	119	67	51	30	14	70
3	22	98	54	47	24	20	95	65	43	32	15	63
4	20	111	51	102	23	21	83	73	39	30	17	49
5	17	91	46	89	23	21	87	89	36	27	15	40
6	16	75	42	69	22	22	89	87	31	40	24	35
7	16	62	41	61	22	23	87	72	35	39	34	31
8	17	52	39	49	21	23	98	66	175	30	32	30
9	39	52	38	46	19	23	225	59	217	26	26	33
10	39	58	38	39	19	23	188	50	165	24	22	36
11	33	60	37	35	19	23	153	44	125	24	18	31
12	29	71	36	32	19	21	127	39	92	27	16	31
13	26	99	37	31	19	20	111	36	72	24	15	33
14	27	83	37	31	19	18	96	36	59	22	14	62
15	28	70	38	30	19	16	132	37	48	19	15	81
16	77	61	84	30	18	18	186	35	41	18	50	64
17	66	55	76	30	17	22	160	32	39	17	39	48
18	59	51	64	29	16	21	130	30	52	18	31	36
19	52	47	55	27	15	19	119	30	52	19	26	31
20	45	47	44	25	15	19	350	28	99	17	24	38
21	46	134	41	26	15	19	267	27	88	16	21	54
22	45	135	37	30	15	19	204	27	69	16	19	51
23	40	220	34	31	16	20	162	28	56	15	63	42
24	37	161	30	32	16	25	139	59	46	14	60	35
25	33	137	30	30	16	40	123	51	65	16	45	29
26	30	151	28	29	16	73	103	43	68	17	125	28
27	29	138	27	29	16	121	87	36	58	15	122	28
28	31	111	26	28	16	191	82	33	49	15	75	34
29	32	94	35	26	---	229	80	34	43	16	65	39
30	29	82	54	26	---	218	83	34	37	16	55	48
31	27	---	87	26	---	197	---	75	---	14	124	---
TOTAL	1056	2723	1419	1230	527	1559	4098	1497	2112	686	1235	1325
MEAN	34.1	90.8	45.8	39.7	18.8	50.3	137	48.3	70.4	22.1	39.8	44.2
MAX	77	220	87	102	27	229	350	89	217	40	125	95
MIN	16	26	26	25	15	16	80	27	31	14	14	28
CFSM	.57	1.51	.76	.66	.31	.84	2.28	.80	1.17	.37	.66	.74
IN.	.65	1.69	.88	.76	.33	.97	2.54	.93	1.31	.43	.77	.82

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

	MEAN	25.8	33.2	25.0	18.2	18.8	50.7	87.5	35.7	23.4	14.7	15.6	14.6
MAX	99.9	90.8	83.8	39.7	40.7	93.6	190	75.4	70.4	30.3	68.5	44.2	
(WY)	1992	1993	1992	1993	1953	1992	1959	1960	1993	1952	1956	1993	
MIN	9.54	12.3	12.4	10.1	9.39	18.7	41.7	10.7	8.90	7.22	6.29	6.82	
(WY)	1956	1954	1956	1956	1963	1956	1958	1958	1959	1959	1957	1955	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1952 - 1993

ANNUAL TOTAL	17357	19467	
ANNUAL MEAN	47.4	53.3	
HIGHEST ANNUAL MEAN			30.2
LOWEST ANNUAL MEAN			54.5
HIGHEST DAILY MEAN	328	350	1992
LOWEST DAILY MEAN	10	14	1958
ANNUAL SEVEN-DAY MINIMUM	11	15	16.0
INSTANTANEOUS PEAK FLOW		408	753
INSTANTANEOUS PEAK STAGE		4.44	Aug 4 1956
INSTANTANEOUS LOW FLOW		12	Aug 4 1958
ANNUAL RUNOFF (CFSM)	.79	.89	5.3
ANNUAL RUNOFF (INCHES)	10.76	12.07	5.5
10 PERCENT EXCEEDS	93	114	(a)1410
50 PERCENT EXCEEDS	31	36	6.23
90 PERCENT EXCEEDS	14	17	(b)4.1
			Mar 13 1958
			.50
			6.84
			65
			16
			7.6

(a) From rating curve extended above 450 ft<sup>3</sup>/s.

(b) Result of freezeup.

## STREAMS TRIBUTARY TO LAKE MICHIGAN

## 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 September 1993 (discontinued).

REVISED RECORDS.--WDR MI-88-1: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 585 ft above sea level, from river-profile map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2040	2410	3310	2690	2240	2260	4700	2610	2660	2270	1980	2140
2	1940	2630	2990	2320	2140	2120	4600	2410	2860	2260	1860	2150
3	1850	2990	2820	1930	2100	2300	4370	2560	2640	2250	1910	2140
4	1920	3660	2680	2070	2190	2230	3930	2830	2320	2190	2080	2020
5	1950	4210	2580	2650	2180	2090	3220	2940	2300	2160	1800	1880
6	1950	4540	2630	3390	2080	2120	2780	3200	2240	2270	1890	1890
7	1860	4100	2390	3440	2040	2120	2820	3210	2090	2480	2150	1890
8	1850	3250	2360	2990	2070	2060	2910	3020	2220	2560	1950	1890
9	1920	2750	2370	2660	1990	2060	3210	2810	2550	2450	1910	1860
10	2100	2490	2340	2360	2080	2060	3600	2520	3010	2340	2080	1860
11	2240	2700	2440	2240	2010	2050	3930	2460	3210	2400	2040	1860
12	2230	2840	2450	2120	2020	1970	4120	2410	2820	2070	1800	1980
13	2110	3080	2310	2070	2020	1940	4090	2320	2560	2260	1900	1950
14	2060	3520	2300	2380	2020	1990	3710	2250	2190	2190	1890	2480
15	2060	3650	2390	2130	2020	1920	3460	2250	2230	2080	1750	3220
16	2200	3600	2540	2220	2020	1860	3870	2240	2270	2100	1780	3850
17	2450	3190	2870	2290	2020	2540	4310	2220	2070	1630	1890	3440
18	3020	2860	3300	2250	e1900	2300	4680	2210	2270	1960	2000	2410
19	3830	2620	3300	2270	e1800	2040	4230	2200	2690	2220	1860	2140
20	3910	2530	3130	1940	1770	2150	3740	2200	3560	2130	1880	2190
21	2860	2620	2810	2050	1810	2180	3880	2120	4370	1970	1880	2240
22	2440	2990	2550	2680	2200	2140	4480	2130	6230	1980	1820	2310
23	2290	3840	2280	2770	2140	2190	5060	2170	5300	1910	1830	2330
24	2250	4390	2320	2670	1980	2250	4540	2330	4190	1900	2030	2200
25	2200	4750	2330	2350	e1900	2230	4240	2360	3790	1930	2060	2080
26	2160	4520	e2250	2210	2020	2280	3880	2310	3890	2070	2060	2040
27	2090	4360	2110	2310	1690	2680	3380	2260	3960	1980	1910	1890
28	2070	4220	2060	2210	2180	3210	3070	2220	3100	2280	2050	2080
29	2020	4080	2590	2210	---	4000	2870	2200	2710	2200	2180	2080
30	1930	3760	2480	e2150	---	4410	2780	2170	2320	1790	1980	2130
31	2150	---	2530	2100	---	4570	---	2350	---	1840	2010	---
TOTAL	69950	103150	79810	74100	56630	74320	114460	75490	90620	66120	60210	66620
MEAN	2256	3438	2575	2390	2022	2387	3815	2435	3021	2133	1942	2221
MAX	3910	4750	3310	3440	2240	4570	5060	3210	6230	2560	2180	3850
MIN	1850	2410	2060	1930	1690	1860	2780	2120	2070	1750	1860	1860
CFSM	1.35	2.05	1.54	1.43	1.21	1.43	2.28	1.45	1.80	1.27	1.16	1.32
IN.	1.55	2.29	1.77	1.64	1.26	1.65	2.54	1.67	2.01	1.47	1.34	1.48

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

	1945	2086	2083	1953	1942	2420	2996	2258	2013	1748	1663	1797
MEAN	1945	2086	2083	1953	1942	2420	2996	2258	2013	1748	1663	1797
MAX	3930	3438	2908	2574	2480	3645	4002	3090	3081	2805	2255	3662
(WY)	1987	1993	1992	1973	1984	1976	1959	1960	1989	1969	1987	1986
MIN	1380	1571	1577	1563	1502	1774	2055	1530	1491	1352	1343	1390
(WY)	1964	1965	1963	1963	1963	1958	1958	1958	1964	1977	1958	1963

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1952 - 1993

ANNUAL TOTAL	872790	931480	
ANNUAL MEAN	2385	2552	
HIGHEST ANNUAL MEAN			2075
LOWEST ANNUAL MEAN			2598
HIGHEST DAILY MEAN			1644
LOWEST DAILY MEAN			1958
HIGHEST SEVEN-DAY MEAN	4760	Apr 19	6800
LOWEST SEVEN-DAY MEAN	1500	Aug 18	570
ANNUAL SEVEN-DAY MINIMUM	1570	Aug 14	1090
INSTANTANEOUS PEAK FLOW			7280
INSTANTANEOUS PEAK STAGE			(a)9.25
INSTANTANEOUS LOW FLOW			Dec 28 1985
ANNUAL RUNOFF (CFSM)	1.42	1510	Feb 27
ANNUAL RUNOFF (INCHES)	19.36	1.52	1.24
10 PERCENT EXCEEDS	3620	20.66	16.81
50 PERCENT EXCEEDS	2180	3860	2910
90 PERCENT EXCEEDS	1660	2250	1910
		1910	1450

(a) Backwater from ice.

(e) Estimated.



## 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.--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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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)
OCT 22...	0930	3670	374	8.0	7.0	0.90	10.4	87	200	K34
DEC 02...	0930	3740	344	7.8	2.5	6.1	12.0	91	55	K14
FEB 24...	0945	2710	426	7.9	0.0	3.9	12.9	90	K28	K24
APR 08...	0930	2520	338	8.0	7.0	7.4	12.0	102	K3	K8
JUL 27...	0930	2370	398	8.2	22.5	0.40	7.9	94	K34	K8

DATE	HARD-NESS TOTAL (MG/L AS CaCO3) (00900)	HARD-NESS NONCARB DISSOLV FLD AS CaCO3 (MG/L AS Ca) (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 22...	170	33	48	12	6.8	1.1	167	137	12	23
DEC 02...	150	27	45	10	6.3	1.0	155	127	12	22
FEB 24...	190	46	54	13	10	1.2	174	143	13	36
APR 08...	160	38	46	11	6.4	1.1	149	122	11	22
JUL 27...	180	35	53	12	10	1.0	179	146	11	28

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) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	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)
OCT 22...	<0.10	8.0	203	0.28	2010	<0.010	0.150	0.050	0.20	0.030
DEC 02...	<0.10	7.5	202	0.27	2040	<0.010	0.200	0.040	0.20	0.020
FEB 24...	<0.10	9.2	228	0.31	1670	0.020	0.330	0.050	<0.20	0.020
APR 08...	<0.10	6.8	195	0.27	1330	<0.010	0.570	0.040	0.20	0.010
JUL 27...	0.10	7.7	240	0.33	1540	0.010	0.130	0.040	0.30	0.020

## STREAMS TRIBUTARY TO LAKE MICHIGAN

04126520 MANISTEE RIVER AT MANISTEE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
OCT 22...	0.020	<0.010	20	19	<3	43	8	4	<10
DEC 02...	<0.010	<0.010	10	17	<3	65	8	6	<10
FEB 24...	0.010	<0.010	--	--	--	--	--	--	--
APR 08...	0.010	<0.010	20	18	<3	33	7	8	<10
JUL 27...	0.020	<0.010	<10	23	<3	20	7	7	<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)	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 22...	<1	<1	<1.0	210	<6	4	40	95
DEC 02...	<1	<1	<1.0	200	<6	8	81	85
FEB 24...	--	--	--	--	--	--	--	--
APR 08...	<1	<1	<1.0	220	<6	10	68	93
JUL 27...	<1	<1	<1.0	250	<6	7	45	99

## 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 sea level (Michigan Department of Transportation bench mark).

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	118	117	142	148	141	134	152	153	154	155	136	144
2	117	196	142	145	142	134	148	150	149	153	134	139
3	116	155	141	149	139	135	146	154	147	154	135	138
4	117	150	142	182	138	135	146	163	145	151	136	136
5	118	142	142	161	137	133	148	191	146	149	132	133
6	113	139	141	152	136	133	150	157	143	226	160	133
7	110	134	140	148	136	133	150	151	144	166	153	129
8	112	132	139	146	135	134	175	149	154	160	139	130
9	132	138	138	143	134	134	176	146	260	171	136	151
10	137	138	140	141	134	134	158	144	168	162	134	148
11	136	135	142	e140	133	132	156	144	156	158	133	139
12	126	173	141	140	134	131	151	142	150	158	130	137
13	119	172	139	e140	133	131	147	139	147	153	128	163
14	117	146	138	e140	133	130	145	146	160	151	128	320
15	120	144	141	e140	131	129	198	151	152	148	133	208
16	159	141	183	e140	131	141	216	150	144	145	139	175
17	136	141	157	e140	132	139	175	141	148	144	134	168
18	129	138	148	140	e132	e136	164	140	181	148	131	165
19	127	135	147	e140	e132	133	168	140	200	151	131	160
20	133	141	144	140	e132	133	198	139	203	146	128	162
21	130	188	141	156	e132	132	183	138	174	143	127	175
22	125	155	141	159	e132	131	175	137	168	140	126	159
23	124	177	141	150	e132	132	166	143	165	139	134	156
24	122	155	140	148	e132	137	168	168	163	139	129	151
25	120	149	e140	145	e132	143	171	154	208	146	127	148
26	119	166	e141	146	e132	151	159	148	180	148	126	145
27	118	159	e141	145	e132	155	154	147	170	141	131	144
28	118	149	141	144	e133	158	159	147	165	144	130	163
29	117	145	160	142	---	163	166	144	161	140	128	157
30	117	143	155	142	---	166	159	151	158	137	134	150
31	117	---	158	143	---	163	---	172	---	136	188	---
TOTAL	3819	4493	4486	4535	3752	4305	4927	4639	4963	4702	4190	4726
MEAN	123	150	145	146	134	139	164	150	165	152	135	158
MAX	159	196	183	182	142	166	216	191	260	226	188	320
MIN	110	117	138	140	131	129	145	137	143	136	126	129
CFSM	1.04	1.27	1.23	1.24	1.14	1.18	1.39	1.27	1.40	1.29	1.15	1.34
IN.	1.20	1.42	1.41	1.43	1.18	1.36	1.55	1.46	1.56	1.48	1.32	1.49

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1990 - 1993, BY WATER YEAR (WY)

	1992	1993	1992	1993	1992	1993	1992	1993	1992	1993	1992	1993
MEAN	132	139	143	141	135	151	158	145	146	139	127	138
MAX	148	150	151	147	144	164	169	150	165	152	135	158
(WY)	1992	1993	1992	1992	1992	1992	1992	1993	1993	1993	1991	1993
MIN	123	129	133	130	127	139	143	141	122	134	117	129
(WY)	1993	1991	1991	1991	1991	1993	1990	1992	1991	1992	1992	1990

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1990 - 1993

ANNUAL TOTAL	51831	53537	
ANNUAL MEAN	142	147	142
HIGHEST ANNUAL MEAN			147
LOWEST ANNUAL MEAN			135
HIGHEST DAILY MEAN	253	320	386
LOWEST DAILY MEAN	110	110	110
ANNUAL SEVEN-DAY MINIMUM	113	115	113
INSTANTANEOUS PEAK FLOW		394	516
INSTANTANEOUS PEAK STAGE		2.91	3.55
INSTANTANEOUS LOW FLOW		83	79
ANNUAL RUNOFF (CFSM)	1.20	1.24	1.20
ANNUAL RUNOFF (INCHES)	16.34	16.88	16.32
10 PERCENT EXCEEDS	164	168	163
50 PERCENT EXCEEDS	141	142	138
90 PERCENT EXCEEDS	118	130	121

(a) Aug. 16, Oct. 7, 1992.

(e) Estimated.

## 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 sea level (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 sea level.

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, 3.73 ft, June 21; minimum, 2.71 ft, Jan. 20, Feb. 13-16, 19-21.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.24	3.16	2.82	2.81	2.74	2.73	2.80	3.36	3.39	3.37	3.16	3.25
2	3.22	3.18	2.79	2.80	2.75	2.73	2.81	3.35	3.38	3.34	3.16	3.23
3	3.23	3.15	2.77	2.79	2.76	2.73	2.84	3.34	3.37	3.35	3.16	3.22
4	3.23	3.10	2.77	2.81	2.77	2.73	2.89	3.36	3.36	3.35	3.17	3.19
5	3.25	3.03	2.79	2.82	2.77	2.73	2.93	3.38	3.36	3.35	3.18	3.17
6	3.27	2.99	2.79	2.80	2.77	2.73	2.98	3.38	3.35	3.46	3.22	3.17
7	3.28	2.96	2.78	2.78	2.76	2.74	3.03	3.37	3.34	3.48	3.23	3.18
8	3.30	2.92	2.80	2.77	2.75	2.75	3.10	3.35	3.36	3.47	3.23	3.18
9	3.35	2.91	2.79	2.75	2.75	2.77	3.16	3.34	3.39	3.48	3.22	3.18
10	3.36	2.89	2.79	2.78	2.73	2.77	3.20	3.34	3.43	3.46	3.20	3.20
11	3.37	2.88	2.79	2.80	2.73	2.78	3.22	3.34	3.45	3.43	3.20	3.21
12	3.34	2.90	2.78	2.80	2.72	2.78	3.24	3.33	3.45	3.40	3.20	3.21
13	3.31	2.93	2.77	2.83	2.72	2.77	3.26	3.35	3.45	3.37	3.19	3.22
14	3.29	2.93	2.76	2.83	2.72	2.76	3.28	3.35	3.46	3.35	3.19	3.38
15	3.28	2.94	2.75	2.81	2.72	2.75	3.37	3.37	3.47	3.31	3.20	3.39
16	3.31	2.93	2.76	2.79	2.72	2.76	3.45	3.36	3.46	3.28	3.28	3.33
17	3.31	2.93	2.78	2.77	2.72	2.77	3.42	3.35	3.46	3.24	3.27	3.27
18	3.31	2.91	2.78	2.75	2.72	2.77	3.39	3.35	3.51	3.26	3.26	3.23
19	3.31	2.90	2.78	2.73	2.72	2.76	3.37	3.34	3.58	3.34	3.25	3.20
20	3.31	2.89	2.77	2.72	2.71	2.76	3.43	3.33	3.71	3.31	3.23	3.18
21	3.31	2.90	2.77	2.74	2.72	2.75	3.43	3.32	3.72	3.28	3.21	3.18
22	3.30	2.91	2.77	2.79	2.75	2.74	3.41	3.32	3.69	3.24	3.18	3.17
23	3.29	2.95	2.77	2.80	2.76	2.73	3.39	3.33	3.64	3.21	3.19	3.17
24	3.29	2.94	2.77	2.80	2.76	2.73	3.38	3.37	3.59	3.18	3.18	3.18
25	3.31	2.93	2.77	2.81	2.75	2.73	3.38	3.37	3.59	3.16	3.18	3.19
26	3.30	2.93	2.78	2.81	2.74	2.74	3.36	3.36	3.55	3.14	3.17	3.20
27	3.30	2.92	2.77	2.81	2.74	2.76	3.35	3.36	3.52	3.13	3.17	3.22
28	3.29	2.90	2.78	2.80	2.73	2.77	3.34	3.35	3.48	3.14	3.17	3.27
29	3.29	2.87	2.82	2.79	---	2.78	3.34	3.34	3.44	3.13	3.16	3.31
30	3.26	2.84	2.83	2.77	---	2.79	3.36	3.35	3.41	3.14	3.16	3.30
31	3.21	---	2.83	2.76	---	2.80	---	3.39	---	3.15	3.25	---
MEAN	3.29	2.95	2.78	2.79	2.74	2.75	3.23	3.35	3.48	3.30	3.20	3.23
MAX	3.37	3.18	2.83	2.83	2.77	2.80	3.45	3.39	3.72	3.48	3.28	3.39
MIN	3.21	2.84	2.75	2.72	2.71	2.73	2.80	3.32	3.34	3.13	3.16	3.17



## STREAMS TRIBUTARY TO LAKE MICHIGAN

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-83-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 596.43 ft above sea level (Antrim County Road Commission bench mark). Nov. 19, 1959 to Sept. 30, 1966, nonrecording gage at site 600 ft upstream at same datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	175	180	197	201	191	e180	220	204	207	170	167	191
2	175	272	195	192	e188	181	206	195	191	172	175	174
3	172	254	193	194	185	185	200	201	184	176	174	173
4	169	244	192	254	183	184	199	225	182	170	175	170
5	169	227	194	228	183	187	207	221	182	168	169	168
6	170	224	191	202	182	187	216	203	179	329	183	169
7	170	195	191	193	e180	189	218	193	184	192	179	168
8	170	192	189	190	179	189	239	190	193	177	169	170
9	214	203	187	185	e180	190	310	186	240	231	167	203
10	245	214	191	e185	180	189	241	185	195	201	169	259
11	226	202	192	e185	179	189	211	185	182	175	167	209
12	200	217	190	e185	179	186	200	183	177	173	164	178
13	187	327	190	e185	179	e184	193	183	174	169	183	186
14	189	230	189	186	180	e182	191	186	190	170	164	638
15	186	213	192	186	181	e180	298	187	195	167	168	359
16	290	205	281	186	180	179	392	183	179	166	200	205
17	268	204	241	188	180	182	248	182	202	165	174	189
18	216	199	207	185	e180	e179	220	184	307	194	168	185
19	211	193	200	e185	e180	176	214	189	255	209	167	178
20	217	205	195	186	e180	176	276	184	315	174	170	178
21	220	333	190	187	e180	176	255	182	223	168	166	192
22	208	258	190	198	e180	176	269	180	198	165	164	181
23	197	235	191	194	e180	176	231	190	184	164	194	183
24	189	216	189	192	e180	183	226	257	178	163	176	175
25	185	210	e188	190	e180	202	253	209	194	171	168	173
26	184	251	e188	187	e180	220	209	198	191	180	167	174
27	183	251	e188	188	e180	251	198	193	183	170	180	178
28	182	212	188	187	e180	281	214	206	177	172	180	202
29	182	202	208	187	---	297	207	190	173	171	170	209
30	181	198	214	186	---	293	227	190	172	179	176	184
31	179	---	222	189	---	275	---	278	---	167	274	---
TOTAL	6109	6766	6153	5966	5069	6204	6988	6122	5986	5618	5447	6201
MEAN	197	226	198	192	181	200	233	197	200	181	176	207
MAX	290	333	281	254	191	297	392	278	315	329	274	638
MIN	169	180	187	185	179	176	191	180	172	163	163	168
CFSM	2.90	3.32	2.92	2.83	2.67	2.95	3.43	2.91	2.94	2.67	2.59	3.04
IN.	3.35	3.71	3.37	3.27	2.78	3.40	3.83	3.35	3.28	3.08	2.98	3.40

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	188	191	189	179	180	211	223	194	183	173	171	183	183	235	226	217	198	209	281	273	237	230	210	203	223	207	207
MAX	235	226	217	198	209	281	273	237	230	210	203	223	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
(WY)	1987	1993	1983	1990	1984	1979	1979	1983	1969	1975	1972	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986
MIN	167	163	163	157	157	174	181	164	160	151	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
(WY)	1967	1982	1982	1971	1982	1972	1987	1982	1982	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1967 - 1993

ANNUAL TOTAL	70904	72629	189
ANNUAL MEAN	194	199	204
HIGHEST ANNUAL MEAN			171
LOWEST ANNUAL MEAN			171
HIGHEST DAILY MEAN	380	Apr 16	840
LOWEST DAILY MEAN	161	Aug 23	130
ANNUAL SEVEN-DAY MINIMUM	163	Aug 11	136
INSTANTANEOUS PEAK FLOW			786
INSTANTANEOUS PEAK STAGE			5.67
INSTANTANEOUS LOW FLOW			(a)150
ANNUAL RUNOFF (CFSM)	2.85	2.93	2.78
ANNUAL RUNOFF (INCHES)	38.85	39.79	37.75
10 PERCENT EXCEEDS	226	242	222
50 PERCENT EXCEEDS	185	188	179
90 PERCENT EXCEEDS	168	170	160

(a) Result of freezeup.

(e) Estimated.

## 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 sea level. Prior to Aug. 4, 1972, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	120	121	274	e150	e108	e70	e1000	532	618	137	89	102
2	111	224	249	e150	e108	e72	e560	445	421	128	102	98
3	103	1300	218	e148	e108	e74	e450	494	307	124	126	96
4	96	1180	200	e146	e106	e76	e420	1250	251	118	173	102
5	88	724	192	e140	e104	e78	e440	944	218	116	174	95
6	85	511	e185	e134	e102	e80	e500	674	198	177	145	96
7	85	379	e175	e130	e100	e82	e680	499	181	218	187	95
8	85	356	e165	e122	e98	e82	827	399	187	180	216	93
9	102	277	e160	e118	e98	e80	1800	329	609	163	173	114
10	487	376	e150	e112	e96	e80	1460	277	610	224	157	201
11	327	451	e148	e110	e94	e80	1000	242	440	226	159	187
12	236	387	e144	e106	e92	e78	735	211	307	204	136	155
13	241	e420	140	e102	e90	e78	569	183	237	185	119	140
14	237	e360	137	e100	e90	e76	471	174	288	168	110	500
15	218	e320	140	e98	e88	e74	442	206	339	156	109	758
16	498	e290	1100	e98	e86	e74	1420	252	259	138	112	514
17	720	e270	758	e96	e84	e74	1530	225	258	127	111	329
18	465	e250	443	e96	e82	e76	1310	200	600	120	106	250
19	370	e260	364	e96	e80	e76	997	202	467	119	102	216
20	333	328	312	e94	e78	e78	746	200	361	117	115	181
21	360	1540	e270	e96	e76	e78	652	245	325	110	136	161
22	291	1310	e240	e98	e76	e80	650	235	262	103	119	145
23	250	745	e215	e100	e74	e84	517	215	215	96	106	134
24	223	520	e195	e102	e72	e90	596	553	186	91	103	129
25	197	408	e185	e104	e72	e120	998	493	181	85	102	123
26	179	375	e175	e104	e70	e170	718	349	211	86	101	116
27	163	411	e165	e105	e70	e275	545	257	191	87	101	111
28	151	351	e160	e104	e70	e450	827	301	179	89	113	109
29	145	311	e160	e104	---	e700	849	273	164	95	109	118
30	140	312	e155	e106	---	e1300	647	302	147	95	100	118
31	130	---	e155	e108	---	e1600	---	885	---	90	98	---
TOTAL	7236	15067	7729	3477	2472	6485	24356	12046	9217	4172	3909	5584
MEAN	233	502	249	112	88.3	209	812	389	307	135	126	186
MAX	720	1540	1100	150	108	1600	1800	1250	618	226	216	756
MIN	85	121	137	94	70	70	420	174	147	85	89	93
CFSM	1.27	2.73	1.36	.61	.48	1.14	4.41	2.11	1.67	.73	.69	1.01
IN.	1.46	3.05	1.56	.70	.50	1.31	4.92	2.44	1.86	.84	.79	1.13

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1972 - 1993, BY WATER YEAR (WY)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	214	291	182	121	107	276	852	265	182	103	105	151										
MAX	347	807	328	248	217	544	1589	633	432	261	349	318										
(WY)	1979	1989	1983	1980	1984	1973	1985	1972	1974	1979	1973	1978										
MIN	71.8	72.7	63.0	60.3	65.9	90.7	281	123	76.8	60.3	58.5	65.3										
(WY)	1977	1977	1977	1977	1979	1978	1987	1987	1988	1988	1991	1976										

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1972 - 1993

ANNUAL TOTAL	77874	101750	235
ANNUAL MEAN	213	279	344
HIGHEST ANNUAL MEAN			149
LOWEST ANNUAL MEAN			1985
HIGHEST DAILY MEAN	2200	1800	4050
LOWEST DAILY MEAN	55	70	45
ANNUAL SEVEN-DAY MINIMUM	56	71	50
INSTANTANEOUS PEAK FLOW		(a)2270	4500
INSTANTANEOUS PEAK STAGE		(b)14.24	18.44
INSTANTANEOUS LOW FLOW			(c)33
ANNUAL RUNOFF (CFSM)	1.16	1.52	1.28
ANNUAL RUNOFF (INCHES)	15.74	20.57	17.37
10 PERCENT EXCEEDS	441	630	475
50 PERCENT EXCEEDS	115	165	126
90 PERCENT EXCEEDS	67	85	71

(a) Gage height, 11.04 ft.

(b) Backwater from ice.

(c) Result of freezeup.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

## 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 sea level. 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, 2.69 ft, Sept. 15; minimum, 0.93 ft, Mar. 23.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.33	1.87	2.13	1.88	1.54	1.21	1.28	2.43	2.51	2.34	2.20	2.43
2	2.33	2.02	2.12	1.87	1.52	1.14	1.29	2.41	2.50	2.32	2.21	2.41
3	2.33	2.13	2.09	1.86	1.50	1.12	1.29	2.39	2.48	2.31	2.21	2.40
4	2.33	2.16	2.08	1.88	1.48	1.11	1.27	2.41	2.47	2.30	2.22	2.37
5	2.32	2.18	2.06	1.90	1.46	1.10	1.27	2.42	2.44	2.28	2.22	2.35
6	2.31	2.17	2.00	1.89	1.50	1.09	1.27	2.40	2.42	2.35	2.21	2.33
7	2.32	2.13	1.99	1.88	1.45	1.08	1.28	2.42	2.42	2.35	2.21	2.31
8	2.32	2.09	1.96	1.86	1.43	1.07	1.31	2.42	2.42	2.34	2.20	2.32
9	2.37	2.07	1.94	1.85	1.41	1.06	1.41	2.43	2.51	2.33	2.19	2.34
10	2.40	2.05	1.94	1.82	1.40	1.05	1.45	2.41	2.53	2.32	2.20	2.41
11	2.44	2.03	1.94	1.80	1.38	1.05	1.46	2.40	2.53	2.31	2.20	2.40
12	2.44	2.03	1.92	1.78	1.38	1.06	1.45	2.40	2.50	2.29	2.20	2.39
13	2.40	2.06	1.90	1.81	1.36	1.05	1.44	2.37	2.47	2.28	2.19	2.39
14	2.41	2.11	1.88	1.81	1.34	1.17	1.43	2.36	2.43	2.27	2.18	2.56
15	2.40	2.09	1.87	1.80	1.32	1.09	1.54	2.37	2.41	2.25	2.19	2.68
16	2.39	2.07	1.92	1.77	1.33	1.00	1.83	2.35	2.40	2.24	2.22	2.66
17	2.37	2.08	1.96	1.75	1.30	1.08	1.97	2.34	2.41	2.24	2.22	2.63
18	2.36	2.06	1.95	1.73	1.28	1.03	2.05	2.35	2.52	2.24	2.22	2.59
19	2.30	2.03	1.95	1.71	1.28	1.00	2.15	2.34	2.56	2.26	2.21	2.55
20	2.26	2.03	1.93	1.68	1.27	.96	2.28	2.33	2.57	2.24	2.22	2.52
21	2.23	2.08	1.90	1.69	1.26	.95	2.34	2.33	2.56	2.23	2.20	2.50
22	2.18	2.14	1.87	1.69	1.28	.94	2.41	2.33	2.54	2.21	2.19	2.47
23	2.12	2.16	1.87	1.68	1.27	.94	2.47	2.35	2.51	2.20	2.23	2.46
24	2.09	2.14	1.85	1.67	1.26	.94	2.52	2.42	2.48	2.20	2.24	2.43
25	2.04	2.12	1.87	1.65	1.25	.96	2.58	2.43	2.46	2.20	2.24	2.42
26	2.00	2.18	1.86	1.64	1.24	1.00	2.59	2.44	2.43	2.18	2.24	2.40
27	1.97	2.22	1.86	1.62	1.24	1.03	2.53	2.46	2.41	2.19	2.37	2.39
28	1.94	2.21	1.86	1.61	1.23	1.08	2.49	2.45	2.38	2.19	2.41	2.40
29	1.92	2.18	1.87	1.61	---	1.15	2.48	2.45	2.37	2.18	2.40	2.39
30	1.89	2.16	1.87	1.58	---	1.20	2.44	2.45	2.36	2.19	2.39	2.37
31	1.87	---	1.88	1.56	---	1.26	---	2.52	---	2.18	2.43	---
MEAN	2.24	2.10	1.94	1.75	1.36	1.06	1.85	2.40	2.47	2.26	2.24	2.44
MAX	2.44	2.22	2.13	1.90	1.54	1.26	2.59	2.52	2.57	2.35	2.43	2.68
MIN	1.87	1.87	1.85	1.56	1.23	.94	1.27	2.33	2.36	2.18	2.18	2.31

## 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-83-1: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above sea level, 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	214	213	254	237	220	e198	293	308	336	204	190	292
2	208	340	248	e245	208	e198	262	279	269	202	191	218
3	204	450	241	252	e206	e198	246	272	249	204	189	215
4	198	354	235	269	e204	199	240	320	237	199	206	211
5	196	331	235	286	202	200	257	418	227	195	194	207
6	192	287	233	248	194	196	274	492	227	342	195	201
7	196	260	235	233	e194	196	307	353	230	270	204	190
8	195	248	226	227	e184	196	324	290	250	214	192	192
9	244	254	221	215	e194	195	402	267	316	227	186	214
10	251	269	229	207	e194	193	411	250	282	264	183	319
11	256	262	229	e207	e196	193	325	243	238	224	184	345
12	232	260	228	e208	e198	179	287	239	225	214	180	248
13	223	377	226	e209	199	e180	270	239	216	209	183	230
14	221	339	224	e210	198	e180	258	232	236	202	176	549
15	225	286	224	e210	196	e180	335	233	250	198	182	563
16	328	268	292	e210	e196	e180	581	226	224	193	195	325
17	383	263	312	e210	e196	e180	450	222	230	188	190	272
18	317	253	262	e210	e197	180	331	225	408	202	182	254
19	280	243	245	e210	198	e180	321	236	417	263	176	237
20	272	248	235	e210	e198	e182	336	228	431	228	184	222
21	285	358	221	223	e198	185	334	222	428	206	179	221
22	283	430	222	231	e198	185	384	218	296	194	175	231
23	275	334	222	227	e198	186	393	221	265	186	229	226
24	258	297	220	221	e198	194	396	339	239	182	277	217
25	241	282	e219	212	e198	213	484	294	244	185	238	210
26	235	346	218	e212	e198	240	391	272	245	207	194	208
27	230	354	e220	e212	e198	274	309	257	226	200	198	208
28	226	296	e220	212	e198	323	310	256	215	188	247	223
29	223	271	e230	e212	---	371	309	248	211	189	209	250
30	220	261	248	e215	---	387	347	248	208	203	200	230
31	215	---	245	219	---	371	---	405	---	191	323	---
TOTAL	7536	9034	7319	6909	5566	6712	10167	8552	8075	6573	6231	7728
MEAN	243	301	236	223	199	217	339	276	269	212	201	258
MAX	383	450	312	286	220	387	581	492	431	342	323	563
MIN	192	213	218	207	194	179	240	218	208	182	175	190
CFSM	1.23	1.52	1.19	1.13	1.00	1.09	1.71	1.39	1.36	1.07	1.02	1.30
IN.	1.42	1.70	1.38	1.30	1.05	1.26	1.91	1.61	1.52	1.23	1.17	1.45

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1993, BY WATER YEAR (WY)

MEAN	213	224	213	199	197	247	313	239	208	184	180	202
MAX	326	301	306	295	275	354	431	353	272	251	301	290
(WY)	1984	1993	1972	1973	1984	1976	1971	1983	1969	1972	1972	1986
MIN	153	164	157	133	130	172	198	154	149	130	134	141
(WY)	1957	1950	1949	1957	1957	1954	1958	1958	1958	1981	1944	1948

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1942 - 1993

ANNUAL TOTAL	88008	90402	
ANNUAL MEAN	240	248	218
HIGHEST ANNUAL MEAN			268
LOWEST ANNUAL MEAN			167
HIGHEST DAILY MEAN	648	581	1080
LOWEST DAILY MEAN	170	175	113
ANNUAL SEVEN-DAY MINIMUM	173	180	118
INSTANTANEOUS PEAK FLOW		684	1290
INSTANTANEOUS PEAK STAGE		2.84	4.48
INSTANTANEOUS LOW FLOW		(a)93	(a)93
ANNUAL RUNOFF (CFSM)	1.21	1.25	1.10
ANNUAL RUNOFF (INCHES)	16.53	16.98	14.97
10 PERCENT EXCEEDS	313	337	293
50 PERCENT EXCEEDS	222	226	201
90 PERCENT EXCEEDS	188	192	158

(a) Result of freezeup.  
(e) Estimated.



## STREAMS TRIBUTARY TO LAKE HURON

## 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 sea level, from topographic map. September 1950 to October 1990, water-stage recorder at site 2.5 mi downstream at different datum (Station 04129000).

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	71	81	e70	84	73	67	128	109	105	61	70	112
2	63	122	e69	63	72	69	88	104	101	70	50	74
3	66	237	e68	91	e68	67	87	103	76	53	65	68
4	53	144	e67	99	64	66	82	130	77	62	78	62
5	64	142	e66	116	68	66	92	191	70	58	61	58
6	63	97	e65	97	64	65	108	245	70	94	70	65
7	59	90	e64	61	62	68	129	132	68	78	75	62
8	60	80	e64	83	e61	69	128	99	86	67	60	52
9	79	73	e64	56	e61	68	213	89	122	67	60	86
10	103	92	e63	126	e61	69	212	80	88	80	62	138
11	77	79	e63	52	e61	67	149	72	76	66	57	141
12	74	85	e63	60	56	57	99	72	72	66	59	80
13	72	e170	e64	e64	66	e62	107	73	68	60	53	79
14	70	e130	e64	e64	61	63	85	72	64	63	63	291
15	70	e84	e64	e64	62	e63	127	75	72	61	49	312
16	152	e76	e82	e64	e61	e63	311	77	62	52	61	120
17	153	e74	e100	e64	e61	e64	193	68	70	58	67	83
18	122	e70	e80	e64	47	64	115	72	180	62	50	86
19	93	e68	e70	51	e60	e64	114	80	164	133	57	74
20	86	e69	e66	e66	e60	64	119	74	263	83	53	65
21	98	e100	e64	67	e60	63	105	82	218	58	59	85
22	99	e205	e64	76	e60	63	156	61	106	63	50	76
23	84	e100	66	63	e60	62	147	73	82	61	70	79
24	80	e84	60	76	59	61	174	137	78	58	107	62
25	77	e80	e61	69	e60	80	180	103	64	63	70	74
26	70	e100	62	58	e62	91	124	95	77	64	62	72
27	82	e145	e68	e64	63	103	111	83	67	63	68	61
28	53	e90	e74	e64	66	130	100	90	67	66	90	97
29	71	e80	77	65	---	171	112	81	61	61	74	91
30	57	e75	83	e66	---	182	157	81	61	65	53	81
31	71	---	79	67	---	174	---	155	---	55	136	---
TOTAL	2492	3122	2134	2224	1739	2485	4052	3058	2835	2071	2059	2886
MEAN	80.4	104	68.8	71.7	62.1	80.2	135	98.6	94.5	66.8	66.4	96.2
MAX	153	237	100	126	73	182	311	245	263	133	136	312
MIN	53	68	60	51	47	57	82	61	61	52	49	52
CFSM	1.39	1.80	1.19	1.24	1.08	1.39	2.34	1.71	1.64	1.16	1.15	1.67
IN.	1.61	2.01	1.38	1.43	1.12	1.60	2.61	1.97	1.83	1.34	1.33	1.86

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1951 - 1993, BY WATER YEAR (WY)

	MEAN	78.0	82.2	76.6	70.6	70.1	88.6	120	87.4	71.6	64.5	62.9	72.9
MAX	112	112	105	94.9	90.1	136	164	142	94.5	92.7	93.4	120	120
(WY)	1987	1989	1972	1973	1984	1976	1960	1983	1993	1969	1972	1961	1961
MIN	56.6	64.9	61.1	55.1	55.7	65.0	81.3	54.4	50.7	47.5	42.6	53.2	53.2
(WY)	1964	1963	1959	1959	1957	1958	1987	1958	1958	1965	1958	1966	1966

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1951 - 1993

ANNUAL TOTAL	29284	31157	78.7
ANNUAL MEAN	80.0	85.4	90.7
HIGHEST ANNUAL MEAN			62.3
LOWEST ANNUAL MEAN			1985
HIGHEST DAILY MEAN	320	312	769
LOWEST DAILY MEAN	46	47	24
ANNUAL SEVEN-DAY MINIMUM	53	57	38
INSTANTANEOUS PEAK FLOW		579	1500
INSTANTANEOUS PEAK STAGE		4.68	6.80
INSTANTANEOUS LOW FLOW		(c)8.4	8.4
ANNUAL RUNOFF (CFSM)	1.39	1.48	1.36
ANNUAL RUNOFF (INCHES)	18.88	20.09	18.54
10 PERCENT EXCEEDS	106	131	110
50 PERCENT EXCEEDS	72	70	70
90 PERCENT EXCEEDS	57	60	55

(a) From rating curve extended above 500 ft<sup>3</sup>/s, result of failure of Lansing Club Dam; site then in use.

(b) From floodmark; site and datum then in use.

(c) Result of freezeup.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

## 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.

REVISED RECORDS.--WSP 1307: 1942. WDR MI-83-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 658.00 ft above sea level (Stanley Engineering Co. bench mark). Prior to Aug. 1, 1949, at site 1 mi upstream at different datum.

REMARKS.--Records good. Flow completely regulated by Kleber Dam 400 ft upstream. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	241	234	419	290	223	196	566	513	451	201	160	295
2	199	227	396	261	222	195	518	514	350	201	160	318
3	176	380	339	263	196	194	482	496	391	199	133	248
4	178	432	251	282	211	222	401	540	335	192	158	251
5	180	463	316	304	223	213	389	501	248	189	176	251
6	180	462	273	358	211	201	392	533	241	238	190	188
7	177	462	235	376	201	215	392	509	277	264	193	159
8	176	424	243	244	155	235	446	480	242	264	192	160
9	181	380	290	247	236	212	476	461	380	220	176	179
10	202	335	262	213	210	213	536	412	375	212	160	198
11	232	328	292	199	192	235	576	380	422	244	160	274
12	249	325	264	204	197	224	542	301	319	216	160	248
13	239	392	264	236	214	161	491	259	251	190	155	295
14	225	368	264	219	194	178	459	259	276	191	138	337
15	191	437	264	195	197	194	450	259	259	191	136	385
16	221	417	272	214	196	220	625	261	260	183	136	435
17	371	343	356	241	176	229	722	261	259	161	145	420
18	382	358	352	240	163	179	752	261	365	160	150	403
19	366	264	383	209	192	165	715	258	402	181	150	332
20	356	297	329	202	192	204	670	227	556	231	167	254
21	357	342	233	246	191	232	559	228	651	254	178	250
22	333	403	253	228	191	195	606	246	633	221	163	196
23	320	444	338	228	191	206	643	246	574	193	159	224
24	286	461	196	233	194	239	654	354	473	172	240	238
25	251	481	147	243	190	235	811	351	382	163	266	182
26	249	480	168	246	173	325	713	350	263	163	201	179
27	247	481	131	186	153	357	664	358	337	164	154	236
28	230	480	163	195	202	438	606	349	259	180	232	176
29	232	466	305	248	---	543	513	319	255	200	304	241
30	209	395	336	230	---	590	544	252	202	198	261	241
31	215	---	273	221	---	603	---	414	---	165	262	---
TOTAL	7651	11761	8607	7501	5486	8048	16913	11152	10688	6201	5615	7793
MEAN	247	392	278	242	196	260	564	360	356	200	181	260
MAX	382	481	419	376	236	603	811	540	651	264	304	435
MIN	176	227	131	186	153	161	389	227	202	160	133	159
CFSM	.79	1.26	.89	.78	.63	.83	1.81	1.16	1.15	.64	.58	.84
IN.	.92	1.41	1.03	.90	.66	.96	2.02	1.33	1.28	.74	.67	.93

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1943 - 1993, BY WATER YEAR (WY)

	MEAN	243	267	248	219	216	338	543	348	252	200	179	215
MAX	459	489	409	433	398	594	882	638	405	408	351	367	
(WY)	1984	1946	1972	1973	1984	1976	1960	1983	1976	1974	1972	1984	
MIN	138	130	163	150	138	188	297	185	140	112	86.1	116	
(WY)	1957	1950	1990	1948	1948	1956	1987	1987	1958	1966	1949	1949	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1943 - 1993

ANNUAL TOTAL	100584	107416	
ANNUAL MEAN	275	294	
HIGHEST ANNUAL MEAN			272
LOWEST ANNUAL MEAN			350
HIGHEST DAILY MEAN	1340	811	1885
LOWEST DAILY MEAN	110	131	188
ANNUAL SEVEN-DAY MINIMUM	125	144	1860
INSTANTANEOUS PEAK FLOW		1460	4.0
INSTANTANEOUS PEAK STAGE		5.73	50
INSTANTANEOUS LOW FLOW		24	2340
ANNUAL RUNOFF (CFSM)	.88	.95	7.13
ANNUAL RUNOFF (INCHES)	12.03	12.85	.60
10 PERCENT EXCEEDS	434	481	.88
50 PERCENT EXCEEDS	233	248	11.90
90 PERCENT EXCEEDS	152	173	470
			227
			143

## STREAMS TRIBUTARY TO LAKE HURON

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 September 1993 (discontinued). Occasional discharge measurements, water years 1945-50.

REVISED RECORDS.--WSP 1307: 1901-09. WDR MI-80-1: 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 sea level, from topographic map.

REMARKS.--Records fair except for estimated daily discharges, which are poor. Flow regulated at all stages by hydroelectric plant 1,000 ft upstream.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	411	848	e1720	e1020	733	e502	2700	1900	1030	1180	475	718
2	411	1020	e1660	e999	680	e507	2370	1840	e1210	1100	379	960
3	424	1030	e1570	e976	683	e648	1780	1890	e1130	888	503	825
4	424	1340	e1480	e1320	761	e508	1680	1810	e1010	945	320	797
5	202	1530	e1370	e1150	734	e506	1710	1790	936	801	333	895
6	316	1560	e1130	e1280	691	e506	1630	1770	974	687	476	863
7	390	1550	e1310	1110	643	e688	1660	1720	976	657	321	816
8	439	1530	e1330	1120	571	e496	1670	1640	1060	454	286	512
9	426	1510	e1030	885	713	e485	1890	1550	e1310	593	434	565
10	422	1480	e1280	882	654	e748	1990	1360	e1500	502	296	676
11	423	1460	e1020	822	673	e499	2010	1320	e1550	443	443	700
12	690	1390	e1280	837	541	e507	1850	1310	e1590	430	456	490
13	434	1460	e1230	865	623	e504	1780	837	e1450	449	332	664
14	700	1520	e1050	773	523	e503	1590	792	e1340	444	423	881
15	538	1630	e1280	753	723	e604	1580	853	e1190	461	361	861
16	963	1600	e1300	746	512	e503	1820	637	909	431	330	739
17	1180	1580	e1300	840	512	e506	2230	829	1070	254	351	618
18	962	1570	e1300	746	512	e503	2340	635	1130	332	370	754
19	1160	1400	e1300	781	511	e666	2090	672	1410	434	379	814
20	1270	1300	e1360	754	511	e510	2160	767	1880	519	343	758
21	912	1370	e1050	730	511	e512	2040	732	2060	508	454	758
22	1080	1340	e1220	770	614	e508	2140	633	2470	565	87	737
23	1260	e1580	e1250	774	507	e645	2390	773	2390	535	327	799
24	997	e1650	e701	850	492	e512	2370	883	1990	458	322	674
25	839	e1750	e849	764	492	e532	2260	952	1900	503	334	509
26	905	e1920	e699	817	e493	979	2020	952	1760	521	255	802
27	851	e2020	e858	757	e495	1010	1940	1010	1570	524	282	708
28	886	e2040	e986	747	e496	1520	1900	964	1540	523	419	674
29	876	e1970	e1130	786	---	1970	1800	948	1490	512	380	625
30	876	e1840	e1230	711	---	3310	1940	994	1340	392	330	632
31	847	---	e1230	743	---	4100	---	997	---	273	627	---
TOTAL	22514	45788	37503	27108	16604	26497	59330	35760	43155	17318	11428	21824
MEAN	726	1526	1210	874	593	855	1978	1154	1438	559	369	727
MAX	1270	2040	1720	1320	761	4100	2700	1900	2470	1180	627	960
MIN	202	848	699	711	492	485	1580	633	909	254	87	490
CFSM	.59	1.23	.98	.71	.48	.69	1.60	.93	1.16	.45	.30	.59
IN.	.68	1.38	1.13	.81	.50	.80	1.78	1.07	1.30	.52	.34	.66

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 1993, BY WATER YEAR (WY)

	MEAN	688	872	849	752	737	1495	2044	1166	802	543	500	546
MAX	1652	1526	1342	1321	1380	2845	4390	2596	1474	872	1057	1231	
(WY)	1987	1993	1992	1907	1984	1986	1904	1983	1904	1986	1903	1986	
MIN	380	444	441	453	387	733	903	380	398	327	222	184	
(WY)	1990	1905	1905	1982	1902	1980	1987	1987	1988	1988	1908	1902	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1901 - 1993
ANNUAL TOTAL	351018	364829	
ANNUAL MEAN	959	1000	913
HIGHEST ANNUAL MEAN			1181
LOWEST ANNUAL MEAN			626
HIGHEST DAILY MEAN	3860	4100	12100
LOWEST DAILY MEAN	50	87	10
ANNUAL SEVEN-DAY MINIMUM	275	289	20
ANNUAL RUNOFF (CFSM)	.77	.81	.74
ANNUAL RUNOFF (INCHES)	10.55	10.96	10.02
10 PERCENT EXCEEDS	1740	1830	1640
50 PERCENT EXCEEDS	746	840	697
90 PERCENT EXCEEDS	398	425	340

(a) Oct. 29, Dec. 31, 1905.  
(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1980 to August 1993 (discontinued).

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.--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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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 05...	0915	1480	360	8.1	4.5	1.7	10.9	87	40	71
JAN 27...	1100	857	418	8.0	1.0	1.3	10.9	79	K2	<1
MAR 25...	1145	465	426	8.0	1.0	1.7	13.6	97	K1	K2
APR 27...	1230	1930	315	8.1	9.0	2.2	11.4	100	K3	K6
AUG 12...	1400	470	347	8.3	25.0	0.60	8.4	104	40	K21

DATE	HARD-NESS TOTAL (MG/L AS CaCO3) (00900)	HARD-NESS NONCARB DIS-SOLV 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 05...	180	14	49	14	5.0	1.0	202	166	10	6.3
JAN 27...	200	2	56	15	5.5	1.1	244	200	11	6.8
MAR 25...	220	0	61	16	5.8	0.80	266	218	10	6.5
APR 27...	170	14	48	11	3.8	1.2	185	152	8.5	6.1
AUG 12...	190	11	50	15	4.9	0.50	214	175	8.8	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 DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	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) (00655)
NOV 05...	0.20	9.3	212	0.29	847	<0.010	0.067	0.020	0.40	0.020
JAN 27...	0.20	10	247	0.34	572	0.020	0.130	0.040	0.30	<0.010
MAR 25...	<0.10	11	247	0.34	310	0.020	0.130	0.030	<0.20	0.030
APR 27...	0.20	3.6	185	0.25	964	<0.010	<0.050	0.020	0.50	0.030
AUG 12...	0.20	10	210	0.29	266	<0.010	<0.050	0.040	0.40	0.020



## STREAMS TRIBUTARY TO LAKE HURON

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)
NOV 05...	<0.010	<0.010	<10	20	<3	30	<4	3	<10
JAN 27...	<0.010	<0.010	20	22	<3	39	<4	18	<10
MAR 25...	0.020	<0.010	--	--	--	--	--	--	--
APR 27...	0.020	<0.010	10	17	<3	50	<4	8	<10
AUG 12...	<0.010	<0.010	<10	25	<3	7	<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)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 05...	<1	<1	<1.0	99	<6	3	12	100
JAN 27...	<1	<1	<1.0	110	<6	2	4.6	96
MAR 25...	--	--	--	--	--	1	1.3	81
APR 27...	<1	<1	<1.0	95	<6	9	47	81
AUG 12...	<1	<1	<1.0	99	<6	5	6.3	85

## 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 September 1993 (discontinued). 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 sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Prior to Dec. 31, 1952, diurnal fluctuation caused by powerplant 2.5 mi upstream. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	69	98	92	73	70	116	109	103	92	73	114
2	63	92	95	78	71	72	102	105	96	88	71	99
3	61	122	92	90	79	73	94	105	87	e86	71	86
4	60	129	91	102	77	73	90	113	81	e85	74	77
5	59	118	90	111	75	73	92	118	80	84	73	71
6	58	104	84	103	67	73	98	117	78	87	73	69
7	59	93	97	89	68	74	104	103	80	96	78	68
8	60	86	91	81	73	74	114	93	88	92	76	70
9	74	85	84	78	69	72	140	90	103	87	70	71
10	82	91	90	83	75	71	138	88	108	86	71	95
11	80	98	88	77	70	70	117	85	95	83	72	124
12	74	100	87	78	72	61	103	82	84	79	66	114
13	68	110	87	79	71	65	96	79	78	77	64	96
14	67	111	85	79	72	63	94	81	76	75	63	93
15	68	105	85	80	71	67	124	88	79	74	67	108
16	85	97	95	79	67	74	136	85	76	72	80	112
17	102	92	107	79	65	67	121	80	77	71	80	99
18	105	89	105	74	62	61	108	80	107	73	73	87
19	95	86	96	72	65	68	113	81	146	94	67	81
20	88	87	89	76	68	73	127	81	175	119	65	77
21	86	99	72	78	69	69	125	79	203	105	65	78
22	89	121	90	79	67	68	126	78	190	86	64	77
23	89	134	87	81	69	67	120	78	148	78	64	76
24	86	128	71	81	67	69	118	89	120	75	66	75
25	82	116	74	76	65	76	121	98	109	81	66	73
26	77	117	70	65	65	84	113	93	106	93	66	73
27	74	122	80	76	65	94	107	87	101	82	79	74
28	72	117	85	82	67	104	108	87	96	78	90	79
29	71	107	87	72	---	114	113	86	92	77	74	81
30	71	101	94	74	---	125	116	83	94	78	73	81
31	70	---	99	79	---	129	---	97	---	76	115	---
TOTAL	2341	3126	2745	2523	1944	2393	3394	2818	3156	2609	2239	2578
MEAN	75.5	104	88.5	81.4	69.4	77.2	113	90.9	105	84.2	72.2	85.9
MAX	105	134	107	111	79	129	140	118	203	119	115	124
MIN	58	69	70	65	62	61	90	78	76	71	63	68
CFSM	.69	.95	.80	.74	.63	.70	1.03	.83	.96	.77	.66	.78
IN.	.79	1.06	.93	.85	.66	.81	1.15	.95	1.07	.88	.76	.87

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1943 - 1993, BY WATER YEAR (WY)

	MEAN	72.4	77.3	74.9	70.0	67.9	82.1	109	87.2	78.3	67.9	63.2	68.2
MAX	143	124	100	93.9	88.5	121	148	133	132	94.3	93.7	130	130
(WY)	1987	1989	1972	1973	1953	1976	1947	1947	1943	1952	1987	1986	1986
MIN	49.2	51.6	52.3	50.3	46.9	51.4	68.5	52.3	50.0	46.1	42.3	47.6	47.6
(WY)	1964	1965	1982	1965	1963	1965	1958	1958	1958	1965	1964	1964	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1943 - 1993

ANNUAL TOTAL	29205		31866									
ANNUAL MEAN	79.8		87.3							76.5		
HIGHEST ANNUAL MEAN										102		1986
LOWEST ANNUAL MEAN										54.7		1964
HIGHEST DAILY MEAN	179	Apr 22	203	Jun 21						260	Jun 2	1943
LOWEST DAILY MEAN	49	Aug 26	58	Oct 6						30	Apr 21	1946
ANNUAL SEVEN-DAY MINIMUM	51	Aug 21	60	Oct 2						40	Aug 28	1964
INSTANTANEOUS PEAK FLOW			209	Jun 21						274	Jun 2	1943
INSTANTANEOUS PEAK STAGE			2.54	Jun 21						3.00	Jun 2	1943
INSTANTANEOUS LOW FLOW			47	Mar 18						28	Apr 21	1946
ANNUAL RUNOFF (CFSM)	.73		.79							.70		
ANNUAL RUNOFF (INCHES)	9.88		10.78							9.45		
10 PERCENT EXCEEDS	107		115							105		
50 PERCENT EXCEEDS	75		82							71		
90 PERCENT EXCEEDS	57		67							54		

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

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 current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,070 ft above sea level, from topographic map. Apr. 19, 1951 to Nov. 14, 1966, nonrecording gage at same site and datum.

REMARKS.--Records excellent except for estimated daily discharges, which are fair. Occasional regulation by dams upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	183	221	391	279	e180	166	450	451	296	289	132	403
2	174	283	374	e274	e198	167	396	452	284	278	130	384
3	167	344	362	e268	e198	169	356	451	278	268	130	374
4	163	371	349	280	192	170	317	452	282	260	135	343
5	164	383	333	304	193	171	298	491	260	251	133	301
6	159	382	305	296	e183	172	297	491	256	249	135	269
7	159	361	308	290	e190	173	305	484	260	241	139	249
8	164	339	311	e276	190	173	304	474	293	236	138	242
9	203	327	e285	e274	e175	173	310	434	366	233	134	234
10	218	333	304	e260	e180	e166	316	393	373	232	131	261
11	224	344	297	e236	181	e147	314	368	368	221	147	272
12	222	360	294	230	182	e140	308	352	344	214	143	270
13	216	393	290	227	182	e134	296	330	309	210	141	266
14	210	398	283	e218	180	e143	276	318	281	204	136	287
15	207	391	287	224	178	e156	291	314	259	198	135	299
16	274	372	313	223	178	e154	355	306	241	191	170	293
17	293	355	337	224	e171	e136	368	295	235	184	190	294
18	300	338	327	e210	e166	e140	370	287	242	181	187	286
19	312	314	331	e218	e171	156	366	286	259	188	175	268
20	310	315	315	e218	e166	158	429	277	331	185	159	257
21	300	348	276	217	e164	159	477	268	356	178	148	244
22	297	375	277	215	e161	157	489	255	369	165	142	237
23	292	425	271	216	e154	162	481	242	369	152	144	234
24	286	439	252	219	e154	166	455	262	342	144	195	226
25	279	439	242	e208	e145	191	448	261	330	142	209	221
26	268	451	231	e208	e147	240	444	261	341	145	203	222
27	256	455	e225	220	e147	288	435	261	335	145	212	220
28	249	443	e233	210	e154	356	429	261	341	148	208	232
29	242	430	234	e195	---	437	423	253	332	141	198	234
30	233	410	254	e195	---	489	442	248	309	138	222	230
31	226	---	278	205	---	480	---	284	---	135	501	---
TOTAL	7250	11139	9169	7337	4860	6289	11245	10562	9221	6146	5302	8152
MEAN	234	371	296	237	174	203	375	341	307	198	171	272
MAX	312	455	391	304	198	489	489	491	373	289	501	403
MIN	159	221	225	195	145	134	276	242	235	135	130	220
CFSM	.58	.93	.74	.59	.43	.51	.93	.85	.77	.49	.43	.68
IN.	.67	1.03	.85	.68	.45	.58	1.04	.98	.86	.57	.49	.76

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1967 - 1993, BY WATER YEAR (WY)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	216	243	241	200	185	262	406	287	212	166	146	177															
MAX	456	444	373	275	251	508	596	398	307	251	174	379															
(WY)	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MIN	120	163	148	132	141	159	209	152	124	107	119	119															
(WY)	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1967 - 1993
ANNUAL TOTAL	95703	96672	
ANNUAL MEAN	261	265	228
HIGHEST ANNUAL MEAN			280
LOWEST ANNUAL MEAN			158
HIGHEST DAILY MEAN	811	501	1110
LOWEST DAILY MEAN	125	130	100
ANNUAL SEVEN-DAY MINIMUM	129	133	102
INSTANTANEOUS PEAK FLOW		652	1120
INSTANTANEOUS PEAK STAGE		6.11	(a)7.75
INSTANTANEOUS LOW FLOW		127	(b)78
ANNUAL RUNOFF (CFSM)	.65	.66	.57
ANNUAL RUNOFF (INCHES)	8.88	8.97	7.74
10 PERCENT EXCEEDS	388	394	360
50 PERCENT EXCEEDS	228	259	200
90 PERCENT EXCEEDS	141	153	135

(a) Backwater from ice.

(b) Result of freezeup.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

445512084415301 OTSEGO LAKE NEAR GAYLORD, MI

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.

DRAINAGE AREA.--Not determined.

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 sea level (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 sea level.

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, 3.89 ft, Apr. 20, May 5, 6; minimum, 2.60 ft, Oct. 8.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.69	2.81	3.27	3.46	3.59	3.59	3.57	3.83	3.69	3.61	3.38	3.22
2	2.69	2.87	3.28	3.46	3.58	3.59	3.58	3.81	3.68	3.60	3.37	3.20
3	2.70	2.91	3.28	3.47	3.58	3.58	3.58	3.82	3.67	3.60	3.36	3.21
4	2.69	2.95	3.28	3.50	3.57	3.58	3.58	3.84	3.66	3.57	3.35	3.18
5	2.67	2.96	3.31	3.52	3.56	3.58	3.58	3.87	3.65	3.54	3.33	3.17
6	2.66	2.98	3.31	3.52	3.57	3.57	3.58	3.88	3.63	3.59	3.33	3.16
7	2.65	2.97	3.31	3.52	3.57	3.57	3.57	3.86	3.63	3.59	3.34	3.14
8	2.64	2.96	3.31	3.52	3.57	3.57	3.59	3.85	3.65	3.58	3.32	3.13
9	2.68	2.97	3.31	3.52	3.56	3.57	3.64	3.84	3.68	3.57	3.30	3.12
10	2.70	2.97	3.33	3.52	3.56	3.57	3.65	3.83	3.69	3.57	3.30	3.19
11	2.72	2.99	3.34	3.52	3.56	3.57	3.65	3.83	3.68	3.55	3.30	3.20
12	2.72	3.01	3.33	3.51	3.56	3.57	3.65	3.82	3.66	3.54	3.29	3.17
13	2.70	3.08	3.33	3.54	3.56	3.57	3.64	3.78	3.63	3.51	3.29	3.17
14	2.71	3.12	3.33	3.55	3.55	3.56	3.65	3.75	3.63	3.50	3.27	3.36
15	2.72	3.13	3.33	3.55	3.55	3.56	3.69	3.76	3.63	3.48	3.26	3.42
16	2.78	3.13	3.34	3.54	3.55	3.56	3.74	3.74	3.59	3.46	3.27	3.39
17	2.80	3.15	3.35	3.55	3.55	3.57	3.74	3.72	3.58	3.44	3.26	3.38
18	2.82	3.14	3.36	3.55	3.56	3.57	3.73	3.70	3.65	3.46	3.25	3.38
19	2.82	3.14	3.36	3.54	3.56	3.57	3.73	3.71	3.67	3.55	3.23	3.37
20	2.82	3.15	3.36	3.54	3.56	3.57	3.83	3.68	3.79	3.54	3.24	3.35
21	2.85	3.17	3.36	3.55	3.57	3.57	3.82	3.66	3.81	3.52	3.21	3.36
22	2.83	3.19	3.36	3.56	3.60	3.57	3.81	3.65	3.80	3.50	3.18	3.35
23	2.84	3.24	3.36	3.56	3.61	3.56	3.80	3.64	3.77	3.47	3.19	3.37
24	2.86	3.25	3.38	3.56	3.60	3.56	3.79	3.68	3.74	3.44	3.23	3.35
25	2.84	3.25	3.40	3.57	3.60	3.55	3.82	3.69	3.73	3.43	3.22	3.34
26	2.85	3.27	3.42	3.57	3.60	3.55	3.81	3.68	3.71	3.43	3.21	3.34
27	2.83	3.28	3.43	3.58	3.60	3.55	3.77	3.66	3.71	3.43	3.21	3.34
28	2.83	3.28	3.42	3.58	3.60	3.55	3.78	3.68	3.69	3.42	3.20	3.35
29	2.84	3.28	3.44	3.58	---	3.56	3.81	3.67	3.67	3.43	3.18	3.36
30	2.82	3.28	3.45	3.58	---	3.56	3.83	3.66	3.64	3.42	3.16	3.33
31	2.81	---	3.46	3.59	---	3.56	---	3.72	---	3.39	3.24	---
MEAN	2.76	3.10	3.35	3.54	3.57	3.57	3.70	3.75	3.68	3.51	3.27	3.28
MAX	2.86	3.28	3.46	3.59	3.61	3.59	3.83	3.88	3.81	3.61	3.38	3.42
MIN	2.64	2.81	3.27	3.46	3.55	3.55	3.57	3.64	3.58	3.39	3.16	3.12



## STREAMS TRIBUTARY TO LAKE HURON

## 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 sea level.

REMARKS.--Records good. Flow regulated by Mio Dam 500 ft upstream. Several measurements of water temperature were made during the year.

## DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

## DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	903	910	1310	1170	1030	941	1590	1560	1290	1170	817	2060
2	832	1080	1330	1020	848	956	1440	1500	1260	1120	843	1410
3	799	1560	1320	1170	972	956	1240	1490	1210	1110	827	1200
4	799	1620	1280	1340	1020	954	1190	1500	1100	1040	788	1140
5	780	1550	1240	1290	899	908	1210	1670	1120	1020	774	1090
6	770	1420	1200	1280	895	872	1190	1840	1130	1050	815	1020
7	774	1240	1150	1210	851	927	1280	1700	1120	1060	836	968
8	778	1230	1170	1100	903	913	1310	1560	1230	1060	835	924
9	854	1220	1180	879	911	887	1310	1480	1430	1040	824	936
10	962	1200	1160	1010	948	887	1480	1370	1540	990	804	1050
11	981	1260	1160	1030	918	892	1370	1250	1390	960	793	1210
12	990	1290	1140	1040	904	827	1290	1210	1240	942	825	1250
13	965	1450	1130	1130	906	861	1260	1160	1160	936	830	1130
14	886	1470	1140	1020	905	755	1200	1110	1120	941	799	1150
15	883	1310	1120	999	905	832	1270	1240	1090	923	788	1250
16	1230	1310	1170	1020	905	1020	1650	1160	1020	875	842	1220
17	1330	1320	1380	1050	856	920	1780	1110	998	849	883	1180
18	1230	1210	1350	925	690	806	1530	1130	1530	859	888	1130
19	1100	1150	1280	844	685	852	1430	1150	1720	1090	872	1070
20	1170	1150	1210	1010	846	875	1640	1140	2450	1150	837	1050
21	1130	1260	1100	1150	942	875	1800	1100	2270	1060	816	1010
22	1110	1500	1100	1090	817	876	1820	1090	1820	974	805	968
23	1170	1790	1120	1030	791	933	1720	1080	1620	858	796	967
24	1110	1760	1050	977	844	932	1630	1190	1410	838	886	985
25	1050	1570	935	977	811	985	1630	1230	1440	851	905	952
26	1020	1590	888	861	844	1220	1620	1140	1650	847	865	939
27	997	1660	835	957	876	1310	1500	1130	1410	856	972	941
28	980	1580	992	1040	913	1480	1450	1160	1270	883	1050	1020
29	967	1530	1260	957	---	1640	1550	1170	1240	848	918	1080
30	844	1360	1330	860	---	1720	1630	1120	1210	778	969	967
31	917	---	1220	995	---	1750	---	1290	---	799	2310	---
TOTAL	30411	41550	36250	32431	24635	31562	44010	40030	41488	29777	27812	33247
MEAN	981	1385	1169	1046	880	1018	1467	1291	1383	961	897	1108
MAX	1330	1790	1380	1340	1030	1750	1820	1840	2450	1170	2310	2060
MIN	770	910	835	844	685	755	1190	1080	998	778	774	924
CFSM	.89	1.26	1.06	.95	.80	.93	1.33	1.17	1.26	.87	.82	1.01
IN.	1.08	1.41	1.23	1.10	.83	1.07	1.49	1.35	1.40	1.01	.94	1.12

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1993, BY WATER YEAR (WY)

	MEAN	950	1001	976	897	881	1096	1474	1166	1000	867	825	885
MAX	1779	1430	1303	1321	1152	1813	2241	1636	1422	1131	1016	1575	1575
(WY)	1987	1992	1967	1973	1973	1976	1971	1983	1954	1969	1975	1986	1986
MIN	685	738	711	697	660	733	977	723	683	655	578	661	661
(WY)	1965	1964	1964	1965	1958	1956	1958	1958	1958	1958	1958	1958	1958

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

ANNUAL TOTAL	399574
ANNUAL MEAN	1092
HIGHEST ANNUAL MEAN	
LOWEST ANNUAL MEAN	
HIGHEST DAILY MEAN	3270
LOWEST DAILY MEAN	727
ANNUAL SEVEN-DAY MINIMUM	748
INSTANTANEOUS PEAK FLOW	
INSTANTANEOUS PEAK STAGE	
INSTANTANEOUS LOW FLOW	
ANNUAL RUNOFF (CFSM)	.99
ANNUAL RUNOFF (INCHES)	13.51
10 PERCENT EXCEEDS	1440
50 PERCENT EXCEEDS	1010
90 PERCENT EXCEEDS	779

## FOR 1993 WATER YEAR

413203	
1132	
2450	Jun 20
685	Feb 19
790	Oct 2
2600	Jan 4
4.93	Jan 4
431	Sep 23
1.03	
13.97	
1550	
1090	
837	

## WATER YEARS 1952 - 1993

1001	
1213	1986
746	1958
4110	Mar 28 1976
21	Aug 9 1977
420	Aug 8 1977
4380	Sep 30 1988
6.16	Sep 30 1986
7.0	Aug 4 1977
.91	
12.37	
1360	
928	
717	

## 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 sea level.

REMARKS.--Water-discharge records good. Flow regulated by Foote Dam 0.6 mi upstream.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1410	2060	1900	1800	1440	1420	2130	2210	1790	1710	1190	2780
2	1390	2270	1860	1610	1070	1600	2060	2110	2000	1660	1480	2090
3	1300	1640	1740	1330	1530	1490	1970	2090	1870	1630	1500	1890
4	1060	1210	1710	1820	1520	1460	1740	2100	1700	1560	1130	1690
5	1110	1140	1760	2090	1310	1300	1360	2170	1700	1460	1080	1600
6	1160	1470	1720	2020	1200	1200	1530	2330	1530	1500	1150	1510
7	1200	1940	1610	1760	1100	1340	1940	2220	1600	1460	1190	1250
8	1200	1780	1680	1630	1380	1410	1870	2080	1820	1440	1430	1360
9	1580	1740	1630	1170	1250	1280	1920	1930	1880	1540	1490	1240
10	1750	1830	1540	1630	1480	1200	2020	1940	2040	1490	1350	1390
11	1650	1740	1680	1580	1360	1240	2040	1890	1970	1250	1020	1650
12	1370	1840	1720	1430	1300	1170	2040	1750	1880	1120	1010	1610
13	1170	2160	1660	1680	1450	1470	1820	1210	1770	1340	1410	1730
14	1220	2140	1640	1400	1350	1170	1590	1520	1520	1490	1290	1730
15	1480	1960	1550	1530	1210	1020	1770	1690	1470	1530	1080	1780
16	2120	2010	1680	1420	1180	1500	2110	1540	1460	1250	1490	1710
17	1990	1970	1820	1520	1210	1520	2200	1520	1460	1080	1600	1660
18	1630	1800	1740	1310	926	1330	2190	1540	1950	1350	1250	1680
19	1800	1670	1970	1040	998	1260	1960	1500	2360	1850	1090	1630
20	1900	1500	1800	1170	1190	1390	2670	1480	2890	1670	1090	1380
21	1830	1760	1580	1690	1350	1500	2660	1450	3360	1530	1090	1230
22	1810	1910	1640	1820	1340	1480	2670	1450	2680	1510	1160	1190
23	1770	2110	1610	1710	1160	1460	2500	1560	2470	1380	1410	1350
24	2640	2810	1510	1700	1060	1440	2190	1810	1990	1340	1610	1380
25	3270	2600	1170	1350	1060	1460	2470	1750	1930	1190	1460	1220
26	1910	2330	1120	961	1420	1810	2320	1610	2330	1120	1340	1460
27	1170	2310	1180	1350	1500	1980	1840	1580	2020	1160	1340	1630
28	872	2310	1630	1640	1270	2020	1860	1590	1800	1030	1560	1730
29	599	2170	1740	1420	---	2270	2160	1680	1680	1090	1380	1850
30	1240	1990	1820	1270	---	2670	2320	1710	1630	1070	1470	1330
31	1880	---	1810	1460	---	2660	---	1800	---	1110	2570	---
TOTAL	48481	58170	51220	47311	35614	47520	61920	54810	58550	42910	41710	47730
MEAN	1564	1939	1652	1526	1272	1533	2064	1768	1952	1384	1345	1591
MAX	3270	2810	1970	2090	1530	2670	2670	2330	3360	1850	2570	2780
MIN	599	1140	1120	961	926	1020	1360	1210	1460	1030	1010	1190
CFSM	1.02	1.26	1.07	.99	.83	1.00	1.34	1.15	1.27	.90	.87	1.03
IN.	1.17	1.41	1.24	1.14	.86	1.15	1.50	1.32	1.41	1.04	1.01	1.15

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1987 - 1993, BY WATER YEAR (WY)

	1987	1988	1989	1990	1991	1992	1993
MEAN	1437	1656	1539	1412	1304	1772	2146
MAX	1770	1944	1870	1527	1380	2097	2441
(WY)	1992	1992	1992	1992	1992	1990	1992
MIN	1152	1100	1132	1259	1224	1533	1684
(WY)	1990	1990	1990	1991	1989	1993	1990

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1987 - 1993

ANNUAL TOTAL	586448	595946	1509
ANNUAL MEAN	1602	1633	1639
HIGHEST ANNUAL MEAN			1397
LOWEST ANNUAL MEAN			1990
HIGHEST DAILY MEAN	3930	3360	5430
LOWEST DAILY MEAN	599	599	460
ANNUAL SEVEN-DAY MINIMUM	1110	1110	656
INSTANTANEOUS PEAK FLOW		3480	5850
INSTANTANEOUS PEAK STAGE		12.99	16.27
INSTANTANEOUS LOW FLOW		135	135
ANNUAL RUNOFF (CFSM)	1.04	1.06	.98
ANNUAL RUNOFF (INCHES)	14.17	14.40	13.32
10 PERCENT EXCEEDS	2100	2150	2060
50 PERCENT EXCEEDS	1520	1590	1400
90 PERCENT EXCEEDS	1160	1170	1040

## STREAMS TRIBUTARY TO LAKE HURON

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.--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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00085)	PH WATER WHOLE FIELD (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 04...	1145	1200	315	8.1	7.0	1.0	9.8	84	<1	K2
JAN 28...	1000	1650	302	8.1	0.0	1.5	13.6	96	K4	<1
MAR 24...	1145	1390	344	8.0	1.0	1.3	13.2	95	<1	<1
APR 28...	1030	1990	269	8.3	8.0	1.3	11.0	95	K2	<1
AUG 13...	1010	1400	--	8.0	23.5	0.30	8.3	--	K17	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 (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 04...	160	8	44	11	4.7	0.70	180	--	148	8.8
JAN 28...	150	4	44	10	4.7	0.60	179	--	147	9.6
MAR 24...	160	8	47	11	4.8	0.50	188	--	154	9.6
APR 28...	140	9	40	8.9	3.8	0.70	148	4	127	7.5
AUG 13...	150	13	44	10	4.6	0.40	168	--	138	--
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) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)
NOV 04...	6.1	<0.10	8.5	171	0.23	554	0.010	0.050	0.020	<0.20
JAN 28...	6.0	<0.10	8.6	173	0.24	771	0.020	0.120	0.020	<0.20
MAR 24...	5.8	<0.10	9.4	185	0.25	694	0.030	0.220	0.070	<0.30
APR 28...	4.9	0.10	6.7	162	0.22	870	<0.010	<0.050	0.020	0.20
AUG 13...	5.2	0.10	9.0	183	--	--	<0.010	0.140	0.030	0.30

## STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01066)
NOV 04...	0.020	<0.010	<0.010	<10	21	<3	10	<4	<1
JAN 28...	<0.010	<0.010	<0.010	20	18	<3	34	<4	12
MAR 24...	0.050	0.010	<0.010	--	--	--	--	--	--
APR 28...	0.010	<0.010	0.010	10	17	<3	11	<4	<1
AUG 13...	<0.010	<0.010	<0.010	<10	25	<3	5	<4	<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)	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 04...	<10	<1	<1	<1.0	73	<6	2	6.5	76
JAN 28...	<10	2	<1	<1.0	67	<6	3	13	61
MAR 24...	--	--	--	--	--	--	8	30	--
APR 28...	<10	<1	<1	<1.0	59	<6	5	27	81
AUG 13...	<10	<1	<1	<1.0	70	<6	5	19	69



## STREAMS TRIBUTARY TO LAKE HURON

## 04142000 RIFLE RIVER NEAR STERLING, MI

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.

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 sea level. 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	244	247	530	e500	e260	e190	911	750	609	273	151	241
2	233	614	486	441	e250	e195	690	607	431	256	150	197
3	225	1560	454	428	e250	e200	588	533	345	254	152	193
4	217	1420	425	656	e250	e210	527	553	308	245	177	190
5	208	1070	398	909	e250	e230	650	730	352	227	181	178
6	201	820	e350	669	e250	e250	720	742	426	222	175	180
7	216	642	e330	533	e250	e260	736	581	367	217	200	186
8	226	530	e310	433	e240	e280	710	475	746	209	182	181
9	380	499	e300	378	e240	e320	786	423	1250	204	164	179
10	460	555	e290	e330	e230	e400	889	385	877	198	161	193
11	345	623	e290	e320	e230	e300	738	356	601	200	164	206
12	301	739	e290	e310	e230	e260	626	331	417	228	168	184
13	262	1250	e290	e300	e220	e220	565	303	312	206	155	178
14	250	1120	e320	e300	e220	e200	505	292	293	203	154	203
15	256	801	384	e290	e210	e185	533	301	315	211	158	317
16	774	624	538	e290	e210	e200	807	296	280	188	227	261
17	955	552	747	e280	e210	e300	746	288	264	178	276	213
18	671	513	619	e280	e210	e270	578	274	360	177	196	195
19	492	460	502	e280	e200	e250	498	283	506	221	174	187
20	429	445	432	e280	e200	e240	1190	283	918	223	172	179
21	455	595	343	e280	e200	e230	1670	272	1070	188	162	180
22	520	865	e310	e290	e195	e240	1300	256	916	179	156	184
23	529	1450	e290	e300	e190	e260	874	262	612	175	173	185
24	483	1510	e270	e290	e190	e300	729	423	467	168	279	177
25	404	1210	e250	e280	e190	e400	880	429	434	174	300	172
26	359	1040	e230	e270	e190	e700	756	339	673	181	206	182
27	335	970	e220	e270	e190	e1000	631	293	556	177	201	195
28	310	800	e210	e270	e190	1750	600	309	391	167	276	249
29	297	661	e220	e270	---	1750	632	301	306	160	232	228
30	276	586	e300	e260	---	1490	759	277	279	158	199	206
31	253	---	e680	e260	---	1270	---	521	---	154	226	---
TOTAL	11566	24771	11608	11247	6145	14350	22824	12468	15681	6221	5947	5999
MEAN	373	826	374	363	219	463	761	402	523	201	192	200
MAX	955	1560	747	909	260	1750	1670	750	1250	273	300	317
MIN	201	247	210	260	190	185	498	256	264	154	150	172
CFSM	1.17	2.58	1.17	1.13	.69	1.45	2.38	1.26	1.63	.63	.80	.62
IN.	1.34	2.88	1.35	1.31	.71	1.67	2.65	1.45	1.82	.72	.69	.70

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1937 - 1993, BY WATER YEAR (WY)

	MEAN	242	294	290	249	277	566	650	396	287	193	177	207
MAX	741	826	579	538	741	1035	1160	859	842	335	282	712	
(WY)	1987	1993	1992	1973	1938	1991	1959	1983	1945	1969	1956	1986	
MIN	142	180	156	152	150	206	262	175	124	126	122	124	
(WY)	1964	1964	1964	1956	1956	1964	1945	1977	1964	1966	1964	1948	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1937 - 1993

ANNUAL TOTAL	155309	148827	(a)320
ANNUAL MEAN	424	408	501
HIGHEST ANNUAL MEAN			1991
LOWEST ANNUAL MEAN			166
HIGHEST DAILY MEAN	2330	1750	4500
LOWEST DAILY MEAN	165	150	98
ANNUAL SEVEN-DAY MINIMUM	174	156	105
INSTANTANEOUS PEAK FLOW		1880	(b)5340
INSTANTANEOUS PEAK STAGE		(c)7.37	13.74
INSTANTANEOUS LOW FLOW		148	(d)75
ANNUAL RUNOFF (CFSM)	1.33	1.27	1.00
ANNUAL RUNOFF (INCHES)	18.05	17.30	13.58
10 PERCENT EXCEEDS	800	765	565
50 PERCENT EXCEEDS	290	290	230
90 PERCENT EXCEEDS	190	181	150

(a) Does not include water year 1937.

(b) From rating curve extended above 3,800 ft<sup>3</sup>/s.

(c) Backwater from ice.

(d) Result of freezeup.

(e) Estimated.

## 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-87-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 844.96 ft above sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Flow regulated by dam at Linden since 1967. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	142	67	118	82	91	e60	184	130	44	88	36	59
2	96	78	117	e80	e88	60	227	124	43	81	31	63
3	100	82	104	e86	84	60	253	120	43	76	27	73
4	106	81	97	112	79	62	224	118	44	73	22	76
5	99	77	86	137	78	68	220	120	50	71	22	75
6	92	74	82	150	76	65	205	120	55	66	22	74
7	81	67	91	160	e72	66	200	114	58	59	22	72
8	68	67	90	168	69	69	189	110	63	54	22	71
9	67	69	78	e175	63	79	180	107	80	51	22	71
10	64	76	81	e180	61	80	170	104	86	47	22	71
11	64	79	81	e175	64	79	169	94	87	43	22	70
12	67	89	76	166	64	88	167	45	87	42	22	66
13	69	110	66	159	64	93	159	22	86	37	21	61
14	69	130	62	150	64	e92	124	21	77	38	21	57
15	68	141	66	146	64	91	127	35	90	38	20	68
16	77	142	72	135	64	87	136	48	97	33	20	75
17	84	149	87	123	64	79	140	49	87	27	20	74
18	75	143	85	e117	e64	80	144	49	45	22	19	72
19	69	139	84	e112	e64	80	146	50	71	20	19	69
20	68	150	82	e106	e63	80	165	49	93	20	26	66
21	80	152	80	102	61	80	161	49	95	20	30	66
22	91	111	78	104	60	81	173	48	109	20	30	66
23	95	117	75	112	e61	84	180	48	110	19	37	68
24	94	125	75	109	e63	88	184	49	109	19	49	73
25	93	120	e71	e108	e65	89	182	48	111	24	51	72
26	91	122	e67	e108	e64	95	173	47	116	30	52	68
27	78	121	e63	e107	e62	103	163	45	119	31	52	70
28	70	125	e65	107	e61	111	153	45	113	41	52	90
29	68	122	72	e104	---	122	141	44	105	46	54	104
30	67	120	74	e100	---	139	138	43	97	45	59	107
31	67	---	82	96	---	155	---	44	---	38	59	---
TOTAL	2519	3245	2507	3876	1897	2665	5177	2139	2470	1319	983	2167
MEAN	81.3	108	80.9	125	67.7	86.0	173	69.0	82.3	42.5	31.7	72.2
MAX	142	152	118	180	91	155	253	130	119	88	59	107
MIN	64	67	62	80	60	60	124	21	43	19	19	57
CFSM	.97	1.29	.97	1.49	.81	1.03	2.06	.82	.98	.51	.38	.86
IN.	1.12	1.44	1.11	1.72	.84	1.18	2.30	.95	1.10	.59	.44	.96

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1968 - 1993, BY WATER YEAR (WY)

	MEAN	48.3	62.3	68.5	65.1	66.2	109	120	69.8	48.6	33.8	24.4	36.6
MAX	158	118	121	135	140	208	234	149	117	66.5	77.6	144	144
(WY)	1982	1989	1976	1973	1976	1976	1975	1974	1989	1989	1992	1975	1975
MIN	16.1	23.1	39.7	26.4	24.8	55.8	76.2	28.9	12.0	7.70	3.28	5.91	5.91
(WY)	1979	1979	1970	1984	1980	1969	1968	1977	1971	1988	1971	1969	1969

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1968 - 1993

ANNUAL TOTAL	28793		30964										
ANNUAL MEAN	78.7		84.8										
HIGHEST ANNUAL MEAN													
LOWEST ANNUAL MEAN													
HIGHEST DAILY MEAN	248		253		Apr 28								
LOWEST DAILY MEAN	21		19		May 17								
ANNUAL SEVEN-DAY MINIMUM	23		20		Jun 29								
INSTANTANEOUS PEAK FLOW			282										
INSTANTANEOUS PEAK STAGE			6.46										
INSTANTANEOUS LOW FLOW			19										
ANNUAL RUNOFF (CFSM)	.94		1.01										
ANNUAL RUNOFF (INCHES)	12.80		13.76										
10 PERCENT EXCEEDS	123		146										
50 PERCENT EXCEEDS	75		77										
90 PERCENT EXCEEDS	38		36										

(a) July 22, 23, 24, 25, Aug. 17, 18, 19.

(b) May 22, 23, 1971.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

## 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. 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 sea level. Prior to Oct. 15, 1933, at site 1.5 mi upstream at datum 5.46 ft higher.

REMARKS.--Records good. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	502	345	715	1260	600	348	1820	920	232	539	187	284
2	459	642	679	914	491	366	2020	819	236	492	169	249
3	418	1000	655	1020	475	381	1910	751	243	417	157	243
4	370	791	599	1870	536	446	1750	701	239	371	152	260
5	333	751	514	2330	543	449	1680	829	255	333	148	319
6	283	783	478	1930	520	450	1550	921	274	281	152	348
7	279	742	479	1690	423	496	1350	953	357	254	142	317
8	292	665	421	1630	e400	668	1220	999	433	239	137	285
9	393	617	392	1540	391	829	1130	953	550	230	133	272
10	519	603	399	1310	416	831	1070	771	667	232	162	276
11	460	572	411	1070	392	712	1030	615	649	237	136	238
12	465	914	427	1060	397	637	1000	536	658	252	131	262
13	404	1730	444	1020	405	574	889	476	586	229	141	236
14	352	1420	473	879	396	427	825	425	480	230	127	267
15	515	1220	484	786	385	423	794	364	401	226	151	434
16	810	1240	570	793	375	539	781	321	369	229	124	455
17	795	1310	568	751	363	786	785	307	346	222	112	450
18	724	1280	547	e600	276	664	770	293	326	212	107	457
19	717	1210	539	e415	281	626	825	305	380	201	161	403
20	695	1040	519	e470	e300	557	2700	304	606	191	198	335
21	678	852	459	612	e310	536	2570	306	762	190	155	341
22	611	795	446	980	328	675	2070	301	966	175	196	392
23	548	1490	410	1170	305	1050	1930	292	1080	168	197	428
24	503	1380	327	1230	310	1340	1850	296	1120	148	212	430
25	468	1130	e255	1210	290	1450	1690	286	1150	208	204	405
26	441	1100	e240	1020	328	1540	1430	283	1090	217	203	522
27	414	1110	257	955	358	1570	1250	279	852	240	189	581
28	391	1070	350	827	347	1630	1050	283	717	276	173	963
29	383	942	417	617	---	1680	858	271	631	229	180	894
30	368	806	650	535	---	1680	983	255	548	210	186	800
31	350	---	1490	554	---	1650	---	239	---	191	279	---
TOTAL	14940	29550	15614	33048	10939	26010	41580	15654	17203	7869	5101	12146
MEAN	482	985	504	1066	391	839	1386	505	573	254	165	405
MAX	810	1730	1490	2330	600	1680	2700	999	1150	539	279	963
MIN	279	345	240	415	276	348	770	239	232	148	107	236
CFSM	.90	1.83	.94	1.98	.73	1.56	2.58	.94	1.07	.47	.31	.75
IN.	1.03	2.04	1.08	2.29	.76	1.80	2.88	1.08	1.19	.54	.35	.84

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	190	252	314	345	445	761	728	451	270	156	116	145
MEAN	190	252	314	345	445	761	728	451	270	156	116	145
MAX	1442	985	922	1066	1728	1682	2060	1950	1051	816	578	922
(WY)	1982	1993	1976	1993	1938	1948	1947	1956	1989	1957	1992	1975
MIN	32.6	52.1	56.6	66.9	65.5	119	162	119	34.0	24.0	13.2	25.0
(WY)	1964	1964	1964	1940	1940	1964	1931	1958	1934	1934	1931	1931

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1931 - 1993
ANNUAL TOTAL	196669	229654	350
ANNUAL MEAN	537	629	629
HIGHEST ANNUAL MEAN			97.7
LOWEST ANNUAL MEAN			1993
HIGHEST DAILY MEAN	2450	2700	5920
LOWEST DAILY MEAN	99	107	2.0
ANNUAL SEVEN-DAY MINIMUM	109	128	7.7
INSTANTANEOUS PEAK FLOW		3110	6240
INSTANTANEOUS PEAK STAGE		7.93	10.35
INSTANTANEOUS LOW FLOW		103	.20
ANNUAL RUNOFF (CFSM)	1.00	1.17	.65
ANNUAL RUNOFF (INCHES)	13.60	15.88	8.83
10 PERCENT EXCEEDS	976	1270	787
50 PERCENT EXCEEDS	466	470	195
90 PERCENT EXCEEDS	195	206	63

(e) Estimated.

## 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 sea level. Prior to Aug. 22, 1968, nonrecording gage at same site and datum. Prior to Oct. 1, 1970, at datum 2.00 ft higher.

REMARKS.--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.

## DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

## DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	634	411	983	e1600	e750	e450	2190	1210	265	697	204	320
2	575	573	902	e1200	e620	e475	2470	1100	256	674	199	306
3	527	1380	855	e1300	e600	e500	2520	1040	262	613	185	285
4	508	1170	816	e2400	e680	e560	2390	956	267	540	177	279
5	460	973	733	3340	e670	e570	2350	1310	278	486	172	297
6	415	971	609	2740	e640	e580	2060	1280	284	402	170	352
7	342	955	616	2190	e550	e650	1790	1220	320	351	175	374
8	327	882	568	1990	e510	e850	1570	1240	467	327	168	338
9	403	783	516	1880	e500	e1050	1480	1230	540	310	162	312
10	523	749	489	e1600	e500	e1000	1430	1090	695	279	169	305
11	562	727	508	e1400	e500	e900	1330	864	748	275	192	310
12	529	897	521	e1300	e500	e800	1460	702	731	282	164	272
13	519	2390	542	e1200	e490	e700	1260	617	727	289	156	306
14	450	2050	579	e1100	e490	e550	1120	555	611	265	162	282
15	504	1560	612	e1000	e480	e520	1080	503	522	268	156	451
16	972	1430	708	e970	e460	e700	1050	402	435	259	176	570
17	1230	1500	775	e900	e430	e980	1070	364	399	258	158	532
18	e900	1510	700	e850	e350	e850	1030	356	371	249	148	523
19	e870	1470	678	e500	e370	e750	1030	362	354	253	143	517
20	e850	1350	665	e600	e380	e700	3170	363	755	233	210	460
21	e820	1160	602	e850	e390	e680	3730	353	882	217	228	424
22	e740	998	597	e1300	e400	e900	2850	358	1070	212	188	437
23	e680	2330	536	e1500	e390	e1300	2440	345	1160	201	242	500
24	e610	2150	e420	e1550	e380	e1700	2320	342	1250	195	256	517
25	e570	1630	e330	e1450	e370	e1800	2240	337	1300	189	246	514
26	e560	1450	e300	e1300	e410	e1900	1860	320	1390	241	234	556
27	e530	1410	e250	e1150	e450	e2000	1610	311	1220	231	228	705
28	e490	1360	e450	e1000	e440	e2050	1430	317	995	287	219	936
29	e465	1260	e550	e750	---	e2100	1210	311	878	275	204	1200
30	448	1110	e850	e680	---	e2100	1180	290	769	235	231	1030
31	427	---	e1900	e720	---	e2100	---	285	---	215	238	---
TOTAL	18435	38589	20160	42110	13700	32765	54720	20333	20201	9808	5960	14210
MEAN	595	1286	650	1358	489	1057	1824	656	673	316	192	474
MAX	1230	2390	1900	3340	750	2100	3730	1310	1390	697	256	1200
MIN	327	411	250	500	350	450	1030	285	256	189	143	272
CFSM	.93	2.02	1.02	2.13	.77	1.66	2.86	1.03	1.06	.50	.30	.74
IN.	1.08	2.25	1.18	2.46	.80	1.91	3.20	1.19	1.18	.57	.35	.83

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1940 - 1993, BY WATER YEAR (WY)

	MEAN	230	320	396	431	541	992	941	595	337	204	143	174
MAX	1921	1286	1274	1358	1843	2047	2564	2532	1212	1079	669	1271	1271
(WY)	1982	1993	1976	1993	1976	1976	1947	1958	1989	1957	1992	1975	1975
MIN	40.6	58.9	62.9	80.5	76.4	140	253	155	86.1	42.1	42.2	42.1	42.1
(WY)	1965	1965	1964	1940	1940	1964	1946	1958	1941	1965	1964	1964	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1940 - 1993

ANNUAL TOTAL	250907												
ANNUAL MEAN	686												
HIGHEST ANNUAL MEAN										(a)445			
LOWEST ANNUAL MEAN										797		1993	
HIGHEST DAILY MEAN										118		1964	
LOWEST DAILY MEAN										7290		Apr 6 1947	
ANNUAL SEVEN-DAY MINIMUM	2990				Apr 25		3730		Apr 21			Aug 8 1966	
INSTANTANEOUS PEAK FLOW	120				Jul 7		143		Aug 19			Aug 4 1966	
INSTANTANEOUS PEAK STAGE	135				Jul 1		157		Aug 13			Apr 6 1947	
ANNUAL RUNOFF (CFSM)							4050		Apr 21	(b)7500		Mar 29 1960	
ANNUAL RUNOFF (INCHES)							11.42		Apr 21	(c)15.44		Aug 8 1966	
10 PERCENT EXCEEDS							142		Aug 19	27			
50 PERCENT EXCEEDS							1.25			.70			
90 PERCENT EXCEEDS							16.99			9.49			
							1280			1030			
							588			235			
							250			78			

(a) Does not include water year 1940.

(b) Including overflow by-passing gage.

(c) Present datum.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE HURON

## 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-78-1: Drainage area.

GAGE.--Water-stage recorder. Concrete control since Oct. 12, 1938. Datum of gage is 805.79 ft above sea level. Prior to May 25, 1954, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges during the winter period, which are fair, and those for period of no gage-height record, Aug. 22 to Sept. 29, which are poor. Prior to 1941, occasional regulation caused by dam upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	39	62	e80	e55	e28	224	63	16	22	15	e12
2	35	45	58	e100	e50	29	212	60	18	21	12	e14
3	33	47	55	128	e45	32	203	58	18	20	9.9	e17
4	24	52	52	146	40	34	192	58	17	19	8.7	e20
5	20	55	49	150	38	35	173	62	19	17	7.6	e24
6	20	55	e46	158	36	35	153	62	22	15	6.5	e21
7	24	53	44	175	e36	38	142	62	25	14	6.6	e18
8	25	49	41	e165	35	42	132	58	29	12	6.4	e15
9	25	47	38	e140	e33	48	119	53	34	11	7.5	e14
10	26	45	37	e120	31	52	106	49	36	11	7.0	e13
11	39	43	37	e100	31	53	96	44	38	10	6.8	e13
12	45	53	37	82	30	53	93	40	35	9.2	6.2	e12
13	55	67	39	74	30	e48	88	36	29	8.2	6.1	e12
14	55	88	39	e70	30	e43	82	34	25	7.4	5.8	e13
15	55	113	41	67	29	e38	77	34	24	7.6	5.3	e17
16	52	123	42	65	29	40	79	32	22	7.6	5.1	e23
17	52	115	43	e62	e28	42	80	27	20	7.3	5.1	e30
18	54	99	44	e60	e28	41	83	15	17	6.9	5.1	e27
19	53	83	44	e57	27	e40	84	11	19	7.1	5.1	e25
20	50	73	44	e53	27	42	118	12	37	6.6	4.8	e23
21	49	67	e43	50	27	43	127	13	92	5.9	4.6	e21
22	46	64	41	56	26	46	151	15	145	4.8	e4.4	e20
23	46	73	39	60	26	54	127	16	154	3.8	e5.5	e19
24	45	75	e35	69	24	64	103	17	122	2.5	e6.2	e18
25	45	85	e33	e75	e29	80	96	16	82	2.1	e7.0	e17
26	52	89	e30	e73	e34	103	87	19	59	3.7	e6.5	e21
27	52	87	27	71	e30	132	72	18	47	5.0	e5.5	e27
28	48	81	26	66	e28	162	67	19	40	7.0	e6.0	e35
29	45	74	28	e61	---	198	68	19	34	11	e7.0	e45
30	43	67	41	e56	---	225	69	18	26	17	e8.5	50
31	41	---	63	e51	---	227	---	16	---	18	e10	---
TOTAL	1288	2106	1298	2740	912	2147	3503	1056	1301	320.7	213.8	636
MEAN	41.5	70.2	41.9	88.4	32.6	69.3	117	34.1	43.4	10.3	6.90	21.2
MAX	55	123	63	175	55	227	224	63	154	22	15	50
MIN	20	39	26	50	24	28	67	11	16	2.1	4.4	12
CFSM	.75	1.27	.76	1.60	.59	1.25	2.11	.62	.78	.19	.12	.38
IN.	.87	1.42	.87	1.84	.61	1.44	2.36	.71	.88	.22	.14	.43

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1933 - 1993, BY WATER YEAR (WY)

	MEAN	17.9	24.5	28.4	31.3	41.6	73.8	71.2	38.8	22.6	10.4	8.89	15.5
MAX	134	101	93.3	132	174	154	226	188	127	38.5	49.8	226	
(WY)	1987	1986	1951	1973	1938	1948	1947	1956	1943	1957	1937	1985	
MIN	2.36	3.84	3.99	3.58	5.62	14.2	19.2	7.49	2.12	1.60	1.48	.89	
(WY)	1939	1939	1964	1940	1940	1964	1946	1988	1988	1941	1944	1941	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1933 - 1993

ANNUAL TOTAL	16291.1	17521.5	(a)32.0
ANNUAL MEAN	44.5	48.0	71.7
HIGHEST ANNUAL MEAN			9.05
LOWEST ANNUAL MEAN			1985
HIGHEST DAILY MEAN	227	227	1300
LOWEST DAILY MEAN	3.0	2.1	26
ANNUAL SEVEN-DAY MINIMUM	4.2	4.0	.50
INSTANTANEOUS PEAK FLOW		231	1380
INSTANTANEOUS PEAK STAGE		17.22	(b)20.95
INSTANTANEOUS LOW FLOW		1.7	.14
ANNUAL RUNOFF (CFSM)	.80	.87	.58
ANNUAL RUNOFF (INCHES)	10.96	11.79	7.85
10 PERCENT EXCEEDS	76	100	73
50 PERCENT EXCEEDS	41	38	16
90 PERCENT EXCEEDS	14	7.5	3.8

- (a) Does not include water year 1933.  
 (b) From floodmark.  
 (c) Sept. 16, 18, 1970.  
 (e) Estimated.

## 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 sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	139	123	243	579	e180	e107	906	301	87	136	60	79
2	126	149	221	e500	e150	e110	915	260	91	126	56	74
3	119	227	207	e480	e140	e120	863	240	90	123	50	87
4	108	230	184	e500	e150	e125	759	224	84	114	46	97
5	105	224	186	743	e140	e135	686	255	90	103	43	91
6	90	219	173	883	e130	e145	628	287	103	92	42	86
7	86	201	e165	741	e120	e160	556	266	110	84	47	85
8	85	183	e160	632	e115	178	504	240	122	79	45	78
9	101	172	152	543	e115	197	459	209	150	72	44	71
10	111	167	149	e450	e115	205	438	185	175	68	46	65
11	113	164	154	e350	e110	190	411	166	167	66	45	59
12	123	195	165	e910	e110	176	401	151	152	62	41	56
13	126	475	181	e270	e110	e150	381	138	130	60	39	63
14	128	569	194	e240	e110	e140	337	127	110	70	37	57
15	153	495	193	e210	e110	e130	307	135	124	68	35	110
16	234	469	197	e190	e110	e140	322	129	113	63	36	124
17	245	423	205	e170	e105	e170	326	121	100	58	37	121
18	213	370	202	e160	e105	e180	317	107	90	54	37	120
19	207	312	197	e150	e105	171	315	101	96	61	35	108
20	196	269	194	e170	e105	162	498	98	277	60	36	93
21	199	251	173	e210	e105	153	844	96	468	55	35	90
22	199	235	e155	256	e105	164	712	97	663	51	34	88
23	185	350	e140	333	e105	224	574	96	623	47	34	84
24	179	474	e120	337	e105	318	463	100	499	42	49	77
25	166	416	e105	e320	e105	420	397	100	369	41	39	72
26	156	400	e100	e270	e105	499	355	97	273	51	40	76
27	163	372	e90	e250	e105	618	314	96	226	50	41	81
28	160	339	e110	e210	e105	757	276	96	198	58	47	150
29	147	304	e160	e190	---	894	267	92	175	58	59	160
30	134	271	e250	e160	---	985	318	81	152	63	69	153
31	127	---	440	e170	---	972	---	82	---	63	75	---
TOTAL	4623	9048	5575	10977	3275	9095	14849	4773	6107	2198	1379	2755
MEAN	149	302	180	354	117	293	495	154	204	70.9	44.5	91.8
MAX	245	569	440	883	180	985	915	301	663	136	75	160
MIN	85	123	90	150	105	107	267	81	84	41	34	56
CFSM	.67	1.36	.81	1.60	.53	1.33	2.24	.70	.92	.32	.20	.42
IN.	.78	1.52	.94	1.85	.55	1.53	2.50	.80	1.03	.37	.23	.46

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1980 - 1993, BY WATER YEAR (WY)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	175	202	196	176	210	355	349	153	127	70.3	67.0	153		
MAX	583	474	349	354	485	712	630	274	251	122	166	635		
(WY)	1987	1986	1988	1993	1985	1985	1985	1983	1989	1986	1992	1985		
MIN	52.7	91.8	84.1	73.1	89.4	157	196	82.4	31.2	39.1	34.6	29.5		
(WY)	1983	1981	1990	1981	1982	1989	1989	1988	1988	1988	1981	1991		

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1980 - 1993

ANNUAL TOTAL	68742	74654	185
ANNUAL MEAN	188	205	295
HIGHEST ANNUAL MEAN			1985
LOWEST ANNUAL MEAN			128
HIGHEST DAILY MEAN	829	985	2950
LOWEST DAILY MEAN	37	34	14
ANNUAL SEVEN-DAY MINIMUM	45	35	16
INSTANTANEOUS PEAK FLOW		994	3090
INSTANTANEOUS PEAK STAGE		5.12	(a)9.61
INSTANTANEOUS LOW FLOW		31	12
ANNUAL RUNOFF (CFSM)	.85	.93	.84
ANNUAL RUNOFF (INCHES)	11.57	12.57	11.35
10 PERCENT EXCEEDS	336	465	370
50 PERCENT EXCEEDS	165	149	125
90 PERCENT EXCEEDS	80	57	48

(a) Backwater from ice.

(e) Estimated.

## 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 current year.

REVISED RECORDS.--WDR MI-78-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 721.39 ft above sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Flow regulated by Holloway Reservoir, 1.5 mi upstream from station. From 1954 to 1991 annual mean discharge and runoff figures adjusted for change in contents in Holloway Reservoir. Several measurements of water temperature were made during the year. City of Flint gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	293	347	716	929	463	219	2250	442	181	274	96	116
2	262	496	653	1050	412	222	2120	560	183	239	98	119
3	250	709	593	1050	306	236	2010	583	186	223	100	125
4	232	747	549	1320	257	266	1880	588	187	209	100	129
5	205	855	507	1610	324	287	1720	621	195	190	96	135
6	187	1060	477	1880	351	297	1570	650	199	169	95	134
7	178	1040	385	2110	314	312	1460	638	212	165	95	132
8	173	1030	324	1880	307	351	1330	608	224	166	e93	130
9	192	990	356	1540	312	407	1210	566	236	151	e92	123
10	197	915	368	1280	315	463	1020	510	266	144	e93	117
11	207	683	370	789	314	478	943	457	286	137	e91	113
12	211	619	379	675	292	460	969	419	276	128	e90	110
13	212	874	401	861	281	425	939	366	250	122	e88	109
14	225	1080	422	789	278	361	882	322	231	112	e87	109
15	295	1260	437	728	272	329	804	312	217	95	e88	149
16	410	1330	444	680	273	356	789	308	218	94	e88	168
17	517	1320	474	633	264	403	787	290	210	98	e88	181
18	537	1150	471	548	232	445	773	274	201	100	e87	190
19	563	976	458	386	210	460	776	259	216	104	e86	195
20	579	795	445	300	233	479	1150	243	275	101	e85	191
21	557	665	437	386	255	473	1500	233	428	103	86	177
22	532	710	402	477	261	461	1860	229	652	103	84	163
23	497	836	380	575	242	520	1570	225	785	100	85	157
24	490	1020	349	670	233	663	1220	215	753	100	84	149
25	466	1070	287	734	229	854	1230	223	683	98	85	147
26	429	1080	248	732	229	1210	1180	221	599	96	84	153
27	427	1050	239	723	227	1550	654	221	488	98	85	159
28	433	970	260	702	222	1720	175	208	427	93	90	203
29	388	870	280	629	---	1970	117	208	364	96	94	263
30	354	787	348	514	---	2220	187	199	318	96	100	292
31	330	---	620	471	---	2300	---	185	---	96	107	---
TOTAL	10828	27334	13079	27651	7898	21197	35075	11383	9946	4100	2820	4638
MEAN	349	911	422	892	282	684	1169	367	332	132	91.0	155
MAX	579	1330	716	2110	463	2300	2250	650	785	274	107	292
MIN	173	347	239	300	210	219	117	185	181	93	84	109

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1953 - 1993, BY WATER YEAR (WY)

	MEAN	216	253	301	283	366	804	675	357	231	148	128	213
MAX	1688	911	900	1153	1123	1984	1549	1789	697	437	345	1507	
(WY)	1987	1993	1988	1973	1968	1976	1960	1956	1989	1967	1953	1986	
MIN	59.4	19.1	14.0	49.7	66.4	76.5	175	43.6	20.3	47.4	36.3	42.3	
(WY)	1966	1972	1972	1961	1964	1964	1964	1977	1977	1977	1977	1954	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1953 - 1993
ANNUAL TOTAL	164824	175949	
ANNUAL MEAN	450	482	331
HIGHEST ANNUAL MEAN			638
LOWEST ANNUAL MEAN			82.7
HIGHEST DAILY MEAN	1810	2300	5940
LOWEST DAILY MEAN	114	84	2.1
ANNUAL SEVEN-DAY MINIMUM	116	85	3.6
INSTANTANEOUS PEAK FLOW		2320	6150
INSTANTANEOUS PEAK STAGE		11.59	14.97
INSTANTANEOUS LOW FLOW		82	2.1
10 PERCENT EXCEEDS	855	1060	753
50 PERCENT EXCEEDS	379	314	169
90 PERCENT EXCEEDS	165	98	62

(a) Aug. 22, 23.

(b) Oct. 11, 12, 1971.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

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-78-1: Drainage area. WDR MI-85-1: 1968(M), 1973(M), 1975, 1982(P).

GAGE.--Water-stage recorder. Datum of gage is 747.39 ft above sea level.

REMARKS.--Records good except for estimated daily discharges during the winter period, which are fair, and those for period of no gage-height record, Aug. 29 to Sept. 28, which are poor. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	64	41	117	305	e80	e35	426	144	34	47	21	e28
2	55	108	109	243	e70	e40	462	125	33	43	22	e25
3	48	161	101	252	e75	e65	396	117	32	40	19	e28
4	39	151	94	400	e55	e90	347	110	30	36	17	e26
5	37	152	84	533	e60	104	334	139	37	33	16	e25
6	34	149	59	408	e55	110	285	132	36	30	17	e27
7	32	129	67	335	e50	123	243	127	45	28	17	e26
8	31	100	64	284	e48	168	216	115	55	26	16	e25
9	44	89	61	223	e46	191	201	98	74	24	16	e23
10	41	84	63	161	e44	193	195	79	86	23	15	e22
11	47	82	65	145	e43	167	172	56	97	21	17	e21
12	50	190	72	140	e41	139	218	41	74	21	16	e23
13	45	440	80	133	e40	112	187	44	45	19	17	e26
14	41	307	83	124	e39	103	170	44	45	22	16	e30
15	82	284	84	127	e38	102	160	48	41	20	14	e100
16	130	270	96	120	e37	112	215	43	38	19	15	e65
17	123	231	92	115	e36	175	178	41	34	16	15	e50
18	115	187	89	96	e36	151	164	39	31	16	14	e40
19	108	147	86	e75	e35	128	159	39	52	16	14	e25
20	97	134	85	e60	e35	112	506	37	136	14	16	e32
21	107	127	73	e120	e35	89	490	36	339	13	13	e40
22	95	123	73	189	e35	114	334	34	340	12	13	e38
23	92	289	60	193	e34	186	283	33	293	11	17	e34
24	100	245	48	212	e34	251	221	36	228	11	15	e31
25	74	221	e40	192	e34	306	195	34	175	18	16	e30
26	61	205	e38	167	e34	337	164	34	131	17	22	e45
27	57	184	e36	134	e34	381	144	32	100	23	19	e65
28	53	162	e35	116	e34	421	128	33	84	43	17	e98
29	49	144	e60	105	---	446	130	31	66	47	e21	101
30	44	129	150	e90	---	432	174	29	51	51	e24	106
31	42	---	384	e85	---	396	---	31	---	35	e26	---
TOTAL	2037	5265	2648	5882	1237	5779	7437	1981	2862	795	533	1255
MEAN	65.7	175	85.4	190	44.2	186	248	63.9	95.4	25.6	17.2	41.8
MAX	130	440	384	533	80	446	506	144	340	51	26	106
MIN	31	41	35	60	34	35	128	29	30	11	13	21
CFSM	.66	1.77	.86	1.91	.44	1.88	2.49	.64	.96	.26	.17	.42
IN.	.76	1.97	.99	2.20	.46	2.16	2.78	.74	1.07	.30	.20	.47

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 1993, BY WATER YEAR (WY)

MEAN	44.0	61.0	76.7	71.0	92.0	171	164	74.9	46.9	26.4	21.2	47.2
MAX	236	181	213	192	294	317	350	200	146	54.4	107	314
(WY)	1982	1986	1976	1973	1976	1973	1975	1974	1989	1969	1975	1985
MIN	10.7	16.2	22.2	15.6	24.3	57.9	80.9	24.7	7.39	5.48	5.83	7.06
(WY)	1967	1966	1970	1970	1970	1969	1966	1977	1988	1966	1966	1966

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1966 - 1993

ANNUAL TOTAL	36336.7	37711	74.5
ANNUAL MEAN	99.3	103	122
HIGHEST ANNUAL MEAN			35.3
LOWEST ANNUAL MEAN			1370
HIGHEST DAILY MEAN	594	533	1370
LOWEST DAILY MEAN	2.8	11	2.1
ANNUAL SEVEN-DAY MINIMUM	11	13	2.3
INSTANTANEOUS PEAK FLOW		604	1500
INSTANTANEOUS PEAK STAGE		9.30	(a)11.85
INSTANTANEOUS LOW FLOW		10	1.6
ANNUAL RUNOFF (CFSM)	1.00	1.04	.75
ANNUAL RUNOFF (INCHES)	13.60	14.11	10.18
10 PERCENT EXCEEDS	191	243	170
50 PERCENT EXCEEDS	82	64	40
90 PERCENT EXCEEDS	30	19	11

(a) From floodmark.

(b) July 22, 23, 24.

(c) Estimated.



## 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-78-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 678.80 ft above sea level (levels by the National Weather Service and City of Flint).

REMARKS.--Records good. Some regulation by small reservoirs upstream from station and by Holloway Reservoir. From 1954 to 1991 annual mean discharge and runoff figures adjusted for change in contents in Holloway Reservoir. 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	519	526	1260	2340	885	420	4650	1040	353	552	210	277
2	482	1250	1190	2020	760	462	4750	1110	318	494	202	295
3	452	1460	877	2000	721	518	4140	1160	314	444	184	321
4	415	1330	944	3270	560	586	3690	1220	304	412	188	274
5	383	1300	899	4620	610	584	3470	1500	462	388	174	271
6	360	1520	806	3850	656	586	3050	1330	363	359	185	312
7	336	1530	761	3700	575	661	2660	1210	472	329	192	301
8	323	1460	615	3320	566	909	2410	1110	603	313	169	267
9	583	1430	626	2660	549	1070	2170	1010	689	309	170	254
10	389	1340	661	2110	550	1140	2110	906	541	319	249	247
11	375	1260	693	1580	550	1000	1870	778	525	266	209	225
12	372	1920	698	1310	530	890	2070	687	493	251	166	308
13	368	3640	731	1620	510	773	1910	613	438	235	177	257
14	379	2510	774	1370	498	664	1740	549	437	303	160	365
15	904	2150	799	1360	491	605	1700	561	406	234	163	1020
16	1200	2280	886	1160	501	684	1770	512	369	206	214	505
17	1060	2190	911	1160	469	1030	1780	487	351	185	174	662
18	958	1770	863	973	430	946	1610	478	342	181	167	360
19	918	1610	822	844	402	879	1580	493	611	197	176	261
20	984	1460	833	650	414	871	5350	430	1300	192	238	371
21	1020	1240	765	905	440	878	4360	411	1760	184	170	478
22	928	1340	729	1580	469	979	3430	395	2000	176	155	388
23	844	2870	686	1760	442	1840	3070	394	1760	168	169	354
24	813	2440	606	1720	420	2120	2490	392	1440	162	217	326
25	760	1910	513	1690	407	2270	2400	360	1350	342	191	323
26	713	1830	458	1460	409	2740	2000	329	1480	248	182	578
27	650	1840	448	1370	408	3310	1590	342	1080	202	172	746
28	667	1700	446	1080	406	3660	812	375	843	519	222	1050
29	626	1530	605	1090	--	3860	754	337	703	283	274	765
30	572	1380	1190	930	--	4070	1020	317	640	254	286	673
31	525	--	2810	904	--	4150	--	350	--	231	322	--
TOTAL	19878	52016	25905	56406	14628	45155	76406	21185	22727	8938	6147	12834
MEAN	641	1734	836	1820	522	1457	2547	683	758	288	198	428
MAX	1200	3640	2810	4620	885	4150	5350	1500	2000	552	322	1050
MIN	323	526	446	650	402	420	754	317	304	162	155	225

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1932 - 1993, BY WATER YEAR (WY)

	344	446	541	577	765	1518	1342	740	459	255	228	344
MEAN	344	446	541	577	765	1518	1342	740	459	255	228	344
MAX	2764	1734	1739	2008	2867	3514	4209	3575	1613	1009	868	2635
(WY)	1987	1993	1976	1973	1938	1985	1947	1956	1943	1967	1975	1986
MIN	60.6	69.9	70.8	84.8	87.6	187	335	110	81.3	56.1	31.3	45.9
(WY)	1936	1965	1964	1940	1940	1964	1946	1958	1934	1936	1936	1941

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1932 - 1993
ANNUAL TOTAL	346257	362225	
ANNUAL MEAN	946	992	628
HIGHEST ANNUAL MEAN			1258
LOWEST ANNUAL MEAN			153
HIGHEST DAILY MEAN	5330	5350	14500
LOWEST DAILY MEAN	185	155	14
ANNUAL SEVEN-DAY MINIMUM	198	174	23
INSTANTANEOUS PEAK FLOW		6220	14900
INSTANTANEOUS PEAK STAGE		12.04	16.95
INSTANTANEOUS LOW FLOW		94	9.0
10 PERCENT EXCEEDS	1700	2160	1460
50 PERCENT EXCEEDS	745	650	326
90 PERCENT EXCEEDS	336	224	97

## 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-78-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 697.92 ft above sea level. Prior to Nov. 14, 1952, nonrecording gage at site 600 ft upstream at present datum.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	88	96	328	1580	e150	e65	1700	446	98	69	16	30
2	77	133	295	895	e140	e85	1500	333	92	58	14	27
3	67	613	268	668	e130	e85	1110	280	84	51	13	31
4	58	781	245	1470	e135	e85	916	255	76	44	12	37
5	51	530	226	3500	e145	e70	1260	355	85	38	13	37
6	46	386	e210	2500	e155	e80	1330	580	113	33	15	36
7	42	293	e195	1550	e155	e100	995	434	111	29	15	36
8	39	235	e185	e800	e150	e120	794	320	111	29	17	31
9	47	206	e175	e450	e130	e150	699	250	139	31	16	27
10	52	191	171	e340	e115	e180	837	207	148	29	14	27
11	58	192	177	e290	e105	e200	714	177	131	27	21	33
12	55	299	201	e260	e100	e180	565	154	103	48	57	32
13	51	1950	269	e240	e100	e160	470	137	78	40	109	30
14	49	2100	306	e230	e100	e130	381	125	64	33	91	30
15	60	1250	307	e220	e95	e95	341	131	110	32	50	60
16	114	733	336	e210	e95	e90	461	124	227	30	71	98
17	304	489	349	e200	e90	e150	542	113	140	25	99	120
18	337	391	312	e180	e85	e220	465	103	96	23	124	119
19	242	386	281	e160	e85	e260	387	101	89	28	100	88
20	198	416	e220	e150	e85	e250	2520	100	170	31	63	64
21	200	549	e150	e170	e80	e230	3580	93	272	30	41	52
22	277	588	e120	e230	e80	e240	1820	89	420	24	30	47
23	281	1300	e95	e300	e75	e320	978	91	371	21	26	44
24	249	1870	e95	e410	e70	e450	637	117	224	19	26	44
25	219	1340	e100	e400	e65	e600	665	122	156	19	25	42
26	183	1000	e105	e330	e65	e900	587	115	142	20	23	47
27	154	766	e110	e270	e65	e1200	460	102	132	21	21	64
28	138	577	e115	e230	e65	e270	370	97	116	22	20	131
29	123	452	e120	e200	---	3250	319	93	97	20	22	205
30	113	373	e200	e180	---	2780	373	85	81	19	22	248
31	105	---	e900	e160	---	2210	---	91	---	17	26	---
TOTAL	4077	20485	7166	18773	2910	17665	27776	5820	4276	960	1212	1917
MEAN	132	683	231	606	104	570	926	188	143	31.0	39.1	63.9
MAX	337	2100	900	3500	155	3250	3580	580	420	69	124	248
MIN	39	96	95	150	65	65	319	85	64	17	12	27
CFSM	.37	1.90	.64	1.69	.29	1.59	2.58	.52	.40	.09	.11	.18
IN.	.42	2.12	.74	1.95	.30	1.83	2.88	.60	.44	.10	.13	.20

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1948 - 1993, BY WATER YEAR (WY)

MEAN	84.3	140	194	180	269	765	538	223	112	58.0	33.5	102
MAX	952	683	653	840	982	2260	1296	1131	591	309	201	2239
(WY)	1987	1993	1985	1952	1954	1985	1960	1956	1984	1967	1953	1986
MIN	2.58	7.23	6.26	5.16	6.36	59.8	100	27.5	12.9	5.04	2.48	1.33
(WY)	1949	1950	1959	1959	1959	1964	1964	1958	1964	1966	1963	1948

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1948 - 1993

ANNUAL TOTAL	109853	113037	(a)224
ANNUAL MEAN	300	310	471
HIGHEST ANNUAL MEAN			27.6
LOWEST ANNUAL MEAN			11800
HIGHEST DAILY MEAN	4680	Apr 17	12
LOWEST DAILY MEAN	20	Jun 16	14
ANNUAL SEVEN-DAY MINIMUM	29	Jun 11	14
INSTANTANEOUS PEAK FLOW		4390	Apr 21
INSTANTANEOUS PEAK STAGE		12.41	Apr 21
INSTANTANEOUS LOW FLOW		12	(c)
ANNUAL RUNOFF (CFSM)	.84	.86	.50
ANNUAL RUNOFF (INCHES)	11.38	11.71	.62
10 PERCENT EXCEEDS	655	746	540
50 PERCENT EXCEEDS	180	130	60
90 PERCENT EXCEEDS	60	28	7.6

(a) Does not include water year 1948.

(b) From floodmark.

(c) Aug. 3-5.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

## 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-78-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 632.60 ft above sea level (levels by Edmonds Engineering, Inc.). Prior to June 19, 1969, nonrecording gage at bridge 90 ft downstream at present datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	141	194	e610	2430	e330	e140	2950	705	203	126	47	54
2	126	256	e560	1350	e310	e140	2470	610	196	112	46	55
3	117	618	e510	914	e280	e140	1920	534	179	101	45	65
4	104	1030	e470	1810	e290	e140	1540	511	162	91	42	67
5	103	843	e410	5360	e310	e150	1720	596	174	82	40	64
6	99	651	e380	5010	e330	e180	1940	847	235	76	40	60
7	93	535	e360	2780	e330	e220	1590	770	251	72	43	58
8	88	459	e340	1620	e330	e269	1230	601	230	67	44	56
9	129	412	e330	e900	e280	329	1070	492	237	65	44	52
10	131	386	e320	e720	265	395	1210	430	271	73	44	56
11	135	387	e360	e600	e230	432	1170	383	244	68	44	52
12	137	464	e380	e560	e220	e380	931	342	203	93	44	56
13	124	2190	e450	e510	e210	e330	804	294	167	97	66	59
14	113	3360	e530	e480	e210	e260	680	267	146	91	107	59
15	133	2110	526	e460	208	e190	615	276	139	84	93	124
16	217	1270	539	e450	205	e190	771	270	224	74	96	133
17	367	905	572	e420	e190	e310	930	247	255	66	102	155
18	471	774	527	e370	e180	e460	834	225	186	58	116	160
19	414	733	480	e330	e180	e540	715	227	171	72	129	147
20	359	725	e400	e310	e180	e510	2200	221	263	74	116	116
21	369	800	e280	e350	e170	466	6190	209	410	69	83	97
22	416	948	e210	444	e170	490	3910	196	427	62	62	83
23	447	1510	e170	647	e160	681	1830	196	468	56	55	78
24	420	2730	e170	865	e150	965	1160	250	359	50	58	73
25	375	2170	e180	e840	e140	1270	1160	273	258	52	56	72
26	341	1600	e190	e700	e140	2170	1040	246	228	62	51	84
27	301	1270	e210	e570	e140	2660	821	219	219	59	47	97
28	264	1000	212	e480	e140	3930	687	206	195	62	44	167
29	244	816	223	e420	---	5230	609	192	166	60	42	286
30	228	708	379	e360	---	5100	624	172	144	54	46	329
31	208	---	1590	e340	---	3990	---	190	---	50	49	---
TOTAL	7214	31854	12868	33400	6278	32657	45321	11197	7010	2278	1941	3014
MEAN	233	1062	415	1077	224	1053	1511	361	234	73.5	62.6	100
MAX	471	3360	1590	5360	330	5230	6190	847	468	126	129	329
MIN	88	194	170	310	140	140	609	172	139	50	40	52
CFSM	.36	1.65	.64	1.67	.35	1.63	2.34	.56	.36	.11	.10	.16
IN.	.42	1.84	.74	1.93	.36	1.88	2.61	.65	.40	.13	.11	.17

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1969 - 1993, BY WATER YEAR (WY)

MEAN	258	336	403	349	477	1383	1046	450	255	121	81.8	328
MAX	1738	1062	1048	1476	1717	3695	1909	1182	1064	701	254	3834
(WY)	1987	1993	1985	1973	1976	1985	1991	1991	1984	1970	1992	1986
MIN	29.0	42.7	41.5	37.8	68.7	273	486	92.4	47.5	32.1	28.6	21.5
(WY)	1980	1972	1977	1977	1970	1970	1977	1977	1988	1987	1978	1991

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1969 - 1993

ANNUAL TOTAL	187036	195032	457
ANNUAL MEAN	511	534	816
HIGHEST ANNUAL MEAN			187
LOWEST ANNUAL MEAN			19500
HIGHEST DAILY MEAN	6850	Apr 18	6190
LOWEST DAILY MEAN	58	Jun 17	40
ANNUAL SEVEN-DAY MINIMUM	78	Jun 11	42
INSTANTANEOUS PEAK FLOW			6840
INSTANTANEOUS PEAK STAGE			15.60
INSTANTANEOUS LOW FLOW			40
ANNUAL RUNOFF (CFSM)	.79		.83
ANNUAL RUNOFF (INCHES)	10.79		11.25
10 PERCENT EXCEEDS	1050	1220	1050
50 PERCENT EXCEEDS	282	256	172
90 PERCENT EXCEEDS	123	59	40

- (a) From floodmark.  
(b) Aug. 5, 6.  
(c) July 14-16, 1988.  
(e) Estimated.

## 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-78-1: Drainage area.

GAGE--Water-stage recorder. Datum of gage is 583.96 ft above sea level (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 Sept. 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	191	252	916	2870	e440	e190	3980	973	275	178	73	85
2	174	335	816	2830	e420	e180	3170	931	265	165	70	85
3	159	727	736	2350	e390	e190	2620	793	242	150	71	89
4	147	1240	663	2570	e400	e190	2160	791	224	136	67	95
5	134	1240	615	5540	e410	e200	2160	833	246	124	64	92
6	131	972	547	6720	e420	e270	2370	1080	293	114	66	85
7	127	769	502	4220	431	345	2140	1140	318	110	69	81
8	127	630	e480	2340	e420	421	1770	903	301	102	66	79
9	186	543	466	1560	e390	520	1560	722	299	96	64	77
10	201	499	448	e1000	e370	618	1620	603	314	98	65	74
11	187	486	457	e850	e330	644	1660	526	292	99	63	76
12	184	650	491	e750	e300	e540	1530	470	256	103	62	77
13	177	2170	578	e700	e300	e450	1310	404	221	125	60	79
14	160	3710	708	e650	305	e350	1100	365	197	130	78	90
15	177	2830	749	e630	302	e260	971	376	189	128	113	149
16	352	1830	758	e500	297	e260	1110	360	203	112	111	175
17	497	1380	804	e560	289	e500	1350	329	286	101	109	172
18	580	1190	775	e520	e270	e620	1290	306	240	103	114	178
19	603	1090	696	e470	e260	975	1130	308	230	110	128	176
20	502	1030	655	e430	e250	904	2890	294	299	106	137	158
21	519	1070	e400	655	e240	746	6690	277	447	105	121	139
22	552	1260	e300	794	e230	750	6140	263	477	98	94	121
23	580	2110	e250	1090	e220	1040	2750	267	520	89	83	110
24	563	3040	e230	1400	e210	1430	1800	328	431	82	83	103
25	490	2700	e240	1490	e200	1950	1690	353	325	85	81	95
26	425	2060	e250	e1100	e195	2640	1580	323	281	93	77	106
27	384	1730	e270	e800	e190	3230	1290	289	268	94	70	123
28	340	1440	e290	e660	e190	4330	1080	271	250	85	65	174
29	311	1200	338	e580	---	5950	950	248	221	90	67	244
30	292	1040	581	e500	---	6390	948	236	197	86	74	310
31	268	---	1870	e470	---	5280	---	265	---	78	79	---
TOTAL	9720	41223	17879	47299	8669	42373	62809	15627	8607	3375	2544	3697
MEAN	314	1374	577	1526	310	1367	2094	504	287	109	82.1	123
MAX	603	3710	1870	6720	440	6390	6690	1140	520	178	137	310
MIN	127	252	230	430	190	190	948	236	189	78	60	74
CFSM	.37	1.63	.69	1.81	.37	1.63	2.49	.60	.34	.13	.10	.15
IN.	.43	1.82	.79	2.09	.38	1.87	2.78	.69	.38	.15	.11	.16

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1936 - 1993, BY WATER YEAR (WY)

MEAN	228	328	428	432	603	1630	1194	615	342	161	101	236
MAX	2637	1374	1335	2185	2225	4943	3121	2650	1499	938	523	5000
(WY)	1987	1993	1985	1973	1976	1976	1947	1956	1945	1970	1953	1986
MIN	31.7	43.1	50.7	45.1	55.6	179	201	104	60.4	20.4	20.1	23.5
(WY)	1947	1965	1940	1959	1959	1964	1946	1941	1964	1936	1944	1941

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1936 - 1993

ANNUAL TOTAL	250257	263822	518
ANNUAL MEAN	684	723	1063
HIGHEST ANNUAL MEAN			96.6
LOWEST ANNUAL MEAN			1985
HIGHEST DAILY MEAN	8630	6720	21700
LOWEST DAILY MEAN	89	60	(a)1.5
ANNUAL SEVEN-DAY MINIMUM	113	64	4.4
INSTANTANEOUS PEAK FLOW		7620	22200
INSTANTANEOUS PEAK STAGE		18.49	27.52
INSTANTANEOUS LOW FLOW		59	1.5
ANNUAL RUNOFF (CFSM)	.81	.86	.62
ANNUAL RUNOFF (INCHES)	11.07	11.67	8.37
10 PERCENT EXCEEDS	1400	1780	1220
50 PERCENT EXCEEDS	360	329	180
90 PERCENT EXCEEDS	173	85	48

(a) Approximate.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE HURON

## 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 sea level.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	102	114	208	e250	e88	e64	341	309	269	101	58	71
2	97	301	196	e200	e66	e66	272	225	186	96	59	79
3	94	818	187	256	e84	e68	241	203	142	95	58	75
4	89	924	175	438	e84	e72	228	231	129	92	59	80
5	85	609	166	865	e84	e76	292	501	134	88	65	79
6	83	345	e155	569	e84	e82	300	446	141	84	69	74
7	84	269	e150	e270	e84	e88	282	283	126	88	85	71
8	85	229	e145	e210	e82	e96	269	213	140	87	81	72
9	135	207	143	e180	e82	e130	269	182	190	86	75	76
10	177	239	e140	e150	e80	e200	280	160	162	83	70	87
11	145	266	e135	e130	e78	e170	245	144	130	76	67	76
12	124	271	e135	e120	e78	e140	233	139	122	73	69	126
13	113	507	e135	e110	e76	e100	263	131	108	71	63	145
14	103	447	e140	e105	e74	e68	229	125	101	72	61	92
15	105	300	160	e100	e72	e62	228	127	111	74	65	81
16	303	218	236	e98	e72	e68	387	126	106	71	77	78
17	469	216	316	e96	e70	e100	351	116	98	68	95	93
18	295	213	252	e94	e70	e85	272	110	105	65	82	109
19	196	204	215	e94	e68	e80	234	116	202	87	79	112
20	160	194	192	e94	e68	e75	583	122	493	88	109	104
21	173	267	e170	e94	e68	e74	848	130	604	77	105	101
22	198	372	e150	e96	e66	e78	567	115	329	70	82	97
23	181	531	e140	e100	e64	e90	310	111	208	66	80	92
24	162	742	e130	e98	e64	e120	247	167	158	65	131	88
25	147	599	e120	e96	e64	e280	327	203	144	64	123	85
26	137	398	e110	e92	e64	547	281	149	194	69	92	82
27	129	358	e105	e90	e64	680	226	130	161	68	88	82
28	125	295	e100	e90	e64	702	207	127	127	65	89	91
29	119	250	e100	e90	---	676	213	126	114	67	91	88
30	118	218	e130	e88	---	573	314	115	106	64	86	94
31	117	---	e320	e88	---	460	---	197	---	60	123	---
TOTAL	4650	10921	5156	5451	2082	6170	9339	5579	5340	2380	2536	2680
MEAN	150	364	166	176	74.4	199	311	180	178	76.8	81.8	89.3
MAX	469	924	320	865	88	702	848	501	604	101	131	145
MIN	83	114	100	88	64	62	207	110	98	60	58	71
CFSM	.94	2.28	1.04	1.10	.46	1.24	1.95	1.12	1.11	.48	.51	.56
IN.	1.08	2.54	1.20	1.27	.48	1.43	2.17	1.30	1.24	.55	.59	.62

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1987 - 1993, BY WATER YEAR (WY)

	1987	1988	1989	1990	1991	1992	1993
MEAN	130	201	156	109	102	233	266
MAX	202	364	253	176	172	296	478
(WY)	1991	1993	1992	1993	1991	1991	1991
MIN	68.9	82.3	61.2	83.1	74.4	152	115
(WY)	1990	1990	1990	1990	1993	1987	1987

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1987 - 1993
ANNUAL TOTAL	60637	62284	
ANNUAL MEAN	166	171	145
HIGHEST ANNUAL MEAN			184
LOWEST ANNUAL MEAN			111
HIGHEST DAILY MEAN	987	924	1340
LOWEST DAILY MEAN	60	58	40
ANNUAL SEVEN-DAY MINIMUM	63	60	41
INSTANTANEOUS PEAK FLOW		1010	(a)1450
INSTANTANEOUS PEAK STAGE		9.58	(b)11.06
INSTANTANEOUS LOW FLOW		52	39
ANNUAL RUNOFF (CFSM)	1.04	1.07	.91
ANNUAL RUNOFF (INCHES)	14.10	14.48	12.34
10 PERCENT EXCEEDS	320	315	251
50 PERCENT EXCEEDS	115	116	96
90 PERCENT EXCEEDS	71	69	64

(a) Gage height, 10.74 ft.

(b) Backwater from ice.

(c) July 6, Sept. 9, 1988.

(e) Estimated.

## 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. 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 sea level (levels by Michigan Department of Natural Resources). Prior to Oct. 21, 1938, nonrecording gage at site 30 ft upstream at present datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	332	400	591	565	384	e280	871	723	469	382	175	321
2	316	680	580	520	e370	e280	850	664	479	357	176	304
3	302	1110	530	475	e370	e280	782	621	452	341	177	284
4	290	956	506	660	367	363	691	623	419	327	176	284
5	278	837	488	963	365	337	735	748	413	318	170	277
6	268	706	465	678	365	317	731	695	397	295	198	262
7	264	661	448	577	e360	386	708	616	381	274	232	250
8	259	611	438	528	354	380	689	562	389	274	248	242
9	353	569	431	e500	349	471	693	515	412	272	251	237
10	378	567	433	e480	341	491	717	474	409	265	233	232
11	377	568	432	e470	332	404	726	447	383	254	224	226
12	366	617	429	e450	323	360	777	427	360	242	241	228
13	344	867	429	452	331	e310	760	398	333	224	206	231
14	320	754	433	e440	320	e280	708	375	324	233	199	289
15	325	667	434	e430	315	e260	699	366	323	225	219	357
16	490	611	519	e420	313	e290	853	351	304	212	252	354
17	584	572	551	418	306	e440	851	334	290	205	263	334
18	553	545	500	e410	e300	e370	816	333	315	207	242	307
19	528	518	477	e410	e290	e340	780	346	558	258	242	288
20	529	498	464	e410	e290	336	1150	329	1090	288	307	275
21	529	532	456	e410	e290	327	1370	315	1170	269	317	272
22	500	589	429	e420	e280	357	1180	306	950	246	314	271
23	473	885	420	434	e280	458	1150	311	796	227	441	279
24	460	1120	e400	427	e280	546	992	408	650	213	454	270
25	447	953	e380	415	e280	690	980	410	549	215	407	256
26	438	899	e350	e400	e280	713	869	400	521	214	371	260
27	428	848	e320	e400	e280	873	755	377	525	208	402	302
28	422	747	e300	395	e280	908	693	363	497	209	380	315
29	416	684	e310	e390	---	913	664	350	451	207	345	301
30	410	633	e450	e380	---	749	756	339	416	188	336	295
31	404	---	670	e380	---	738	---	421	---	178	341	---
TOTAL	12383	21194	14043	14707	8995	14262	24976	13947	15025	7827	8537	8413
MEAN	399	706	453	474	321	460	833	450	501	252	275	280
MAX	584	1120	670	963	384	913	1370	748	1170	382	454	357
MIN	259	400	300	380	280	260	664	306	290	178	170	226
CFSM	.96	1.70	1.09	1.14	.77	1.11	2.00	1.08	1.20	.61	.66	.67
IN.	1.11	1.90	1.26	1.32	.80	1.28	2.23	1.25	1.34	.70	.76	.75

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	251	302	303	278	328	580	597	384	282	193	169	229
MAX	1058	836	627	655	1401	1709	1204	934	711	694	585	1682	
(WY)	1987	1986	1992	1973	1938	1976	1967	1974	1943	1969	1972	1986	
MIN	117	151	144	112	124	204	231	175	117	77.3	70.6	97.7	
(WY)	1947	1939	1931	1945	1940	1937	1945	1977	1941	1936	1931	1931	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1931 - 1993

ANNUAL TOTAL	158560	164309	324
ANNUAL MEAN	433	450	585
HIGHEST ANNUAL MEAN			1976
LOWEST ANNUAL MEAN			1931
HIGHEST DAILY MEAN	1650	1370	6210
LOWEST DAILY MEAN	140	170	19
ANNUAL SEVEN-DAY MINIMUM	144	177	49
INSTANTANEOUS PEAK FLOW		1460	6660
INSTANTANEOUS PEAK STAGE		7.45	(a)15.58
INSTANTANEOUS LOW FLOW		166	12
ANNUAL RUNOFF (CFSM)	1.04	1.08	.78
ANNUAL RUNOFF (INCHES)	14.18	14.69	10.59
10 PERCENT EXCEEDS	712	751	598
50 PERCENT EXCEEDS	390	397	240
90 PERCENT EXCEEDS	190	242	130

(a) From floodmark.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

## 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 sea level. 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.--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 2.1 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	190	205	472	e520	e235	e185	1200	510	252	191	111	265
2	170	438	427	e480	e230	e190	1020	514	297	173	114	269
3	152	634	400	e450	e225	e190	871	513	351	160	117	272
4	149	701	395	966	e225	e190	778	515	319	154	119	265
5	162	803	349	1120	e225	e200	751	561	260	151	111	230
6	162	827	316	991	e220	e220	711	496	230	168	135	203
7	149	746	306	e700	e210	e240	683	502	237	151	164	175
8	149	647	296	e500	e200	e260	672	464	263	143	202	168
9	190	545	292	e400	e250	e280	672	402	313	142	177	172
10	209	481	294	e350	e250	e300	634	329	312	142	139	182
11	245	425	278	e330	e245	e260	591	278	295	158	135	162
12	274	481	280	e310	e240	e230	612	282	249	159	160	158
13	242	593	291	e300	e230	e210	570	245	202	155	118	150
14	208	546	295	e295	e225	e190	541	230	205	140	103	183
15	210	536	302	e290	e220	e180	536	222	228	129	129	278
16	281	533	386	e285	e215	e200	562	208	224	143	163	321
17	277	506	405	e280	e210	e300	562	210	203	151	172	332
18	312	462	415	e275	e180	e260	578	213	199	140	170	295
19	324	419	434	e270	e150	e240	606	216	213	139	155	220
20	306	397	439	e270	e160	e230	1250	225	490	149	176	197
21	311	401	333	e270	e170	e240	1090	230	637	159	203	208
22	310	384	e290	e275	e175	e270	1050	222	724	133	212	188
23	302	742	e260	e280	e180	381	978	211	735	117	204	186
24	310	725	e220	e280	e180	516	817	232	668	115	226	183
25	292	739	e190	e270	e180	662	759	242	512	138	273	182
26	257	813	e170	e265	e180	767	661	269	355	145	321	191
27	237	758	e160	e260	e185	968	686	277	277	145	366	208
28	231	658	e160	e255	e185	1120	740	223	236	151	278	228
29	232	567	291	e250	---	1320	608	239	202	135	225	265
30	229	522	433	e245	---	1420	550	219	202	137	202	282
31	215	---	657	e240	---	1340	---	245	---	125	215	---
TOTAL	7287	17234	10236	12272	5780	13559	22339	9744	9890	4538	5595	6618
MEAN	235	574	330	396	206	437	745	314	330	146	180	221
MAX	324	827	657	1120	250	1420	1250	561	735	191	366	332
MIN	149	205	160	240	150	180	536	208	199	115	103	150
CFSM	.82	1.99	1.15	1.37	.72	1.52	2.59	1.09	1.14	.51	.63	.77
IN.	.94	2.23	1.32	1.59	.75	1.75	2.89	1.26	1.28	.59	.72	.85

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	163	206	213	193	233	473	442	278	184	106	92.4	142
MAX	894	574	486	680	997	1214	1054	677	575	299	236	1364	
(WY)	1987	1993	1983	1973	1938	1976	1967	1956	1989	1957	1972	1986	
MIN	66.4	82.6	78.4	66.6	72.6	161	159	109	50.8	35.6	34.7	47.5	
(WY)	1939	1931	1940	1945	1940	1937	1945	1949	1934	1934	1936	1932	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1931 - 1993
ANNUAL TOTAL	114471	125092	
ANNUAL MEAN	313	343	227
HIGHEST ANNUAL MEAN			398
LOWEST ANNUAL MEAN			97.8
HIGHEST DAILY MEAN	1100	1420	4960
LOWEST DAILY MEAN	56	103	40
ANNUAL SEVEN-DAY MINIMUM	68	119	10
INSTANTANEOUS PEAK FLOW		1450	5160
INSTANTANEOUS PEAK STAGE		6.70	(a)12.82
INSTANTANEOUS LOW FLOW		101	(b).40
ANNUAL RUNOFF (CFSM)	1.09	1.19	.79
ANNUAL RUNOFF (INCHES)	14.79	16.16	10.71
10 PERCENT EXCEEDS	640	676	470
50 PERCENT EXCEEDS	241	260	150
90 PERCENT EXCEEDS	107	151	67

(a) From floodmark.

(b) Caused by closing dam during construction of waterworks.

(c) Estimated.

## 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 sea level. 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	325	250	615	e900	e260	e190	1590	650	349	233	138	256
2	250	433	536	e520	e250	e170	1360	620	332	249	107	347
3	216	1260	507	e530	e250	e140	1130	619	323	230	96	382
4	204	966	405	1060	e250	e170	1040	632	388	209	95	438
5	175	1030	482	2130	e250	e200	1060	951	389	197	114	396
6	157	1020	e400	1450	e240	e220	1040	842	319	142	117	279
7	168	941	e300	1210	e230	e240	955	567	284	183	130	260
8	165	757	e330	e825	e220	e270	905	670	296	175	155	228
9	173	740	e340	e800	e260	e300	890	525	328	158	209	208
10	227	617	348	e500	e270	e330	916	504	411	157	231	196
11	241	576	387	e450	e270	e280	824	484	397	130	160	236
12	240	493	333	e400	e270	e260	821	230	365	134	109	208
13	301	1120	343	e380	e260	e240	843	410	326	139	177	205
14	231	728	382	e360	e250	e230	714	308	232	160	158	216
15	248	710	388	e350	e240	e220	698	302	241	153	108	413
16	341	627	384	e340	e230	e220	731	293	297	129	237	570
17	526	617	556	e340	e220	e220	720	247	291	111	214	537
18	306	593	521	e340	e200	e350	728	252	263	143	190	480
19	355	508	542	e330	e170	e290	697	254	266	152	206	442
20	398	495	502	e330	e180	e270	1870	247	633	144	180	285
21	361	419	e400	e330	e190	e280	2040	270	1050	142	191	236
22	399	540	e350	e330	e200	e330	1450	266	887	163	220	323
23	392	1240	e300	e340	e200	e400	1290	268	907	145	249	281
24	325	1450	e250	e340	e200	e600	1160	283	825	116	327	245
25	341	1030	e220	e330	e200	e900	1040	277	724	110	271	242
26	343	1030	e200	e320	e200	e1200	897	326	488	149	362	243
27	278	1050	e190	e310	e200	e1600	713	292	387	163	422	245
28	262	879	e190	e300	e200	1700	849	401	348	151	494	358
29	235	789	e300	e290	---	1820	849	151	334	165	300	345
30	236	603	e450	e280	---	1940	763	297	214	143	325	360
31	248	---	e700	e270	---	1850	---	248	---	140	271	---
TOTAL	8667	23511	12151	16685	6360	17430	30583	12686	12894	4915	6563	9460
MEAN	280	784	392	538	227	562	1019	409	430	159	212	315
MAX	526	1450	700	2130	270	1940	2040	951	1050	249	494	570
MIN	157	250	190	270	170	140	697	151	214	110	95	196
CFSM	.72	2.01	1.01	1.38	.58	1.44	2.61	1.05	1.10	.41	.54	.81
IN.	.83	2.24	1.16	1.59	.61	1.66	2.92	1.21	1.23	.47	.63	.90

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1934 - 1993, BY WATER YEAR (WY)

	MEAN	225	267	296	260	337	691	634	358	239	140	126	202
MAX	1238	784	647	865	1356	1725	1549	980	900	549	421	2034	
(WY)	1987	1993	1983	1973	1938	1976	1967	1956	1989	1957	1972	1986	
MIN	72.0	94.8	96.9	70.5	91.3	207	211	106	43.9	35.5	37.4	58.0	
(WY)	1949	1950	1963	1977	1963	1964	1963	1958	1934	1934	1936	1948	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1934 - 1993

ANNUAL TOTAL	149652		161905									
ANNUAL MEAN	409		444									
HIGHEST ANNUAL MEAN										315		
LOWEST ANNUAL MEAN										541		1986
HIGHEST DAILY MEAN										150		1963
LOWEST DAILY MEAN										8750		Sep 12 1986
ANNUAL SEVEN-DAY MINIMUM	1590	Apr 22	2130	Jan 5						7.8		Jul 2 1988
INSTANTANEOUS PEAK FLOW	46	Aug 14	95	Aug 4						17		Aug 13 1938
ANNUAL SEVEN-DAY MINIMUM	89	Aug 20	114	Aug 1						(a)8360		Sep 12 1988
INSTANTANEOUS PEAK STAGE			2660	Apr 20						(b)12.08		Feb 2 1968
INSTANTANEOUS LOW FLOW			8.61	Dec 31						(c)7.6		(d)
ANNUAL RUNOFF (CFSM)			82	Jul 13						.81		
ANNUAL RUNOFF (INCHES)	1.05		1.14							10.96		
10 PERCENT EXCEEDS	866		15.44							659		
50 PERCENT EXCEEDS	300		926							197		
90 PERCENT EXCEEDS	122		320							81		

(a) Gage height, 11.74 ft.

(b) Backwater from ice.

(c) Does not include water years 1934 to 1952.

(d) July 1, 2, 1988.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE HURON

## 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, Hydrologic 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, 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 sea level. Prior to Sept. 30, 1955, at datum 10.00 ft higher.

REMARKS.--Records good except for estimated daily discharges, which are poor. About 8.5 ft<sup>3</sup>/s diverted above station for industrial use and returned to river 0.25 mi downstream from station, remainder returned 1 mi downstream. Prior to 1992 water year, diversion was used in computing annual mean discharge and runoff figures. Extremes and daily discharge 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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1820	896	3760	5470	e1800	e1200	7220	4240	1980	1150	377	1470
2	1850	2960	3390	4110	e2000	e1500	5370	3720	2890	1240	635	1310
3	914	10400	3410	2320	e2100	e1700	4700	3350	2700	899	508	961
4	702	12500	3140	3860	e2100	e1600	4090	3320	1770	695	634	771
5	1050	10000	2450	10700	e1500	e1900	4840	5300	1620	652	517	710
6	1070	6760	1790	9640	e1200	e1700	5260	7840	1170	1180	548	630
7	1070	5110	2030	6280	e1200	e1400	5040	4770	1930	1360	421	903
8	1180	4280	2330	e3500	e1400	2090	4700	3750	1930	1170	448	1330
9	1470	3950	2210	e2500	e1400	2710	4590	3310	2560	887	773	831
10	2510	3820	2250	e1800	e1100	3170	4710	2800	2630	616	869	643
11	1490	3880	2290	e1700	e1600	3220	4220	2310	2490	507	953	631
12	1560	4220	2250	e2300	e2000	2630	3940	1680	1550	611	792	508
13	1840	8040	1750	e2500	e1100	2310	4360	1860	1510	635	642	761
14	1730	7610	2100	e2600	e900	e1400	3550	1770	1540	645	502	874
15	1730	5540	2500	e2700	e1100	e1000	3100	1120	1570	928	444	1210
16	2140	4460	2690	e2200	e1100	e1300	3790	952	1580	803	997	1520
17	3830	4090	4030	e1500	e1200	e1200	4860	1480	1160	602	959	1420
18	3900	3820	3860	e1800	e1200	e2000	4240	1490	1440	602	1040	950
19	3470	3680	3630	e2300	e1300	e2100	3500	1440	2040	825	861	772
20	2990	3480	3460	e2400	e900	2000	8370	1410	6760	838	960	956
21	2990	3430	3080	e2400	e900	1340	13500	1580	10700	986	696	1080
22	2610	4080	2320	e2500	e1300	1640	10800	1060	8090	835	587	953
23	2490	8450	2230	e1800	e1900	2380	6750	827	4690	813	921	1130
24	2960	13900	e1600	e1500	e2200	3160	5420	1430	3600	474	1430	927
25	1730	12400	e1200	e1800	e2100	4110	6310	1900	3050	433	1300	618
26	1780	8550	e1300	e2500	e2000	5830	6260	1990	1980	701	1480	569
27	2590	6760	e1200	e2600	e1300	7290	4920	1920	2000	916	1260	863
28	1920	5290	e1700	e2100	e900	9580	4250	1950	2000	648	953	1150
29	1810	4670	e2400	e2300	---	10200	3910	1610	1680	584	763	1160
30	2020	4060	2970	e1800	---	10500	4120	956	1460	718	1150	1250
31	1250	---	5170	e1300	---	9250	---	1020	---	431	1300	---
TOTAL	62266	180996	80490	94780	40800	103410	160690	74155	82070	24384	25720	28856
MEAN	2009	6033	2596	3057	1457	3336	5356	2392	2736	787	830	962
MAX	3900	13800	5170	10700	2200	10500	13500	7840	10700	1360	1480	1520
MIN	702	896	1200	1300	900	1000	3100	827	1160	431	377	503
CFSM	.84	2.51	1.08	1.27	.61	1.39	2.23	1.00	1.14	.33	.35	.40
IN.	.97	2.81	1.25	1.47	.63	1.60	2.49	1.15	1.27	.38	.40	.45

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1936 - 1993, BY WATER YEAR (WY)

MEAN	1084	1470	1540	1376	1673	3949	3781	2129	1360	717	574	940
MAX	6318	6097	3907	5564	6455	10660	8096	5573	5270	4492	2236	10300
(WY)	1987	1986	1992	1973	1938	1976	1967	1956	1945	1957	1972	1986
MIN	344	493	462	388	466	1027	969	567	355	234	217	250
(WY)	1949	1950	1964	1945	1963	1964	1945	1977	1964	1941	1936	1948

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1936 - 1993

ANNUAL TOTAL	971397		958617									
ANNUAL MEAN	2654		2626									
HIGHEST ANNUAL MEAN										1722		
LOWEST ANNUAL MEAN										3318		1986
HIGHEST DAILY MEAN	17500	Apr 18	13800	Nov 24	36200	Sep 13 1986						
LOWEST DAILY MEAN	291	Jul 5	377	Aug 1	111	Aug 21 1949						
ANNUAL SEVEN-DAY MINIMUM	467	Aug 19	520	Aug 1	126	Aug 11 1936						
INSTANTANEOUS PEAK FLOW			14200	Nov 24	38700	Sep 13 1986						
INSTANTANEOUS PEAK STAGE			22.79	Apr 21	(a)33.89	Sep 13 1986						
INSTANTANEOUS LOW FLOW			333	Aug 4	39	Oct 1 1942						
ANNUAL RUNOFF (CFSM)	1.11		1.09		.72							
ANNUAL RUNOFF (INCHES)	15.06		14.86		9.75							
10 PERCENT EXCEEDS	5660		5290		3980							
50 PERCENT EXCEEDS	1730		1800		926							
90 PERCENT EXCEEDS	649		715		368							

(a) Floodmark.

(e) Estimated.

## 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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	PH SPECIFIC CONDUCTANCE (US/CM) (00095)	WATER WHOLE FIELD (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATURATION) (00301)	COLIFORM, FECAL, 0.7 UM-MP (COLS./100 ML) (31625)	STREPTOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31678)
OCT 06...	1030	710	897	8.5	11.0	1.3	10.2	94	K32	K17
DEC 09...	1100	1500	683	8.1	1.0	4.3	13.6	98	42	K21
MAR 18...	1130	1720	631	8.0	0.0	4.6	14.4	99	K26	80
MAY 25...	1100	1380	534	8.2	14.5	6.1	8.8	89	150	K76
JUN 22...	1400	7580	452	8.0	20.0	2.3	7.4	84	--	--
SEP 02...	1300	1440	506	--	21.0	5.3	9.0	104	210	K44
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)
OCT 06...	270	78	77	18	71	2.8	210	10	188	36
DEC 09...	220	51	65	15	41	2.4	211	--	173	32
MAR 18...	230	53	64	17	32	5.4	215	--	176	32
MAY 25...	210	52	60	15	28	2.2	195	--	160	28
JUN 22...	210	54	59	14	14	3.0	184	--	151	21
SEP 02...	240	--	66	18	15	2.5	--	--	--	30
DATE	SOLIDS, CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	NITROFLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	NITROSILICA, DIS-SOLVED (MG/L AS SiO2) (00955)	NITRORESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	NITROSOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS-SOLVED (TONS PER DAY) (70302)	GEN. NITRITE DIS-SOLVED (MG/L AS N) (00613)	GEN. NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	GEN. AMMONIA DIS-SOLVED (MG/L AS N) (00608)	GEN. AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)
OCT 06...	140	0.30	5.1	506	0.69	970	0.020	0.560	0.030	0.60
DEC 09...	84	0.10	7.3	381	0.52	1540	0.030	1.20	0.130	0.60
MAR 18...	66	<0.10	7.0	353	0.48	1640	0.020	1.10	0.320	1.0
MAY 25...	58	0.10	4.4	315	0.43	1170	0.050	1.40	0.110	0.70
JUN 22...	31	0.20	6.7	285	0.39	5830	0.050	3.10	0.070	0.70
SEP 02...	29	0.20	8.5	298	0.41	1160	0.010	0.910	0.050	0.50

DATE	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHORUS DIS- SOLVED (MG/L AS P) (00666)	PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	PHOS- MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)
OCT 06...	0.060	0.010	0.020	100	35	<3	22	10	7
DEC 09...	0.040	<0.010	0.020	20	30	<3	100	<4	21
MAR 18...	0.080	0.030	0.030	--	--	--	--	--	--
MAY 25...	0.070	0.030	0.040	30	35	<3	64	4	13
JUN 22...	0.060	0.040	0.030	20	38	<3	120	4	7
SEP 02...	0.050	0.030	0.020	--	--	--	--	--	--

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)	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 06...	<10	2	<1	<1.0	370	<6	5	9.6	88
DEC 09...	<10	7	<1	<1.0	260	<6	7	28	97
MAR 18...	--	--	--	--	--	--	15	70	85
MAY 25...	<10	5	<1	<1.0	260	<6	16	60	87
JUN 22...	<10	2	<1	<1.0	200	<6	55	1130	86
SEP 02...	--	--	--	--	--	--	22	86	93

## 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 September 1990, daily discharges greater than 10,000 ft<sup>3</sup>/s only; no daily discharges greater than 10,000 ft<sup>3</sup>/s water years 1944, 1949, 1953, 1955, 1958, 1961, 1963, 1964, 1966. Gage-height records for flood seasons 1910-20 are contained in reports of National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 565.05 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.--Water-discharge records good except for discharges less than 3,000 ft<sup>3</sup>/s, which are fair and for estimated daily discharges, which are poor. Minimum flows affected by wind direction and seiche on Saginaw Bay, 20.3 mi downstream. Considerable diversion through metropolitan area of Saginaw. National Weather Service gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4370	61820	9730	15400	e4500	e2700	25400	9240	4670	2230	2460	2850
2	5290	4650	7740	15000	e4600	e3000	25400	9340	5820	4280	2180	3880
3	1440	10200	7430	15600	e4700	e3200	22800	9310	4530	3530	3630	1720
4	511	12700	7450	12500	e4800	e3500	19500	8940	2840	4300	1040	3460
5	2280	13500	6040	19000	e4400	e4000	17900	9420	3730	5410	2620	1160
6	3140	12100	7300	25600	e3800	e4500	17900	12000	4420	4690	2260	1850
7	3900	10200	4930	25800	e3600	e5200	17200	12700	4210	3700	1640	1870
8	4270	9220	5820	21800	e3500	5990	15800	10200	5280	3520	1420	3220
9	5890	8240	5920	16500	e3700	7690	14600	8440	7220	4100	2730	3150
10	5250	8110	4350	13900	e3000	8410	12900	7380	5010	3450	3160	1050
11	3850	6490	3870	e12000	e3200	8390	11900	6520	5100	2100	2670	3270
12	2460	7780	4860	e9500	e3500	8050	11800	5710	3850	1140	2350	3360
13	2980	12900	5000	e8400	e3100	6760	12300	6230	4950	2240	1600	5240
14	2300	15500	5520	e8100	e2800	6110	10700	6150	5660	-596	1650	3280
15	706	15500	7140	e7800	e2700	6840	7300	5190	3230	2440	1450	1890
16	6940	13900	7640	e7000	e2600	7820	10700	3820	3840	2350	1640	4460
17	5490	10900	7110	e6400	e2500	5540	10600	3910	5720	2040	859	3830
18	6370	9940	7920	e9000	e2500	7740	10800	4640	4250	2960	2430	3650
19	6780	8790	8310	e5900	e2400	8490	8810	2030	3780	1920	2880	1820
20	7130	9210	7200	e5800	e2300	7330	14500	3940	8070	359	2020	2520
21	4790	9460	7290	e6300	e2200	6170	24200	4080	9750	-364	1770	1880
22	6400	5380	6200	e9000	e2600	4180	28800	4820	11300	1220	2790	3910
23	5880	12300	e4400	e9400	e3400	6430	29600	5490	10600	1490	4200	1580
24	2820	17800	e3600	e9300	e3700	9540	24800	6200	9180	2500	4940	3470
25	4770	20700	e3000	e9000	e3500	12600	19600	3600	8210	3050	3140	1030
26	1460	21000	e2500	e9200	e3300	15300	17100	4130	7230	3230	3340	1520
27	4640	16900	e2800	e8400	e3100	17800	15800	4970	6490	2750	4060	2590
28	4250	14600	e4200	e6500	e2900	20600	13400	3220	5310	3520	1330	3100
29	2170	12700	5580	e5700	--	23600	10200	4220	4520	916	2520	3950
30	2740	10400	5920	e4900	--	26600	9820	4150	4980	-1500	3690	5510
31	e2200	--	12200	e4600	--	26100	--	1960	--	1190	1860	--
TOTAL	123467	342890	188970	339300	92700	289180	493130	191950	173750	73865	76329	85170
MEAN	3983	11430	6096	10950	3311	9328	16440	6192	5792	2383	2462	2839
MAX	7130	21000	12200	26800	4700	26600	29800	12700	11300	5410	4940	5510
MIN	511	1820	2500	4600	2200	2700	7300	1960	2840	-1500	859	1030
CFSM	.68	1.89	1.01	1.81	.55	1.54	2.71	1.02	.96	.39	.41	.47
IN.	.76	2.10	1.16	2.08	.57	1.78	3.03	1.18	1.07	.45	.47	.52

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1991 - 1993, BY WATER YEAR (WY)

	MEAN	5349	9297	7931	7815	4804	11190	16790	7088	4347	3215	3194	3600
MAX	8165	11430	10060	10950	6054	13470	18470	9685	5792	3856	4133	5202	5202
(WY)	1991	1993	1991	1993	1991	1991	1991	1991	1993	1992	1992	1992	1992
MIN	3898	5532	6096	5233	3311	9328	15460	5386	2526	2383	2462	2760	2760
(WY)	1992	1992	1993	1992	1993	1993	1992	1992	1992	1993	1993	1993	1991

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1991 - 1993

ANNUAL TOTAL	2391531												
ANNUAL MEAN	6534												
HIGHEST ANNUAL MEAN										7037			
LOWEST ANNUAL MEAN										8170			1991
HIGHEST DAILY MEAN										6174			1992
LOWEST DAILY MEAN	27300									(a)67800			Mar 29 1904
ANNUAL SEVEN-DAY MINIMUM	-1980									-1980			Jun 19 1992
INSTANTANEOUS PEAK FLOW	941									941			Jun 14 1992
INSTANTANEOUS PEAK STAGE										(a)68000			Mar 30 1904
ANNUAL RUNOFF (CFSM)	1.08									(a)24.90			Mar 30 1904
ANNUAL RUNOFF (INCHES)	14.68									1.16			
10 PERCENT EXCEEDS	12600									15.78			
50 PERCENT EXCEEDS	5210									14600			
90 PERCENT EXCEEDS	2500									4930			
										1910			

(a) Includes water years 1904-1990.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE HURON

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 TEMPERATURE (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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	PH SPECIFIC CONDUCTANCE (US/CM) (00095)	WATER WHOLE FIELD (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	TURBIDITY (NTU) (00076)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATURATION) (00301)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREPTOCOCCI, KF AGAR (COLS. PER 100 ML) (31673)
OCT 08...	1100	1630	672	8.4	14.0	9.0	10.5	105	K89	K76
MAR 17...	0930	4860	732	8.2	0.0	3.5	13.8	96	220	110
MAY 27...	0900	4370	576	8.3	16.0	14	9.2	95	280	K12
SEP 01...	0900	3840	647	8.2	22.5	22	4.0	47	K230	K45

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 TOT IT FIELD (MG/L AS CaCO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
OCT 08...	270	80	73	20	41	3.2	216	5	185	35
MAR 17...	270	61	74	21	36	3.5	257	--	211	42
MAY 27...	230	38	65	17	24	2.5	237	--	194	37
SEP 01...	230	65	64	17	39	2.9	201	--	165	31

DATE	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-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) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)
OCT 08...	80	0.20	5.6	413	0.56	1820	<0.010	1.00	0.020	0.70
MAR 17...	71	0.10	6.4	398	0.54	5220	0.020	1.40	0.130	0.70
MAY 27...	51	<0.10	3.6	335	0.46	3950	0.020	0.570	0.060	0.50
SEP 01...	77	0.30	7.5	314	0.43	3260	0.020	0.820	0.050	0.60

## STREAMS TRIBUTARY TO LAKE HURON

04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	MANGA- BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	NESE, DIS- SOLVED (UG/L AS MN) (01056)
OCT 08...	0.080	0.010	<0.010	<10	43	<3	14	7	7
MAR 17...	0.080	0.020	0.010	10	42	<3	41	<4	35
MAY 27...	0.040	<0.010	<0.010	40	42	<3	24	<4	4
SEP 01...	0.050	0.030	0.030	10	40	<3	9	4	1

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS ND) (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)	SEDI- MENT, SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 08...	<10	2	<1	<1.0	280	<6	29	128	99
MAR 17...	<10	2	<1	<1.0	280	<6	8	105	97
MAY 27...	<10	2	<1	<1.0	240	<6	35	413	96
SEP 01...	<10	<1	<1	<1.0	280	<6	45	467	98

## STREAMS TRIBUTARY TO LAKE HURON

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 September 1993 (discontinued).

GAGE.--Water-stage recorder. Datum of gage 578.43 ft above sea level. Prior to June 10, 1987, nonrecording gage at same datum.

REMARKS.--Water-discharge records fair except for estimated daily discharges, which are poor. Some diversions at low flows for agricultural irrigation.

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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	44	109	153	e28	e12	354	105	33	23	3.1	16
2	16	81	92	232	e26	e12	243	103	38	20	2.1	16
3	13	e250	79	157	e24	e12	189	83	33	18	.91	13
4	11	e350	67	315	e24	e12	194	81	29	16	.81	11
5	9.8	e300	58	1180	e26	e12	257	87	27	15	1.2	9.6
6	7.8	e200	e45	1390	e28	e14	372	99	27	11	1.4	12
7	7.6	e150	e45	821	e30	e16	352	109	31	9.0	2.1	11
8	7.1	115	47	e150	e28	e20	267	83	46	8.4	2.4	8.9
9	e22	95	40	e80	e25	e25	214	63	100	7.2	1.3	7.3
10	28	87	38	e60	e21	e35	248	51	110	8.4	2.6	7.0
11	30	94	37	e54	e20	e50	265	43	82	7.8	5.6	6.5
12	39	e220	39	e47	e19	e40	179	39	59	7.5	7.5	5.8
13	39	e800	46	e45	e18	e30	123	35	47	5.8	39	5.6
14	38	e420	73	e43	e18	e25	95	32	43	5.3	19	7.8
15	36	e150	96	e41	e18	e20	82	30	43	5.0	10	56
16	55	131	99	e39	e17	e27	111	29	37	4.8	8.6	63
17	114	135	100	e36	e16	e35	169	26	32	5.0	19	63
18	e200	136	97	e33	e16	e50	156	24	29	5.5	38	46
19	e170	132	79	e30	e16	e60	127	23	33	15	21	29
20	135	134	66	e28	e15	e54	725	21	134	37	14	21
21	107	136	e55	e25	e15	e50	1280	21	255	27	9.2	17
22	104	161	e50	e35	e15	e56	833	19	204	16	7.7	16
23	155	e530	e35	e50	e14	e70	350	19	124	12	6.7	15
24	159	e750	e25	e70	e13	e90	204	24	78	10	7.7	13
25	130	e600	e25	e100	e12	e130	194	30	59	8.1	6.5	13
26	106	385	e25	e60	e12	e200	291	30	50	6.6	5.7	14
27	85	265	e26	e50	e12	e400	207	25	43	6.3	5.2	15
28	70	205	e28	e41	e12	e920	135	23	37	5.3	12	22
29	62	165	e30	e36	---	871	109	20	31	4.2	13	47
30	58	132	e34	e33	---	690	97	20	26	4.0	15	80
31	51	---	79	e30	---	505	---	25	---	4.0	14	---
TOTAL	2085.3	7353	1764	5204	538	4543	8422	1422	1920	338.2	302.32	667.5
MEAN	67.3	245	56.9	168	19.2	147	281	45.9	64.0	10.9	9.75	22.2
MAX	200	800	109	1330	30	920	1280	109	255	37	39	80
MIN	7.1	44	25	25	12	12	82	19	26	4.0	.81	5.6
CFSM	.54	1.96	.46	1.34	.15	1.17	2.25	.37	.51	.09	.08	.18
IN.	.62	2.19	.52	1.55	.16	1.35	2.51	.42	.57	.10	.09	.20

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1987 - 1993, BY WATER YEAR (WY)

	1987	1988	1989	1990	1991	1992	1993
MEAN	125	142	92.7	66.0	51.6	252	230
MAX	363	334	239	168	129	466	397
(WY)	1987	1991	1988	1993	1991	1992	1989
MIN	2.76	10.3	22.4	21.4	10.6	147	103
(WY)	1992	1992	1990	1988	1989	1993	1987

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1987 - 1993

ANNUAL TOTAL	41786.3	34559.32	
ANNUAL MEAN	114	94.7	
HIGHEST ANNUAL MEAN			94.9
LOWEST ANNUAL MEAN			174
HIGHEST DAILY MEAN	1840	1330	2100
LOWEST DAILY MEAN	5.0	.81	.00
ANNUAL SEVEN-DAY MINIMUM	6.7	1.4	.00
INSTANTANEOUS PEAK FLOW		1610	(b)2260
INSTANTANEOUS PEAK STAGE		12.06	(c)14.75
INSTANTANEOUS LOW FLOW		.50	.00
ANNUAL RUNOFF (CFSM)	.91	.76	.76
ANNUAL RUNOFF (INCHES)	12.44	10.28	10.32
10 PERCENT EXCEEDS	307	210	221
50 PERCENT EXCEEDS	45	36	31
90 PERCENT EXCEEDS	12	7.6	2.5

(a) No flow at times most years.

(b) Gage height, 13.20 ft, from floodmark.

(c) From graph based on gage readings.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE HURON

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to August 1993 (discontinued).

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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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 07...	1430	7.9	811	8.4	11.5	1.0	11.3	106	K33	K23
MAR 16...	1430	25	708	7.9	0.0	3.2	4.4	31	--	--
MAY 26...	1400	30	741	8.0	14.5	2.9	9.3	93	K200	K33
AUG 31...	1430	14	653	8.0	20.5	2.1	8.0	91	1000	780

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 07...	400	120	110	30	16	5.1	327	8	281	83
MAR 16...	320	84	92	23	15	5.4	294	--	241	72
MAY 26...	370	94	100	29	13	3.4	337	--	276	78
AUG 31...	300	89	81	23	19	7.0	254	--	208	62

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) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)
OCT 07...	48	0.20	2.0	495	0.87	10.6	<0.010	3.00	0.020	0.50
MAR 16...	38	0.10	5.4	437	0.59	29.0	0.050	2.20	1.10	2.0
MAY 26...	34	0.20	1.5	442	0.60	35.8	0.020	0.560	0.090	0.60
AUG 31...	42	0.30	7.0	279	0.38	10.3	0.020	1.20	0.050	0.60



## STREAMS TRIBUTARY TO LAKE HURON

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	PHOS- PHORUS TOTAL (MG/L AS P) (00665)	PHOS- PHORUS DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)
OCT 07...	0.030	0.010	0.010	<10	50	<3	11	9	4
MAR 16...	0.160	0.110	0.080	150	43	<3	44	<4	81
MAY 26...	0.030	<0.010	<0.010	50	45	<3	16	6	25
AUG 31...	0.170	0.150	0.150	<10	42	<3	14	7	15

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)	SEDI- MENT, SUS- PENDEED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDEED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 07...	<10	1	<1	<1.0	280	<6	82	1.7	72
MAR 16...	<10	<1	<1	<1.0	240	<6	4	0.27	94
MAY 26...	<10	1	<1	<1.0	280	<6	59	4.8	42
AUG 31...	<10	<1	<1	<1.0	240	<6	10	0.37	75

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

## 04159492 BLACK RIVER NEAR JEDDO, MI

LOCATION.--Lat 43°09'09", long 82°37'27", in SE1/4 SE1/4 sec.6, T.8 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, on right bank 650 ft upstream from bridge on Jeddo Road, 0.4 mi downstream from Silver Creek, and 2.2 mi west of Jeddo.

DRAINAGE AREA.--464 mi<sup>2</sup>.

PERIOD OF RECORD.--February 1944 to current year. Published as "near Fargo" prior to October 1991.

REVISED RECORDS.--WSP 1307: 1950(M). WSP 1627: 1956-58. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 655 ft above sea level, from topographic map. Prior to July 9, 1954, nonrecording gage and July 10, 1954, to September 1991 water-stage recorder at site 7.6 mi downstream at different datum (station 04159500).

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	125	85	349	2090	e185	65	2600	458	68	80	35	36
2	105	279	308	744	e170	66	2420	340	69	71	33	37
3	88	2080	275	509	e155	68	1830	261	67	66	32	41
4	75	1390	235	2160	e155	e73	1340	224	63	61	32	39
5	65	743	213	5580	e170	e80	1620	618	64	57	32	37
6	59	504	171	3510	e175	85	1710	1150	68	51	34	36
7	56	376	e160	1430	e180	e95	1240	580	73	48	36	35
8	49	298	e155	842	e140	110	929	383	69	45	35	35
9	58	248	153	578	e115	e150	838	287	73	45	37	33
10	55	223	149	331	e100	e210	1290	223	85	48	36	31
11	59	213	163	270	e95	e250	1010	186	79	47	35	30
12	56	649	196	e350	e90	e200	673	163	69	48	33	34
13	54	4370	290	e290	e86	e150	571	143	62	44	35	36
14	51	3100	344	e260	e82	e120	456	128	58	46	38	35
15	58	1270	320	e250	e80	e110	384	128	409	43	36	60
16	159	720	397	e240	e78	e100	417	124	390	42	43	77
17	566	548	470	e220	e77	e110	544	109	186	41	70	86
18	413	527	354	e200	e77	e200	442	97	122	39	56	70
19	257	646	282	191	e78	e280	366	95	105	42	48	57
20	198	604	249	183	e79	e260	3400	94	385	42	40	48
21	249	701	179	163	e80	238	5060	92	1590	44	37	44
22	411	736	173	294	e80	261	1800	88	1540	41	34	41
23	335	1940	181	784	e79	501	874	83	692	38	32	39
24	260	2230	123	1070	e80	861	595	81	362	36	32	37
25	205	1290	e150	1030	e84	1830	674	90	223	36	43	36
26	167	1050	e120	751	e76	2340	610	85	185	37	40	37
27	147	825	e90	495	e70	2910	446	77	166	37	38	39
28	132	624	95	343	e66	4570	353	73	132	37	37	56
29	119	496	100	236	---	5790	309	72	113	37	34	148
30	107	410	273	175	---	4670	331	68	93	37	32	145
31	94	---	2670	e200	---	3510	---	66	---	36	35	---
TOTAL	4832	29175	9387	25769	2982	30263	35132	6666	7660	1422	1170	1515
MEAN	156	972	303	831	106	976	1171	215	255	45.9	37.7	50.5
MAX	566	4370	2670	5580	185	5790	5060	1150	1590	80	70	148
MIN	49	85	90	163	66	65	309	66	58	36	32	30
CFSM	.34	2.10	.65	1.79	.23	2.10	2.52	.46	.55	.10	.08	.11
IN.	.39	2.34	.75	2.07	.24	2.43	2.82	.53	.61	.11	.09	.12

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1944 - 1993, BY WATER YEAR (WY)

MEAN	118	169	257	251	413	1031	675	292	160	70.9	58.3	115
MAX	1316	972	1031	1315	1855	3218	2102	1511	796	346	559	2237
(WY)	1987	1993	1951	1952	1954	1985	1947	1956	1967	1992	1953	1986
MIN	7.62	10.5	10.3	8.37	15.8	48.9	54.2	40.4	22.4	13.1	8.34	5.53
(WY)	1964	1945	1959	1945	1959	1964	1946	1958	1949	1966	1948	1948

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1944 - 1993

ANNUAL TOTAL	150490	155973	302
ANNUAL MEAN	411	427	705
HIGHEST ANNUAL MEAN			1985
LOWEST ANNUAL MEAN			1964
HIGHEST DAILY MEAN	6970	5790	10100
LOWEST DAILY MEAN	35	30	2.0
ANNUAL SEVEN-DAY MINIMUM	39	33	2.7
INSTANTANEOUS PEAK FLOW		6150	(a)14400
INSTANTANEOUS PEAK STAGE		13.38	(b)18.05
INSTANTANEOUS LOW FLOW		28	(c)1.8
ANNUAL RUNOFF (CFSM)	.89	.92	.65
ANNUAL RUNOFF (INCHES)	12.07	12.50	8.83
10 PERCENT EXCEEDS	1010	1060	664
50 PERCENT EXCEEDS	178	132	60
90 PERCENT EXCEEDS	55	37	15

(a) From rating curve extended above 9,500 ft<sup>3</sup>/s.

(b) Observed; backwater from ice; site and datum then in use.

(c) Observed; site then in use.

(d) Sept. 18, 19, 1946.

(e) Estimated.

## STREAMS TRIBUTARY TO ST. CLAIR RIVER

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 sea level.

REMARKS.--Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	60	38	140	e630	e64	e27	1070	156	26	51	12	e10
2	51	77	121	e300	e60	e28	1020	133	26	43	11	e11
3	43	271	107	e200	e56	e29	892	113	25	38	11	e12
4	37	282	95	e600	e56	e31	734	101	23	34	10	e11
5	33	215	86	e1200	e60	e34	671	254	25	30	10	e10
6	29	160	78	e800	e64	e37	595	311	25	28	9.9	e9.9
7	27	128	e71	e450	e62	e40	476	217	26	26	10	e9.8
8	26	105	e66	e300	e60	e48	376	159	28	24	10	e9.8
9	27	89	e63	e180	e56	e62	320	124	35	23	9.7	e9.4
10	27	80	e60	e150	e51	e90	378	101	31	22	10	e9.2
11	35	78	63	e120	e47	e110	330	84	31	21	10	e9.0
12	34	225	74	e110	e43	e95	272	71	27	21	9.5	e9.7
13	30	847	87	e100	e44	e80	240	62	26	19	9.4	e10
14	28	735	93	e96	e42	e60	195	59	27	19	8.8	e11
15	34	509	95	e92	e41	e50	165	60	26	18	8.3	e18
16	65	352	109	e88	e40	e45	167	58	34	18	8.9	e22
17	124	273	118	e82	e38	e50	175	53	33	17	9.2	e25
18	122	249	112	e76	e37	e80	187	50	30	16	8.8	e20
19	97	237	100	e68	e36	e120	170	50	36	17	8.2	e17
20	80	205	94	e66	e35	e110	155	48	198	17	e8.0	e14
21	82	180	80	e66	e33	e100	666	46	647	17	e8.1	e13
22	98	165	77	e150	e32	e120	952	46	727	16	e8.2	e12
23	100	350	67	e210	e31	228	698	43	524	15	e8.8	e11
24	88	449	48	e300	e30	356	469	42	321	14	e10	e10
25	76	383	e45	e250	e29	594	341	40	224	13	e12	e10
26	66	317	e43	e200	e29	776	286	36	166	15	e11	e11
27	57	270	e40	e150	e28	959	231	32	138	14	e10	e12
28	52	224	e47	e100	e28	1150	178	31	111	14	e10	e17
29	48	188	53	e80	---	1330	141	29	89	13	e9.6	e42
30	44	163	118	e74	---	1270	135	27	68	12	e9.0	e41
31	41	---	606	e68	---	1130	---	27	---	12	e9.7	---
TOTAL	1761	7844	3056	7356	1232	9239	12685	2663	3753	657	299.1	436.6
MEAN	56.8	261	98.6	237	44.0	298	423	85.9	125	21.2	9.65	14.6
MAX	124	847	606	1200	64	1330	1070	311	727	51	12	42
MIN	26	38	40	66	28	27	135	27	23	12	8.0	9.0
CFSM	.34	1.55	.58	1.40	.26	1.76	2.50	.51	.74	.13	.06	.09
IN.	.39	1.73	.67	1.62	.27	2.03	2.79	.59	.83	.14	.07	.10

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1963 - 1993, BY WATER YEAR (WY)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
MEAN	18.4	56.8	89.6	109	134	288	253	89.5	56.0	18.3	14.2	12.7																			
MAX	67.4	261	266	404	382	664	715	328	274	62.6	57.3	95.9																			
(WY)	1991	1993	1988	1974	1968	1973	1975	1974	1989	1967	1973	1992																			
MIN	2.76	5.25	3.72	6.03	6.21	11.2	26.1	16.2	5.91	2.36	3.17	2.39																			
(WY)	1964	1965	1964	1964	1964	1964	1964	1964	1964	1963	1964	1963																			

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1963 - 1993

	1992	1993	1963-1993
ANNUAL TOTAL	43201	50981.7	96.4
ANNUAL MEAN	118	140	174
HIGHEST ANNUAL MEAN			7.84
LOWEST ANNUAL MEAN			3940
HIGHEST DAILY MEAN	963	1330	90
LOWEST DAILY MEAN	13	8.0	1.2
ANNUAL SEVEN-DAY MINIMUM	14	8.5	4570
INSTANTANEOUS PEAK FLOW		1380	8.87
INSTANTANEOUS PEAK STAGE		6.91	.80
INSTANTANEOUS LOW FLOW			.57
ANNUAL RUNOFF (CFSM)	.70	.83	7.75
ANNUAL RUNOFF (INCHES)	9.51	11.22	228
10 PERCENT EXCEEDS	317	351	25
50 PERCENT EXCEEDS	66	56	4.8
90 PERCENT EXCEEDS	20	10	

(a) Aug. 9, 10, 11, 1964.

(e) Estimated.

## 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 sea level (levels by Boldt, McLeod, and Johnson, Inc.). Prior to Feb. 24, 1985, at datum 2.00 ft higher.

REMARKS.--Records good except for estimated daily discharges, which are fair. Some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.6	4.9	13	37	e11	e6.7	74	19	9.8	8.8	3.1	7.0
2	4.1	22	15	29	e10	e7.4	59	14	7.3	8.0	3.0	7.6
3	4.0	34	13	25	e9.5	e8.2	46	13	5.0	7.3	2.7	13
4	3.4	24	11	68	e10	e8.8	39	12	5.4	6.3	2.3	12
5	3.1	18	e11	91	e10	e9.2	39	24	12	5.6	2.2	7.1
6	2.9	14	10	44	e10	e9.7	35	21	11	5.0	2.2	6.1
7	3.1	11	9.8	33	e9.0	e10	31	15	11	4.7	2.6	5.7
8	3.0	9.2	9.1	27	e8.0	e11	26	13	15	4.1	2.1	4.3
9	6.6	8.8	8.4	23	e7.6	e19	25	11	24	3.9	2.1	3.8
10	5.7	8.9	8.6	19	e7.4	e18	29	9.6	16	3.5	6.0	3.3
11	5.2	10	9.9	e18	e7.0	e15	24	8.5	12	3.1	4.0	3.0
12	4.7	44	12	e17	e6.7	e13	27	7.8	8.0	3.2	3.2	3.8
13	4.0	96	13	e17	e6.6	e11	24	6.6	6.9	3.2	2.7	4.1
14	3.6	41	12	e17	e6.5	e10	20	6.2	11	3.2	2.5	4.1
15	13	29	12	e16	e6.4	e8.5	19	9.2	9.8	3.5	2.2	22
16	19	24	17	e14	e6.4	e9.0	25	6.8	7.5	3.2	2.9	13
17	14	23	14	e12	e6.3	e13	22	6.0	6.1	3.0	2.9	8.4
18	10	24	12	e11	e6.3	e16	17	6.1	4.4	5.1	2.5	7.7
19	8.9	20	11	e10	e6.2	e15	18	7.7	17	7.1	2.7	5.3
20	8.8	18	9.7	e9.2	e6.2	e11	108	7.3	89	4.1	2.9	4.5
21	14	17	8.6	e9.2	e6.3	13	44	7.0	139	3.1	2.4	6.4
22	13	20	7.9	e27	e6.3	18	30	7.2	62	2.8	2.2	6.0
23	11	66	7.6	e27	e6.4	26	25	7.1	36	2.6	2.8	5.0
24	9.1	40	e7.2	e25	e6.5	36	25	10	24	2.6	3.2	4.1
25	7.8	33	e6.4	e22	e6.6	48	28	8.4	20	3.6	2.7	3.5
26	7.7	29	e6.0	e19	e6.8	56	25	7.3	27	4.3	2.4	5.8
27	7.2	27	e5.7	e17	e6.7	73	18	6.2	20	3.2	3.6	16
28	6.4	24	5.4	e14	e6.6	85	13	9.2	14	4.2	13	30
29	5.8	20	8.1	e13	---	80	15	6.8	11	4.3	7.6	20
30	5.3	17	32	e12	---	66	19	5.3	9.4	4.5	10	13
31	4.8	---	84	e11	---	51	---	7.6	---	3.7	7.6	---
TOTAL	223.8	776.8	410.4	733.4	209.3	781.5	949	305.9	650.6	134.8	114.3	255.6
MEAN	7.22	25.9	13.2	23.7	7.47	25.2	31.6	9.87	21.7	4.35	3.69	8.52
MAX	19	96	84	91	11	85	108	24	139	8.8	13	30
MIN	2.9	4.9	5.4	9.2	6.2	6.7	13	5.3	4.4	2.6	2.1	3.0
CFSM	.40	1.44	.74	1.31	.42	1.40	1.76	.55	1.20	.24	.20	.47
IN.	.46	1.61	.85	1.52	.43	1.62	1.96	.63	1.34	.28	.24	.53

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

MEAN	7.88	10.6	12.2	11.0	16.0	30.3	24.4	10.7	8.91	4.74	3.31	6.21
MAX	36.8	31.0	28.2	32.9	46.6	60.5	59.6	32.3	32.6	12.5	10.1	38.4
(WY)	1987	1986	1988	1973	1976	1973	1975	1974	1989	1980	1980	1986
MIN	.82	2.49	2.71	2.64	3.24	8.92	9.15	2.76	1.21	.41	.57	.64
(WY)	1967	1966	1977	1977	1980	1989	1966	1977	1988	1966	1966	1965

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1965 - 1993

ANNUAL TOTAL	4495.3	5545.4	
ANNUAL MEAN	12.3	15.2	12.2
HIGHEST ANNUAL MEAN			20.6
LOWEST ANNUAL MEAN			5.13
HIGHEST DAILY MEAN	96	Nov 13	307
LOWEST DAILY MEAN	1.5	Jun 15	.01
ANNUAL SEVEN-DAY MINIMUM	1.7	Jul 1	.14
INSTANTANEOUS PEAK FLOW			(a)354
INSTANTANEOUS PEAK STAGE			(b)9.33
INSTANTANEOUS LOW FLOW			.00
ANNUAL RUNOFF (CFSM)	.68	.84	.68
ANNUAL RUNOFF (INCHES)	9.29	11.46	9.19
10 PERCENT EXCEEDS	27	30	27
50 PERCENT EXCEEDS	8.5	9.5	6.1
90 PERCENT EXCEEDS	3.3	3.2	1.7

(a) From rating curve extended above 100 ft<sup>3</sup>/s.

(b) Datum then in use.

(c) Part of each day June 27, 28, 1977, June 28-28, 1979, June 30, 1988, caused by irrigation pumpage.

(e) Estimated.



## STREAMS TRIBUTARY TO ST. CLAIR RIVER

## 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 sea level (Michigan Department of Transportation bench mark).

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1947 reached a stage of about 9 ft, from information by local residents.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	36	105	771	e80	e45	834	130	36	48	16	22
2	31	115	95	371	e75	e46	1110	108	37	48	15	23
3	29	383	92	257	e70	e48	764	95	35	44	15	28
4	27	337	82	541	e73	e50	524	90	32	40	14	40
5	26	198	76	1160	e74	e55	422	254	33	37	14	37
6	24	137	71	971	e70	e60	362	293	35	33	12	28
7	24	106	68	513	e65	e65	284	174	40	30	13	24
8	23	85	62	307	e60	e75	230	117	39	28	13	22
9	26	73	58	220	e55	e110	224	95	128	26	12	20
10	34	68	58	160	e52	e160	354	84	207	24	12	18
11	34	69	62	134	e50	e140	307	75	118	23	18	17
12	33	305	76	e130	e50	e110	241	70	81	22	18	17
13	31	846	103	e125	e49	e90	219	64	62	19	15	17
14	29	777	111	e120	e49	e70	150	60	54	17	14	18
15	35	427	102	e110	e48	e65	120	63	59	19	13	27
16	69	257	122	e100	e48	e70	133	63	55	18	15	64
17	88	186	136	e90	e47	e90	171	59	45	17	14	45
18	71	182	112	e80	e47	e115	138	57	39	16	14	32
19	57	172	95	e75	e46	e110	116	60	45	20	14	26
20	52	138	87	e70	e46	e100	416	62	322	27	13	22
21	63	122	73	e100	e45	86	772	65	865	19	14	21
22	84	121	70	e200	e45	108	402	61	726	17	12	22
23	77	369	62	e320	e45	184	239	57	416	16	13	22
24	67	464	52	e320	e46	347	177	57	202	14	21	21
25	63	341	e50	e250	e47	581	171	55	145	15	18	20
26	57	282	e45	e200	e47	809	173	51	130	18	13	20
27	52	225	e42	e170	e46	1040	143	47	101	19	12	23
28	47	176	e45	e120	e45	1260	117	46	81	18	12	59
29	44	142	50	e95	---	1300	107	41	65	18	24	92
30	42	119	186	e90	---	1130	122	37	53	19	23	64
31	38	---	662	e85	---	835	---	36	---	19	25	---
TOTAL	1410	7258	3110	8255	1520	9354	9542	2626	4286	748	471	911
MEAN	45.5	242	100	266	54.3	302	318	84.7	143	24.1	15.2	30.4
MAX	88	846	662	1160	80	1300	1110	293	865	48	25	92
MIN	23	36	42	70	45	45	107	36	32	14	12	17
CFSM	.30	1.60	.66	1.76	.36	2.00	2.11	.58	.95	.16	.10	.20
IN.	.35	1.79	.77	2.03	.37	2.30	2.35	.65	1.06	.18	.12	.22

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1963 - 1993, BY WATER YEAR (WY)

	MEAN	44.5	70.9	95.3	85.3	134	265	213	84.9	50.4	24.3	19.0	32.9
MAX	330	375	247	315	528	595	617	270	206	82.3	91.3	256	
(WY)	1982	1986	1988	1973	1976	1973	1975	1974	1989	1967	1992	1985	
MIN	5.00	7.62	5.50	8.92	8.00	15.8	25.9	20.9	6.44	5.21	5.08	5.54	
(WY)	1964	1965	1964	1964	1963	1964	1964	1977	1964	1965	1963	1979	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1963 - 1993

ANNUAL TOTAL	41576		49491									
ANNUAL MEAN	114		136									
HIGHEST ANNUAL MEAN										93.0		
LOWEST ANNUAL MEAN										168		1985
HIGHEST DAILY MEAN	846	Nov 13	1300	Mar 29	3320	Apr 19 1975				11.3		1964
LOWEST DAILY MEAN	12	Jul 6	12	Aug 6	2.4	Sep 6 1978						
ANNUAL SEVEN-DAY MINIMUM	15	Jul 1	13	Aug 4	2.6	Sep 5 1978						
INSTANTANEOUS PEAK FLOW			1340	Mar 28	4520	Apr 19 1975						
INSTANTANEOUS PEAK STAGE			6.56	Mar 28	8.96	Apr 19 1975						
INSTANTANEOUS LOW FLOW			11	(a)	2.3	(b)						
ANNUAL RUNOFF (CFSM)	.75		.90		.62							
ANNUAL RUNOFF (INCHES)	10.24		12.19		8.37							
10 PERCENT EXCEEDS	290		328		220							
50 PERCENT EXCEEDS	66		63		31							
90 PERCENT EXCEEDS	25		18		8.6							

(a) Aug. 9, 10, 27.

(b) Sept. 6, 10, 1978.

(c) Estimated.

## 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 sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	12	25	46	e20	e13	68	27	9.4	18	2.6	4.3
2	13	24	24	e39	e19	e13	70	23	8.7	16	2.5	5.5
3	12	28	26	32	19	14	66	22	8.4	15	2.2	12
4	11	22	26	50	18	14	62	22	8.6	14	2.2	11
5	10	20	23	69	18	e15	58	31	17	12	2.0	8.1
6	9.8	19	20	59	e18	16	54	27	17	11	2.0	8.1
7	9.2	17	19	51	e17	15	50	25	19	10	2.4	8.7
8	8.9	16	18	45	16	16	47	22	28	9.3	2.4	7.2
9	14	17	17	e41	e16	17	47	20	30	9.0	2.2	6.3
10	13	17	18	e39	15	17	50	19	25	9.3	2.2	5.9
11	12	19	18	e38	15	17	45	17	17	8.4	2.3	5.3
12	11	34	19	37	15	e15	44	16	13	7.1	2.1	5.0
13	9.7	64	20	39	15	e14	41	14	10	6.4	1.9	4.9
14	9.2	49	19	40	14	e13	37	14	8.8	5.9	1.8	4.6
15	20	42	19	38	14	e13	36	14	7.6	5.7	1.7	15
16	24	35	21	36	e14	12	41	12	6.5	5.0	1.8	12
17	20	32	21	34	e14	14	39	11	5.7	4.6	1.9	9.0
18	18	31	20	e31	e14	e13	36	10	5.7	4.2	1.8	8.0
19	16	28	19	e28	e14	e14	36	11	10	4.2	2.3	7.0
20	15	27	18	e27	14	15	47	10	33	4.0	4.7	6.3
21	17	26	16	29	14	15	44	9.7	44	3.4	3.3	10
22	15	26	16	36	16	16	39	9.2	38	3.1	2.6	10
23	15	37	16	36	e15	19	36	8.8	31	2.8	5.0	8.7
24	15	35	e15	36	e14	23	33	10	26	2.6	7.7	7.6
25	14	35	e14	e32	e14	32	34	9.6	22	3.5	4.9	7.0
26	14	33	e13	e29	e13	41	33	8.9	25	5.3	3.9	9.0
27	14	30	e12	e26	e13	54	30	8.3	24	4.0	3.4	13
28	14	28	12	24	e13	65	28	8.9	23	3.2	2.9	24
29	14	26	15	e23	---	70	29	8.4	21	2.8	3.8	17
30	12	25	30	e22	---	69	29	7.4	19	2.6	6.2	15
31	12	---	54	21	---	64	---	9.9	---	2.5	4.8	---
TOTAL	424.8	854	623	1133	431	758	1309	466.1	561.4	214.9	93.5	275.5
MEAN	13.7	28.5	20.1	36.5	15.4	24.5	43.6	15.0	18.7	6.93	3.02	9.18
MAX	24	64	54	69	20	70	70	31	44	18	7.7	24
MIN	8.9	12	12	21	13	12	28	7.4	5.7	2.5	1.7	4.3
CFSM	.66	1.36	.96	1.75	.74	1.17	2.09	.72	.90	.33	.14	.44
IN.	.76	1.52	1.11	2.02	.77	1.35	2.33	.83	1.00	.38	.17	.49

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1960 - 1993, BY WATER YEAR (WY)

	MEAN	7.03	10.9	13.2	12.8	14.7	26.5	29.3	18.0	11.1	5.54	4.47	5.94
MAX	38.4	38.2	28.2	36.5	39.1	61.2	45.5	41.6	25.2	14.8	19.5	31.9	
(WY)	1982	1986	1988	1993	1976	1976	1975	1974	1989	1989	1975	1975	
MIN	.37	1.02	.95	1.46	2.15	6.28	13.0	8.03	1.58	.74	.30	.41	
(WY)	1964	1965	1964	1961	1964	1964	1964	1988	1988	1965	1984	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1960 - 1993

ANNUAL TOTAL	6605.6	7144.2	
ANNUAL MEAN	18.0	19.6	
HIGHEST ANNUAL MEAN			13.3
LOWEST ANNUAL MEAN			21.5
HIGHEST DAILY MEAN	64	Nov 13	1975
LOWEST DAILY MEAN	2.6	Jul 7	1964
ANNUAL SEVEN-DAY MINIMUM	3.4	Jul 1	Oct 1 1981
INSTANTANEOUS PEAK FLOW		70	Mar 29
INSTANTANEOUS PEAK STAGE		1.7	Aug 15
INSTANTANEOUS LOW FLOW		1.9	Aug 12
ANNUAL RUNOFF (CFSM)	.86	.94	.04
ANNUAL RUNOFF (INCHES)	11.76	12.72	.04
10 PERCENT EXCEEDS	29	39	181
50 PERCENT EXCEEDS	17	15	4.53
90 PERCENT EXCEEDS	8.5	4.1	.03
			.63
			8.62
			31
			9.3
			1.6

(a) July 9, 16, 1988.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

## 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 sea level, from topographic map. Jan. 29 to July 9, 1964, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48	28	91	74	94	63	123	92	35	97	55	54
2	38	62	90	e78	92	63	137	84	35	83	35	59
3	37	91	87	78	88	64	138	73	36	72	14	69
4	37	90	87	88	84	64	143	74	37	64	14	66
5	35	88	87	95	81	67	147	78	41	58	14	64
6	34	91	87	103	79	67	150	79	39	55	14	67
7	22	90	86	112	76	66	152	84	43	52	13	67
8	14	90	85	121	73	67	154	86	83	32	12	69
9	20	89	86	123	71	67	158	90	115	10	12	67
10	34	88	89	126	69	68	160	89	123	13	24	61
11	34	86	86	125	68	67	161	78	130	15	19	48
12	34	96	84	122	69	67	160	38	111	17	13	34
13	34	104	83	125	70	66	156	38	86	18	12	27
14	36	101	81	124	70	e65	149	39	70	24	12	28
15	76	102	80	121	70	63	143	39	55	26	12	63
16	91	102	78	119	70	64	140	38	55	25	12	77
17	92	102	77	116	70	66	136	37	45	19	11	76
18	93	100	76	113	70	65	135	29	25	19	11	75
19	93	99	74	110	70	65	134	20	44	19	13	72
20	88	95	72	107	69	67	138	24	113	18	19	65
21	83	92	71	107	70	68	132	24	147	16	32	64
22	78	92	70	109	71	69	127	25	149	16	35	65
23	80	95	69	107	70	71	124	26	148	14	43	64
24	80	93	e67	106	e69	72	122	33	142	12	57	64
25	74	94	65	105	e68	74	120	57	136	15	67	63
26	65	94	e63	104	67	77	119	59	125	13	63	65
27	50	94	62	102	66	81	115	58	116	13	60	68
28	27	94	59	100	64	84	111	47	111	22	52	70
29	26	93	62	98	---	91	108	37	106	46	49	72
30	26	93	71	97	---	98	101	35	101	25	54	71
31	26	---	75	95	---	106	---	36	---	16	56	---
TOTAL	1605	2728	2400	3308	2048	2202	4093	1646	2602	944	909	1874
MEAN	51.8	90.9	77.4	107	73.1	71.0	136	53.1	86.7	30.5	29.3	62.5
MAX	93	104	91	126	94	106	161	92	149	97	67	77
MIN	14	28	59	74	64	63	101	20	25	10	11	27
CFSM	.65	1.15	.98	1.35	.92	.90	1.72	.67	1.10	.38	.37	.79
IN.	.75	1.28	1.13	1.55	.96	1.03	1.92	.77	1.22	.44	.43	.88

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1960 - 1993, BY WATER YEAR (WY)

	MEAN	38.1	50.5	61.6	56.9	58.0	82.2	93.8	60.7	44.3	28.7	25.3	31.0
MAX	114	107	109	114	115	188	168	137	94.5	82.0	68.5	129	
(WY)	1982	1986	1986	1973	1974	1976	1974	1974	1989	1968	1968	1975	
MIN	4.83	7.90	15.6	15.5	16.6	28.8	52.5	22.9	6.47	5.79	6.39	4.80	
(WY)	1965	1965	1964	1964	1964	1964	1967	1988	1988	1988	1963	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1960 - 1993

	24799	26359	52.5	
ANNUAL TOTAL	67.8	72.2	87.9	1974
ANNUAL MEAN			20.0	1964
HIGHEST ANNUAL MEAN			274	Mar 12 1974
LOWEST ANNUAL MEAN			3.1	Sep 18 1963
HIGHEST DAILY MEAN	128	161	3.5	Sep 16 1963
LOWEST DAILY MEAN	14	10	276	Mar 12 1974
ANNUAL SEVEN-DAY MINIMUM	16	12	4.95	Mar 12 1974
INSTANTANEOUS PEAK FLOW		164	2.4	May 31 1961
INSTANTANEOUS PEAK STAGE		4.09		
INSTANTANEOUS LOW FLOW		8.0		
ANNUAL RUNOFF (CFSM)	.86	.91	.66	
ANNUAL RUNOFF (INCHES)	11.65	12.38	9.01	
10 PERCENT EXCEEDS	103	122	103	
50 PERCENT EXCEEDS	72	70	46	
90 PERCENT EXCEEDS	28	20	11	

(e) Estimated.

## 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 sea level.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	49	42	e78	108	78	e49	334	72	38	55	23	29
2	43	118	e77	83	e73	48	332	72	34	52	23	39
3	39	97	e75	93	69	54	267	69	32	48	22	83
4	36	72	e73	255	68	57	231	69	31	44	22	62
5	34	63	e71	297	65	56	212	85	58	40	21	45
6	39	62	e69	198	65	57	184	61	45	37	24	48
7	43	57	e66	168	e62	60	163	56	57	34	25	45
8	40	56	e64	163	59	69	145	54	91	32	22	38
9	59	55	e64	149	56	73	151	54	89	33	22	35
10	44	57	65	134	56	68	170	51	77	33	23	33
11	37	61	67	127	56	64	143	50	69	30	23	31
12	34	163	69	114	56	63	143	48	62	25	22	30
13	32	233	69	120	57	62	127	44	52	23	21	33
14	32	127	66	114	55	e61	117	43	51	24	20	34
15	88	111	64	104	54	e60	114	44	45	24	19	104
16	71	99	71	97	54	e59	135	41	37	22	25	63
17	58	97	66	92	54	70	119	39	33	20	22	52
18	53	96	63	e86	e52	62	108	39	32	19	20	48
19	51	e91	62	e84	e51	56	107	47	69	20	35	45
20	52	e90	62	e82	e50	57	160	44	241	17	54	42
21	67	e89	58	e96	e52	60	130	40	310	17	26	56
22	56	e120	57	137	e56	63	117	38	166	17	22	57
23	52	e150	57	115	e56	77	112	39	135	15	57	49
24	59	e120	e55	114	e54	92	110	47	118	14	45	43
25	54	e105	e50	102	e52	111	120	45	101	29	30	41
26	51	e95	e45	93	e51	136	114	42	95	32	26	54
27	49	e89	e43	88	e50	184	102	39	84	25	24	116
28	45	e85	e43	86	e49	213	91	42	81	40	22	108
29	43	e82	62	e81	---	219	98	37	71	27	33	72
30	41	e80	140	e79	---	230	92	34	61	25	40	59
31	40	---	199	77	---	231	---	39	---	23	33	---
TOTAL	1491	2862	2170	3736	1610	2821	4548	1524	2465	896	846	1594
MEAN	48.1	95.4	70.0	121	57.5	91.0	152	49.2	82.2	28.9	27.3	53.1
MAX	88	233	199	297	78	231	334	85	310	55	57	116
MIN	32	42	43	77	49	48	91	34	31	14	19	29
CFSM	.68	1.35	.99	1.70	.81	1.28	2.14	.69	1.16	.41	.38	.75
IN.	.78	1.50	1.14	1.96	.84	1.48	2.39	.80	1.29	.47	.44	.84

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1960 - 1993, BY WATER YEAR (WY)

MEAN	38.9	45.4	52.1	50.8	59.2	96.6	101	62.3	45.0	28.5	25.6	35.3
MAX	123	120	103	127	160	204	194	146	115	58.0	66.7	104
(WY)	1982	1986	1976	1973	1976	1976	1975	1974	1989	1992	1975	1975
MIN	8.50	11.0	14.5	14.9	15.4	25.9	37.2	28.5	13.5	11.7	12.0	12.2
(WY)	1964	1964	1965	1964	1963	1964	1964	1977	1988	1963	1965	1963

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1960 - 1993

ANNUAL TOTAL	22859		26563									
ANNUAL MEAN	62.5		72.8							53.3		
HIGHEST ANNUAL MEAN										86.7		1976
LOWEST ANNUAL MEAN										20.4		1964
HIGHEST DAILY MEAN	233			Nov 13		334		Apr 1		660		Feb 2 1968
LOWEST DAILY MEAN	16			Jul 7		14		Jul 24		6.8		Aug 15 1988
ANNUAL SEVEN-DAY MINIMUM	20			Jul 1		17		Jul 18		7.9		Oct 4 1963
INSTANTANEOUS PEAK FLOW						409		Apr 1		918		Feb 1 1968
INSTANTANEOUS PEAK STAGE						3.63		Apr 1		(a)5.95		Feb 10 1965
INSTANTANEOUS LOW FLOW						14		(b)		(c)1.2		Aug 19 1974
ANNUAL RUNOFF (CFSM)	.88					1.03				.75		
ANNUAL RUNOFF (INCHES)	11.99					13.94				10.21		
10 PERCENT EXCEEDS	104					134				103		
50 PERCENT EXCEEDS	54					57				40		
90 PERCENT EXCEEDS	31					25				16		

(a) Backwater from ice.

(b) July 22, 24.

(c) Caused by regulation due to bridge construction.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

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 sea level.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	11	28	e46	e23	e14	109	23	9.4	8.3	8.3	9.5
2	9.7	26	26	e41	e21	e15	105	21	7.5	11	7.6	11
3	9.3	32	24	37	19	e16	95	20	6.5	15	8.7	17
4	8.9	26	21	62	18	17	85	21	6.2	13	6.4	15
5	8.3	23	21	85	19	18	78	28	14	12	4.3	12
6	8.1	21	18	77	20	18	71	25	11	10	4.1	12
7	7.6	18	19	e62	e18	18	64	20	13	8.8	5.1	11
8	7.6	16	18	55	16	20	58	18	22	8.0	4.1	9.9
9	12	16	17	e48	15	e21	56	17	31	7.9	3.7	8.8
10	9.4	17	18	e44	15	e23	60	19	23	7.6	3.8	8.3
11	8.5	18	19	e40	15	e21	52	17	28	7.3	3.7	7.1
12	8.2	32	21	39	15	e20	50	12	23	6.5	3.5	7.9
13	7.4	54	22	40	16	e19	48	10	21	4.7	3.4	9.0
14	7.2	49	21	40	16	e18	45	9.5	19	4.8	3.3	7.5
15	16	43	21	38	15	e17	43	11	17	4.6	3.1	21
16	18	38	25	35	15	e18	46	9.2	24	3.9	4.0	20
17	14	38	24	33	e15	e19	44	8.2	21	3.6	3.7	18
18	12	38	22	e29	e14	e18	40	8.0	8.0	3.6	3.2	16
19	9.8	33	21	e25	e14	e17	38	11	12	3.9	3.2	15
20	8.8	30	20	e24	e14	e18	52	9.4	37	3.8	3.7	13
21	12	29	16	e26	e15	e19	48	10	52	3.5	3.4	14
22	14	34	17	37	e16	e21	38	9.7	48	3.3	3.1	13
23	14	49	16	34	e16	e24	36	9.5	42	3.2	4.4	12
24	13	48	16	36	e15	e28	35	16	34	3.2	5.7	11
25	8.1	47	14	e34	e15	e34	37	26	29	4.4	8.7	10
26	7.0	43	12	e30	e14	e45	35	23	25	5.5	8.3	13
27	6.3	38	12	29	e14	e60	30	9.0	15	4.1	8.0	18
28	6.0	34	12	28	e14	e80	27	8.3	12	8.9	7.5	25
29	6.3	31	17	e26	---	e100	28	6.9	10	6.3	8.8	17
30	9.5	29	35	e25	---	108	28	5.9	8.9	9.3	10	15
31	11	---	60	24	---	102	---	9.0	---	9.6	9.3	---
TOTAL	308.0	961	653	1229	452	986	1581	450.6	629.5	209.6	188.1	397.0
MEAN	9.94	32.0	21.1	39.6	16.1	31.8	52.7	14.5	21.0	6.78	5.42	13.2
MAX	18	54	60	85	23	108	109	28	52	15	10	25
MIN	6.0	11	12	24	14	14	27	5.9	6.2	3.2	3.1	7.1
CFSM	.39	1.25	.82	1.55	.63	1.24	2.06	.57	.82	.26	.21	.52
IN.	.45	1.40	.95	1.79	.66	1.43	2.30	.65	.91	.30	.24	.58

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

	MEAN	10.6	15.9	18.3	17.2	21.2	36.0	36.1	18.3	13.2	8.14	7.02	9.05
MAX	25.1	46.2	41.3	47.7	62.9	79.7	75.1	57.1	47.7	20.0	48.5	41.2	
(WY)	1962	1966	1976	1973	1976	1976	1975	1974	1989	1969	1975	1975	
MIN	1.79	2.06	3.56	5.26	7.22	14.6	18.2	5.82	2.67	1.47	1.63	1.52	
(WY)	1967	1965	1965	1965	1979	1983	1966	1977	1988	1965	1965	1966	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1965 - 1993
ANNUAL TOTAL	6602.1	8024.8	
ANNUAL MEAN	18.0	22.0	17.5
HIGHEST ANNUAL MEAN			31.5
LOWEST ANNUAL MEAN			9.38
HIGHEST DAILY MEAN	63	109	245
LOWEST DAILY MEAN	3.0	3.1	.92
ANNUAL SEVEN-DAY MINIMUM	4.3	3.4	1.2
INSTANTANEOUS PEAK FLOW		113	290
INSTANTANEOUS PEAK STAGE		3.55	5.19
INSTANTANEOUS LOW FLOW		2.8	.92
ANNUAL RUNOFF (CFSM)	.70	.86	.69
ANNUAL RUNOFF (INCHES)	9.59	11.66	9.31
10 PERCENT EXCEEDS	35	45	38
50 PERCENT EXCEEDS	15	17	12
90 PERCENT EXCEEDS	6.0	6.0	3.3

(a) Oct. 5, 9, 1967.

(e) Estimated.

## 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 sea level (levels by Huron-Clinton Metropolitan Authority); gage readings have been converted to elevations above sea level.

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, 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, Apr. 1, 1993, elevation, 803.6 ft; minimum recorded, 1,758 acre-ft, Nov. 21, 1967, elevation, 794.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,495 acre-ft, Apr. 1, elevation, 803.60 ft; minimum, 4,071 acre-ft, Dec. 29, elevation, 800.83 ft.

MONTHEND ELEVATION, IN FEET ABOVE SEA LEVEL, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

Date	Elevation (feet)	Contents (acre-feet)	Change in contents	
			(acre- feet)	(equivalent in ft <sup>3</sup> /s)
Sept. 30 .....	802.20	4,753	--	--
Oct. 31 .....	801.07	4,187	-566	-9.2
Nov. 30 .....	802.22	4,763	+576	+9.7
Dec. 31 .....	801.26	4,279	-484	-7.9
CAL YR 1992 .....	--	--	+2,228	+3.1
Jan. 31 .....	801.11	4,206	-73	-1.2
Feb. 28 .....	800.87	4,091	-115	-2.1
Mar. 31 .....	803.18	5,268	+1,177	+19.1
Apr. 30 .....	802.64	4,982	-286	-4.8
May 31 .....	802.22	4,763	-219	-3.6
June 30 .....	802.28	4,795	+32	+0.5
July 31 .....	802.09	4,696	-99	-1.6
Aug. 31 .....	802.13	4,717	+21	+0.3
Sept. 30 .....	802.29	4,800	+83	+1.4
WTR YR 1993 .....	--	--	+47	+0.1

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

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 sea level (levels by Huron-Clinton Metropolitan Authority).

REMARKS.--Records good except for estimated daily discharges, which are poor. Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963; occasional regulation by Stony Lake since (see preceding page). From 1963 to 1991 annual mean discharge and runoff figures adjusted for change in contents in Stony Lake. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	e40	80	121	57	39	249	74	31	46	20	22
2	41	e60	76	106	50	40	262	68	31	46	20	24
3	45	e80	77	103	49	43	235	65	32	44	17	36
4	41	e70	75	140	48	50	203	64	30	41	16	41
5	39	e62	75	209	49	53	174	72	41	39	15	40
6	e37	e55	75	203	49	51	154	74	43	35	15	40
7	e35	e52	73	167	44	51	141	72	49	33	16	41
8	e34	e50	73	143	45	54	129	69	62	31	15	39
9	e42	e50	73	120	42	59	128	65	66	31	14	36
10	e40	52	72	109	42	63	129	63	70	32	14	34
11	e39	51	86	95	42	60	121	61	69	29	14	29
12	e39	58	70	92	43	55	118	60	60	25	14	28
13	e40	95	59	98	43	52	106	50	55	21	13	28
14	e43	109	55	94	43	48	88	45	52	21	13	27
15	e45	108	54	89	42	47	88	44	50	20	12	43
16	e48	101	57	84	45	49	93	41	45	17	17	43
17	e41	96	57	79	41	52	92	38	44	15	16	42
18	e39	91	56	68	40	49	89	36	44	13	14	41
19	e37	87	54	59	39	47	86	40	54	14	14	38
20	e35	82	53	58	39	53	98	39	130	14	21	34
21	e40	78	47	61	43	52	105	40	216	12	16	38
22	e43	77	44	77	46	35	95	39	209	11	13	37
23	e41	86	42	86	44	29	87	37	158	9.8	21	37
24	e40	91	38	90	41	46	80	39	120	9.4	25	34
25	e38	95	36	87	40	51	84	42	98	14	19	32
26	e36	95	34	75	40	79	84	46	84	22	17	35
27	e34	92	30	71	39	84	75	47	76	19	17	41
28	e33	87	29	72	39	95	72	47	68	22	16	53
29	e32	80	33	65	---	136	72	41	59	21	17	53
30	e32	80	56	56	---	179	73	33	51	20	22	50
31	e34	---	104	57	---	206	---	33	---	19	23	---
TOTAL	1185	2310	1843	3034	1224	2007	3610	1584	2197	746.2	516	1116
MEAN	38.2	77.0	59.5	97.9	43.7	64.7	120	51.1	73.2	24.1	16.6	37.2
MAX	48	109	104	209	57	206	262	74	216	46	25	53
MIN	22	40	29	56	39	29	72	33	30	9.4	12	22

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1958 - 1993, BY WATER YEAR (WY)

MEAN	31.3	43.0	45.9	42.5	49.1	78.4	79.7	49.3	35.2	21.2	19.4	23.8
MAX	85.8	105	94.0	115	144	199	142	132	120	50.7	76.0	97.7
(WY)	1982	1986	1976	1973	1976	1976	1975	1974	1989	1969	1975	1975
MIN	10.3	10.2	9.11	10.7	9.79	5.14	10.0	17.2	6.93	4.41	4.00	4.72
(WY)	1963	1964	1964	1963	1963	1964	1963	1963	1964	1988	1964	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1958 - 1993

ANNUAL TOTAL	15953.5	21372.2	
ANNUAL MEAN	43.6	58.6	
HIGHEST ANNUAL MEAN			43.2
LOWEST ANNUAL MEAN			79.1
HIGHEST DAILY MEAN	141	262	12.0
LOWEST DAILY MEAN	5.5	9.4	407
ANNUAL SEVEN-DAY MINIMUM	8.4	12	1.3
INSTANTANEOUS PEAK FLOW		271	2.2
INSTANTANEOUS PEAK STAGE		4.91	(b)552
INSTANTANEOUS LOW FLOW		6.3	(c)6.71
10 PERCENT EXCEEDS	78	99	.90
50 PERCENT EXCEEDS	37	47	88
90 PERCENT EXCEEDS	21	20	31
			9.6

(a) July 31, Aug. 1, 1964.

(b) From rating curve extended above 380 ft<sup>3</sup>/s; caused by momentary release of water from Stony Lake.

(c) Backwater from ice.

(e) Estimated.

## 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 sea level (levels by Johnson and Anderson, Inc.).

REMARKS.--Records good except for estimated daily discharges, which are fair. Occasional diversion for sprinkler irrigation. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.5	5.4	15	40	e12	e8.0	110	13	5.6	9.5	2.2	3.5
2	3.9	119	15	22	e11	e12	90	11	4.7	13	2.1	26
3	3.4	76	13	24	e10	e15	50	12	3.9	7.6	1.6	68
4	3.1	33	e11	216	e11	e18	35	12	2.9	5.6	1.9	27
5	3.0	21	10	200	e11	e16	31	33	15	4.5	2.5	9.6
6	3.0	17	e9.5	60	e10	e14	25	18	9.5	3.7	2.3	10
7	3.0	14	e8.5	32	e9.0	e17	18	12	12	4.8	4.3	13
8	3.1	12	e8.3	28	e9.0	e22	16	10	42	3.2	3.0	8.1
9	16	11	e8.2	22	e8.5	e28	36	8.4	18	4.0	2.6	5.2
10	11	12	8.9	17	8.1	e22	61	7.4	9.5	6.2	2.2	5.3
11	5.4	15	17	19	7.5	e17	30	6.5	5.4	4.5	3.2	4.3
12	4.2	140	21	16	7.1	e15	47	7.0	3.6	3.0	2.5	4.5
13	3.4	160	19	35	e9.0	e13	26	5.5	3.4	2.4	2.8	7.0
14	4.0	47	16	39	e8.5	e11	20	4.7	3.9	4.6	1.9	4.5
15	99	29	14	29	e7.5	e9.5	18	5.3	3.5	5.3	3.6	63
16	47	21	20	22	e8.5	e14	28	4.8	2.9	3.0	27	16
17	20	20	15	18	e9.0	e28	20	4.2	2.4	2.3	8.4	8.6
18	14	17	12	e15	e16	e15	15	3.6	2.0	2.1	3.6	6.1
19	12	15	11	e13	7.3	e13	15	5.9	16	4.1	3.6	5.0
20	14	15	12	e12	7.2	16	50	5.9	70	2.6	34	4.2
21	16	14	10	29	7.2	26	26	4.4	92	1.9	9.2	32
22	13	16	e9.0	102	9.1	35	17	3.8	23	1.6	4.3	17
23	10	82	e8.0	54	10	55	14	3.9	14	1.6	12	8.2
24	8.5	35	e7.0	53	e9.5	61	12	8.3	7.7	1.6	19	5.8
25	7.4	33	6.1	42	e8.5	57	27	11	25	19	7.9	5.1
26	7.0	26	6.2	26	e8.3	56	25	6.5	37	23	4.2	16
27	7.5	20	5.1	19	e8.1	56	14	4.1	24	7.9	2.8	47
28	7.6	17	5.2	17	e8.0	52	12	3.4	40	12	2.3	70
29	7.0	15	12	e15	---	44	18	3.1	24	8.7	5.1	19
30	6.0	14	73	e13	---	35	18	2.9	11	4.9	10	13
31	5.5	---	127	e13	---	26	---	4.4	---	2.8	5.0	---
TOTAL	372.5	1071.4	533.0	1262	247.9	827.5	924	246.0	533.9	181.0	197.1	532.0
MEAN	12.0	35.7	17.2	40.7	8.85	26.7	30.8	7.94	17.8	5.84	6.36	17.7
MAX	99	160	127	216	12	61	110	33	92	23	94	70
MIN	3.0	6.4	6.1	12	7.1	8.0	12	2.9	2.0	1.6	1.6	3.5
CFSM	.73	2.16	1.04	2.47	.54	1.62	1.87	.48	1.08	.35	.39	1.07
IN.	.84	2.42	1.20	2.85	.56	1.87	2.08	.55	1.20	.41	.44	1.20

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 1993, BY WATER YEAR (WY)

	MEAN	7.37	12.0	15.6	12.6	18.3	31.5	25.7	14.2	9.59	6.69	5.20	5.94
MAX	33.7	39.8	37.7	40.7	60.3	83.6	47.4	39.9	37.4	23.0	16.0	18.6	
(WY)	1982	1986	1973	1993	1976	1982	1979	1968	1968	1969	1972	1986	
MIN	.82	1.45	1.99	1.23	2.62	10.1	8.30	3.46	1.51	.29	.43	.44	
(WY)	1967	1966	1977	1977	1980	1981	1971	1971	1988	1965	1965	1969	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1965 - 1993

ANNUAL TOTAL	6110.1	6928.3	13.8	
ANNUAL MEAN	16.7	19.0	20.5	1968
HIGHEST ANNUAL MEAN			6.67	1970
LOWEST ANNUAL MEAN			707	Jun 26 1968
HIGHEST DAILY MEAN	160	216	.04	Jul 19 1966
LOWEST DAILY MEAN	1.8	1.6	.09	Aug 22 1969
ANNUAL SEVEN-DAY MINIMUM	2.2	2.2	1160	Jun 26 1968
INSTANTANEOUS PEAK FLOW		349	10.36	Jun 26 1968
INSTANTANEOUS PEAK STAGE		7.78	.00	(a)
INSTANTANEOUS LOW FLOW		1.1	.83	
ANNUAL RUNOFF (CFSM)	1.01	1.15	11.33	
ANNUAL RUNOFF (INCHES)	13.78	15.62	30	
10 PERCENT EXCEEDS	33	42	5.7	
50 PERCENT EXCEEDS	10	12	1.2	
90 PERCENT EXCEEDS	4.0	3.2		

(a) Part of each day July 19, 28, 1966, Aug. 22-28, Sept. 3, 11, 1969.

(e) Estimated.



## 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 sea level (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.--Records good. National Weather Service gage-height telemeter at station.

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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	253	261	481	948	519	334	1390	487	225	396	155	200
2	224	1290	465	615	444	395	1680	410	188	508	150	375
3	215	1270	464	629	446	486	1330	377	179	325	150	872
4	199	691	436	2750	451	530	1030	448	181	274	149	622
5	200	557	435	3400	421	466	883	796	443	270	140	362
6	214	505	428	1680	435	484	796	515	306	274	151	376
7	212	462	418	1060	400	520	725	478	467	400	201	395
8	213	438	389	829	395	648	686	453	1050	334	141	309
9	554	432	371	730	376	634	902	392	659	324	131	270
10	317	464	412	653	366	539	1100	375	524	345	155	279
11	236	515	495	632	367	492	831	361	458	227	162	218
12	220	1710	509	608	369	455	962	314	413	203	143	193
13	236	2290	459	761	399	426	740	287	354	184	145	200
14	280	1270	426	781	383	385	659	271	388	314	134	176
15	1510	760	421	658	368	377	626	269	326	221	194	1100
16	987	645	504	602	366	448	802	250	281	173	806	545
17	572	603	437	570	368	654	694	241	282	156	202	407
18	437	570	406	527	338	483	623	238	257	144	155	363
19	401	541	396	486	327	428	637	284	403	161	148	331
20	410	522	438	490	321	489	997	224	859	147	641	315
21	479	527	379	699	317	566	765	211	2110	135	339	921
22	390	549	368	1500	342	556	643	197	1400	134	253	457
23	361	1230	364	988	348	663	594	201	915	131	385	328
24	345	776	346	892	318	724	550	300	684	132	611	293
25	337	680	318	790	318	732	717	347	910	440	322	279
26	324	632	305	617	332	723	648	319	1330	549	241	552
27	316	569	259	570	318	815	552	312	720	237	193	576
28	278	530	278	552	316	861	499	289	871	493	161	995
29	258	509	382	533	---	838	566	247	680	458	209	541
30	253	489	910	480	---	832	563	203	491	413	258	444
31	252	---	1620	496	---	814	---	270	---	237	193	---
TOTAL	11483	22287	14319	27526	10468	17797	24190	10366	18354	8739	7418	13294
MEAN	370	743	462	888	374	574	806	334	612	282	239	443
MAX	1510	2290	1620	3400	519	861	1680	796	2110	549	806	1100
MIN	199	261	259	480	316	334	499	197	179	131	131	176
CFSM	.83	1.67	1.04	2.00	.84	1.29	1.82	.75	1.38	.63	.54	1.00
IN.	.96	1.87	1.20	2.31	.88	1.49	2.03	.87	1.54	.73	.62	1.11

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1947 - 1993, BY WATER YEAR (WY)

MEAN	268	329	392	385	454	671	663	455	345	260	217	240
MAX	1021	834	837	975	1119	1313	1237	1382	841	664	480	758
(WY)	1982	1986	1968	1950	1976	1976	1950	1956	1989	1957	1980	1975
MIN	72.3	78.2	93.1	91.8	112	217	259	127	120	87.1	69.5	73.3
(WY)	1954	1954	1959	1961	1963	1964	1958	1958	1949	1955	1954	1954

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1947 - 1993

ANNUAL TOTAL	172037	186241	
ANNUAL MEAN	470	510	
HIGHEST ANNUAL MEAN			389
LOWEST ANNUAL MEAN			595
HIGHEST DAILY MEAN	2290	3400	6930
LOWEST DAILY MEAN	114	131	49
ANNUAL SEVEN-DAY MINIMUM	138	141	59
INSTANTANEOUS PEAK FLOW		4720	8840
INSTANTANEOUS PEAK STAGE		16.65	19.56
INSTANTANEOUS LOW FLOW		114	47
ANNUAL RUNOFF (CFSM)	1.06	1.15	.88
ANNUAL RUNOFF (INCHES)	14.41	15.60	11.90
10 PERCENT EXCEEDS	783	876	748
50 PERCENT EXCEEDS	389	428	278
90 PERCENT EXCEEDS	213	200	115

## 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 sea level, from topographic map.

REMARKS.--Records good. Occasional regulation by lakes upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.8	15	23	34	e20	e14	116	25	14	15	7.0	7.1
2	9.2	21	22	e32	e19	e15	116	24	13	15	6.6	7.7
3	8.8	25	21	30	19	e16	97	22	13	14	6.1	11
4	8.0	24	18	60	18	e18	83	22	12	12	6.5	12
5	8.4	21	19	86	18	19	71	26	15	11	6.2	11
6	8.2	19	e18	61	18	17	59	24	16	10	6.1	11
7	8.0	18	17	48	e17	e18	50	22	16	9.4	6.3	12
8	7.9	18	17	42	16	19	44	21	21	5.9	6.2	11
9	11	17	17	37	e15	20	45	19	22	5.5	5.8	9.9
10	11	17	17	35	15	20	48	18	21	6.8	5.6	9.2
11	11	17	17	31	15	20	42	18	20	7.1	5.5	8.9
12	10	26	18	29	15	e19	41	17	19	7.8	5.3	9.0
13	10	47	19	30	15	e18	38	16	17	7.2	5.1	9.8
14	10	36	18	30	15	e17	35	16	16	7.0	4.9	9.1
15	16	32	18	27	15	e17	33	16	16	6.8	4.7	16
16	16	30	19	26	15	17	34	14	15	6.5	5.4	16
17	15	34	19	25	e15	19	32	13	14	6.2	5.6	14
18	14	29	19	e23	e14	e18	30	13	12	6.1	5.2	13
19	13	27	18	e22	e14	e17	30	16	14	6.4	4.9	12
20	13	25	18	e21	e14	17	39	14	38	6.5	5.2	11
21	15	25	e17	22	15	17	35	15	78	6.2	5.4	11
22	14	24	e16	28	16	18	34	14	42	5.8	4.9	11
23	14	31	e15	27	16	21	34	13	30	5.6	5.1	11
24	14	30	e15	27	e15	24	33	14	26	5.4	6.2	10
25	13	29	e14	e26	e14	29	33	16	23	6.2	6.1	9.8
26	13	28	e14	e25	e14	35	31	15	21	7.8	5.7	11
27	13	27	e13	24	e14	48	29	13	20	7.1	5.4	12
28	12	26	14	23	e14	71	27	13	19	9.4	5.2	17
29	12	25	16	e22	---	84	26	13	18	9.1	6.1	17
30	12	24	27	e21	---	86	26	13	16	8.8	7.9	16
31	12	---	43	e20	---	83	---	13	---	7.9	7.3	---
TOTAL	362.3	767	576	994	440	871	1391	528	637	251.5	179.5	346.5
MEAN	11.7	25.6	18.6	32.1	15.7	28.1	46.4	17.0	21.2	8.11	5.79	11.5
MAX	16	47	43	86	20	86	116	26	78	15	7.9	17
MIN	7.9	15	13	20	14	14	26	13	12	5.4	4.7	7.1
CFSM	.54	1.17	.85	1.47	.72	1.29	2.13	.78	.97	.37	.27	.53
IN.	.62	1.31	.98	1.70	.75	1.49	2.37	.90	1.09	.43	.31	.59

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1958 - 1993, BY WATER YEAR (WY)

	MEAN	10.3	14.1	15.6	14.9	18.8	33.3	32.2	19.0	13.4	8.77	7.20	8.95
MAX	35.1	45.0	35.7	42.6	54.0	67.9	71.4	52.2	52.9	22.9	35.0	52.3	
(WY)	1987	1986	1988	1973	1968	1976	1975	1974	1989	1969	1975	1985	
MIN	1.92	2.32	1.64	2.89	2.93	7.81	13.1	7.77	2.76	2.07	1.30	2.02	
(WY)	1964	1964	1964	1959	1964	1964	1963	1977	1963	1964	1965	1966	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1958 - 1993

ANNUAL TOTAL	6182.5	7343.8	16.4
ANNUAL MEAN	16.9	20.1	29.0
HIGHEST ANNUAL MEAN			4.99
LOWEST ANNUAL MEAN			1975
HIGHEST DAILY MEAN	47	Nov 13	302
LOWEST DAILY MEAN	4.5	Jun 16	.90
ANNUAL SEVEN-DAY MINIMUM	5.4	Jun 11	.99
INSTANTANEOUS PEAK FLOW			358
INSTANTANEOUS PEAK STAGE			(a)4.56
INSTANTANEOUS LOW FLOW			.80
ANNUAL RUNOFF (CFSM)	.77		.75
ANNUAL RUNOFF (INCHES)	10.55		10.20
10 PERCENT EXCEEDS	26		34
50 PERCENT EXCEEDS	15		11
90 PERCENT EXCEEDS	8.5		3.1

(a) Backwater from ice.

(b) July 30, 31, 1964, Aug. 6, 7, 1965.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

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-83-1: 1982.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 735 ft above sea level, from topographic map.

REMARKS.--Records fair except for daily discharges below 0.5 ft<sup>3</sup>/s, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	1.8	6.3	53	6.0	1.0	155	3.8	1.1	2.2	.18	.26
2	1.7	19	5.7	25	4.6	1.1	103	3.2	.90	3.5	.14	.71
3	1.6	e83	5.0	15	3.8	1.6	65	2.9	.72	2.3	.25	1.0
4	1.5	32	4.3	158	4.4	2.0	38	6.5	.66	1.6	.13	.29
5	1.5	16	3.9	180	4.5	1.6	27	46	1.4	1.2	.12	.37
6	1.3	9.9	3.3	63	4.6	2.4	18	20	1.1	.92	.11	.66
7	1.1	6.9	3.2	37	3.3	2.8	14	9.7	1.5	.76	.09	.37
8	1.1	5.5	3.0	17	2.8	5.3	11	6.3	1.8	.74	.12	.28
9	1.6	4.5	2.7	10	2.1	7.8	17	4.8	5.4	.83	.15	.30
10	1.3	4.2	2.9	6.5	2.2	8.3	43	3.8	12	.55	.12	.54
11	1.3	4.5	3.6	6.6	2.0	e6.0	19	3.3	5.3	.48	.14	.64
12	1.2	73	5.1	5.9	1.8	e5.0	18	3.0	3.0	.41	.16	.62
13	1.2	184	8.5	7.3	1.9	e4.5	12	2.7	2.1	.33	.18	.39
14	1.1	52	9.4	8.7	1.9	e4.0	8.0	2.4	3.7	.35	.16	.58
15	3.4	31	8.5	9.2	1.8	e3.7	6.9	2.3	6.3	.31	.17	2.0
16	8.1	16	15	7.9	1.7	3.4	10	1.8	2.3	.27	.40	1.0
17	6.9	11	12	6.6	1.6	6.7	9.2	1.4	1.6	.22	.20	.80
18	4.4	13	7.8	4.7	e1.7	7.3	6.6	1.2	1.4	.21	.23	.59
19	3.1	10	6.0	4.2	e1.6	5.8	6.9	1.9	2.9	.22	.27	.52
20	2.7	8.1	5.6	3.0	e1.5	4.8	66	1.5	100	.22	.25	.48
21	5.7	7.8	3.9	4.5	1.4	5.8	32	1.3	252	.22	.23	.59
22	6.2	8.9	3.8	32	1.5	10	12	1.2	71	.25	.21	.45
23	4.9	66	3.4	e33	1.4	20	7.9	1.1	33	.28	.46	.57
24	3.7	42	2.7	e25	1.4	48	6.1	1.7	13	.33	.27	.58
25	3.1	26	2.4	e15	1.2	93	6.9	1.3	9.4	.41	.22	.57
26	2.6	21	2.2	e10	.98	122	6.5	1.1	13	.27	.22	1.1
27	2.3	15	2.1	8.3	.98	157	5.1	.92	7.5	.16	.43	1.3
28	2.2	10	1.6	5.8	.97	171	4.6	.96	4.5	.70	.28	1.2
29	2.0	8.0	3.0	4.1	---	155	4.4	1.0	3.2	.43	.68	1.1
30	1.9	6.7	3.7	3.8	---	115	4.3	.83	2.6	.29	.27	.85
31	1.7	---	145	4.4	---	73	---	1.0	---	.22	.25	---
TOTAL	84.2	796.8	328.9	774.5	65.63	1054.9	743.4	140.91	564.38	21.18	7.07	20.71
MEAN	2.72	26.6	10.6	25.0	2.34	34.0	24.8	4.55	18.8	.68	.23	.69
MAX	8.1	184	145	180	6.0	171	155	46	252	3.5	.68	2.0
MIN	1.1	1.8	1.6	3.0	.97	1.0	4.3	.83	.66	.16	.09	.28
CFSM	.21	2.04	.82	1.92	.18	2.62	1.91	.35	1.45	.05	.02	.05
IN.	.24	2.28	.94	2.22	.19	3.02	2.13	.40	1.61	.06	.02	.06

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1959 - 1993, BY WATER YEAR (WY)

MEAN	2.41	5.48	8.45	6.12	10.7	25.1	16.4	5.17	3.84	1.61	1.31	2.14
MAX	24.1	43.3	35.7	37.6	60.3	75.2	47.1	23.5	21.9	19.7	12.3	33.9
(WY)	1982	1986	1973	1974	1976	1982	1967	1974	1989	1967	1975	1985
MIN	.047	.088	.074	.078	.087	.23	.83	.61	.059	.047	.055	.056
(WY)	1964	1964	1964	1961	1964	1964	1964	1977	1964	1964	1963	1964

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1959 - 1993
ANNUAL TOTAL	3952.35	4602.58	
ANNUAL MEAN	10.8	12.6	7.37
HIGHEST ANNUAL MEAN			14.9
LOWEST ANNUAL MEAN			.36
HIGHEST DAILY MEAN	184	252	497
LOWEST DAILY MEAN	.29	.09	.00
ANNUAL SEVEN-DAY MINIMUM	.40	.12	.00
INSTANTANEOUS PEAK FLOW		333	910
INSTANTANEOUS PEAK STAGE		4.49	6.69
INSTANTANEOUS LOW FLOW			.00
ANNUAL RUNOFF (CFSM)	.83	.97	.57
ANNUAL RUNOFF (INCHES)	11.31	13.17	7.71
10 PERCENT EXCEEDS	28	31	14
50 PERCENT EXCEEDS	3.9	3.0	.98
90 PERCENT EXCEEDS	1.1	.27	.10

(a) Jan. 25 to Feb. 9, 1961, result of freezeup.

(e) Estimated.

## 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 sea level (levels by Michigan Department of Natural Resources). Prior to Nov. 15, 1949, nonrecording gage at same site and datum.

REMARKS.--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.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20.0 ft, from floodmark.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	45	140	1270	152	e52	899	126	42	82	19	20
2	32	129	128	e750	142	63	1600	109	45	115	17	21
3	30	443	119	e400	115	74	1400	100	39	110	14	38
4	27	619	110	e550	126	105	790	101	35	84	12	61
5	25	512	101	2170	123	128	497	281	36	64	11	46
6	23	268	84	2130	137	124	361	403	54	50	11	34
7	23	179	97	1040	114	136	292	251	61	40	12	31
8	23	137	86	488	99	194	242	149	75	37	12	31
9	24	114	81	285	83	267	243	116	95	33	11	28
10	33	104	81	e230	84	309	390	99	112	30	9.5	24
11	43	108	93	e200	78	273	515	90	115	31	8.9	22
12	37	242	127	e200	72	205	347	83	83	27	8.4	19
13	33	1120	171	229	e68	161	266	74	65	23	7.4	18
14	30	1740	171	245	e62	128	214	67	52	21	7.5	20
15	76	910	152	265	e60	103	181	64	52	22	6.3	41
16	218	427	155	239	e57	108	179	64	55	20	12	76
17	241	243	187	206	e55	175	204	57	44	18	14	60
18	168	232	163	199	e53	221	185	49	36	16	14	40
19	100	222	130	168	e52	180	159	49	36	16	12	32
20	80	187	118	139	e51	154	210	63	84	15	13	28
21	93	164	103	126	e50	149	376	60	364	13	13	28
22	141	164	97	268	e49	237	371	57	1140	11	13	29
23	133	314	91	464	e48	348	223	52	1010	10	14	28
24	102	619	e80	609	e48	465	168	51	369	8.6	14	26
25	87	580	e70	526	e48	599	158	61	173	10	15	24
26	75	365	e62	446	e48	781	192	64	463	18	15	24
27	66	281	55	263	e48	889	167	56	562	24	12	27
28	59	223	57	200	e48	1060	134	49	232	19	9.7	71
29	55	184	63	169	---	1340	127	46	138	26	11	89
30	51	158	137	134	---	1300	131	40	100	27	14	63
31	47	---	655	127	---	1030	---	39	---	23	23	---
TOTAL	2209	11033	3964	14735	2170	11358	11221	2970	5767	1043.6	385.7	1099
MEAN	71.3	368	128	475	77.5	366	374	95.8	192	33.7	12.4	36.6
MAX	241	1740	655	2170	152	1340	1600	408	1140	115	23	89
MIN	23	45	55	126	48	52	127	39	35	8.6	6.3	18
CFSM	.36	1.85	.64	2.39	.39	1.84	1.88	.48	.97	.17	.06	.18
IN.	.41	2.06	.74	2.75	.41	2.12	2.10	.56	1.08	.20	.07	.21

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1947 - 1993, BY WATER YEAR (WY)

	MEAN	53.0	93.4	138	131	199	360	275	135	73.0	31.9	25.4	40.9
MAX	479	595	460	507	786	928	560	790	424	127	247	484	
(WY)	1982	1986	1968	1974	1976	1982	1975	1956	1989	1992	1975	1985	
MIN	3.71	7.12	5.63	5.55	8.77	29.6	72.6	25.9	7.08	3.44	2.14	3.12	
(WY)	1964	1964	1959	1961	1963	1964	1963	1958	1988	1955	1955	1963	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1947 - 1993
ANNUAL TOTAL	57975.7	67955.3	
ANNUAL MEAN	158	186	129
HIGHEST ANNUAL MEAN			230
LOWEST ANNUAL MEAN			25.4
HIGHEST DAILY MEAN	1740	2170	5040
LOWEST DAILY MEAN	9.7	6.3	.09
ANNUAL SEVEN-DAY MINIMUM	14	8.4	.10
INSTANTANEOUS PEAK FLOW		2800	6700
INSTANTANEOUS PEAK STAGE		14.95	18.62
INSTANTANEOUS LOW FLOW		5.0	.08
ANNUAL RUNOFF (CFSM)	.80	.94	.65
ANNUAL RUNOFF (INCHES)	10.84	12.70	8.79
10 PERCENT EXCEEDS	419	453	310
50 PERCENT EXCEEDS	92	87	40
90 PERCENT EXCEEDS	29	17	7.1

(a) Part of each day July 4-10, 14, 15, 1988.

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE ST. CLAIR

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 sea level. 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.--Water-discharge records good except for estimated daily discharges, which are fair. National Weather Service gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	346	355	814	2920	892	449	3040	728	324	e600	196	e265
2	317	1860	751	1620	699	556	4500	608	274	e740	196	449
3	303	2540	751	1340	708	761	3690	539	257	e550	e195	1240
4	284	1660	672	3930	760	843	2400	586	254	e450	e190	891
5	276	1370	666	7220	717	651	1770	1510	555	e410	e185	474
6	284	1020	631	5080	732	709	1480	1190	406	e400	e200	463
7	284	866	641	2690	620	827	1290	920	484	e540	253	499
8	289	770	584	1650	635	1160	1160	704	1430	e470	e200	396
9	745	709	535	1210	588	1270	1480	598	896	e440	e175	368
10	447	741	576	e1150	604	1170	2110	543	e760	e450	e195	395
11	350	823	795	e1050	588	1010	1780	513	e700	e350	e210	e290
12	316	2260	871	e1050	536	847	1770	461	e500	e290	e190	e260
13	322	4300	848	e1200	615	746	1370	411	e500	e250	e180	e270
14	363	3790	783	1320	579	653	1180	377	e550	e400	e170	e240
15	2020	2170	748	1160	554	593	1070	382	e470	e320	243	1540
16	1630	1440	867	1020	532	713	1340	357	e420	e250	974	844
17	965	1110	830	960	523	1170	1310	325	e400	e220	277	566
18	760	1020	741	e900	480	965	1140	324	e350	e200	e220	493
19	633	948	654	e850	e470	782	1040	388	449	e215	e200	441
20	588	854	715	e800	e460	819	1600	325	1080	e200	742	411
21	793	859	591	960	e450	977	1570	312	3140	179	384	1170
22	643	926	559	2460	e490	1100	1350	303	3010	176	300	659
23	579	2240	534	2040	e470	1460	1040	299	2280	180	441	459
24	530	1930	517	1970	e450	1720	817	414	1200	181	801	404
25	499	1690	402	1730	e460	1880	1070	483	1130	440	400	382
26	458	1360	e500	1250	e460	2070	1110	427	2620	653	316	791
27	443	1150	e400	1050	454	2300	871	403	1570	e320	262	755
28	387	971	411	911	431	2550	742	371	1320	e620	e210	1610
29	362	885	524	851	---	2800	827	340	970	e580	e260	942
30	353	842	1360	724	---	2710	838	289	e700	e540	943	678
31	345	---	3370	833	---	2350	---	353	---	267	e260	---
TOTAL	16914	43959	23641	53899	15957	38611	46735	15786	29109	11881	9373	18645
MEAN	546	1465	763	1739	570	1246	1558	509	970	383	302	621
MAX	2020	4800	3370	7220	892	2800	4500	1510	3140	740	974	1610
MIN	276	355	400	724	431	449	742	289	254	176	170	240
CFSM	.74	2.00	1.04	2.37	.78	1.70	2.12	.69	1.32	.52	.41	.85
IN.	.86	2.23	1.20	2.73	.81	1.96	2.37	.80	1.48	.60	.48	.94

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1934 - 1993, BY WATER YEAR (WY)

	MEAN	309	409	532	546	740	1143	1063	676	459	288	239	268
MAX	1550	1492	1615	1739	2407	2255	3090	2747	1543	865	744	1144	
(WY)	1982	1986	1968	1993	1938	1982	1947	1943	1989	1969	1975	1975	
MIN	64.1	79.0	84.3	93.9	118	263	249	164	52.9	50.9	51.7	52.5	
(WY)	1935	1945	1945	1945	1940	1964	1946	1958	1934	1934	1934	1941	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1934 - 1993
ANNUAL TOTAL	285453	324510	
ANNUAL MEAN	780	889	557
HIGHEST ANNUAL MEAN			929
LOWEST ANNUAL MEAN			230
HIGHEST DAILY MEAN	4800	Nov 13	19200
LOWEST DAILY MEAN	200	Jul 7	25
ANNUAL SEVEN-DAY MINIMUM	226	Jul 1	28
INSTANTANEOUS PEAK FLOW			21200
INSTANTANEOUS PEAK STAGE			(a)23.55
ANNUAL RUNOFF (CFSM)	1.06		.76
ANNUAL RUNOFF (INCHES)	14.47		10.31
10 PERCENT EXCEEDS	1520		1180
50 PERCENT EXCEEDS	608		320
90 PERCENT EXCEEDS	293		115

(a) From floodmark.

(e) Estimated.

## 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 1975-81): 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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (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)
DEC 03...	1235	756	832	8.4	3.0	2.8	12.5	95	92
MAR 25...	1210	1890	749	8.2	2.0	20	12.6	92	K260
JUN 17...	1310	400	790	8.4	20.0	4.0	6.5	73	K170
SEP 17...	1210	567	696	8.2	16.5	6.8	8.1	84	420

DATE	STREP- TOCOCOI FECAL KF AGAR (COLS. PER 100 ML) (31673)	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)
DEC 03...	110	310	78	85	23	48	3.7	276	2
MAR 25...	1600	220	52	61	16	66	4.2	203	--
JUN 17...	100	270	63	74	21	59	4.2	254	--
SEP 17...	850	240	56	65	18	54	3.9	220	--

DATE	ALKA- LITY 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)	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) (00613)
DEC 03...	230	50	92	0.30	7.0	472	0.64	963	0.030
MAR 25...	166	35	120	0.20	5.1	436	0.59	2220	0.020
JUN 17...	208	47	110	0.30	5.5	469	0.64	507	0.060
SEP 17...	180	41	88	0.30	6.5	395	0.54	605	0.020

## STREAMS TRIBUTARY TO LAKE ST. CLAIR

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI-Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	NITRO- GEN, NO <sub>2</sub> +NO <sub>3</sub> DIS- SOLVED (MG/L AS N) (00631)	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, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)
DEC 03...	2.00	0.130	0.60	0.100	0.070	0.060	10
MAR 25...	1.30	0.250	1.0	0.150	0.130	0.130	20
JUN 17...	1.90	0.120	0.60	0.130	0.100	0.100	20
SEP 17...	1.60	0.080	0.70	0.120	0.070	0.060	20

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01006)	COBALT, DIS- SOLVED (UG/L AS CO) (01036)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)
DEC 03...	47	<3	18	5	35	<10	4
MAR 25...	36	<3	54	<4	59	<10	<1
JUN 17...	53	<3	7	10	26	<10	3
SEP 17...	47	<3	16	7	12	<10	3

DATE	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01146)	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)	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 03...	<1	<1.0	220	<6	15	31	93
MAR 25...	<1	<1.0	200	<6	50	255	91
JUN 17...	<1	<1.0	210	<6	27	29	96
SEP 17...	<1	<1.0	210	<6	38	58	95

## 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, and 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 sea level.

REMARKS.--Records good. Occasional regulation by Quarton Lake upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	14	24	55	30	19	125	32	17	19	10	10
2	13	132	24	34	25	24	104	29	13	20	9.7	47
3	12	83	25	36	25	34	64	28	11	16	9.3	83
4	12	39	22	261	27	39	53	31	11	15	10	52
5	11	30	22	226	28	30	51	49	37	13	8.2	23
6	11	24	20	80	28	29	45	33	21	12	9.3	25
7	10	23	19	55	24	33	39	28	35	11	12	24
8	12	21	19	47	23	44	37	27	73	11	8.7	16
9	41	18	19	40	22	43	62	25	39	14	7.9	15
10	19	21	22	36	22	35	79	24	24	20	11	15
11	14	23	26	35	22	30	49	23	17	13	12	11
12	13	160	29	34	23	27	66	23	14	11	15	13
13	12	206	28	52	24	24	47	21	12	10	18	14
14	17	61	26	49	22	21	40	20	12	15	10	12
15	131	40	25	40	22	20	40	21	13	13	9.6	87
16	61	33	32	36	23	26	61	19	11	9.2	25	33
17	32	31	26	33	21	40	42	18	9.4	8.1	11	18
18	24	28	22	29	21	28	37	18	9.4	7.7	8.8	14
19	21	25	21	26	20	24	40	24	28	9.2	11	13
20	21	24	23	26	19	27	79	19	96	8.8	44	11
21	26	25	20	49	21	33	47	18	123	7.5	17	77
22	20	34	19	102	22	37	38	15	41	7.0	10	34
23	19	93	19	62	21	57	34	14	27	6.1	31	21
24	17	51	17	58	19	69	33	21	20	6.4	36	16
25	16	46	16	48	18	71	55	20	19	42	17	16
26	16	37	15	37	19	75	45	15	18	40	12	35
27	16	31	14	33	18	87	35	12	31	15	11	72
28	16	28	15	32	18	87	32	12	53	24	8.8	91
29	14	26	27	28	--	75	40	11	34	26	14	33
30	14	25	90	27	--	59	40	10	21	26	15	23
31	13	--	140	29	--	48	--	18	--	13	11	--
TOTAL	687	1432	866	1736	627	1295	1559	678	889.8	469.0	443.3	954
MEAN	22.2	47.7	27.9	56.0	22.4	41.8	52.0	21.9	29.7	15.1	14.3	31.8
MAX	131	206	140	261	30	87	125	49	123	42	44	91
MIN	10	14	14	25	18	19	32	10	9.4	6.1	7.9	10
CFSM	.67	1.43	.84	1.68	.67	1.25	1.56	.66	.89	.45	.43	.95
IN.	.77	1.60	.97	1.94	.70	1.45	1.74	.76	.99	.52	.50	1.07

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1950 - 1993, BY WATER YEAR (WY)

	MEAN	11.8	16.2	20.0	19.2	23.5	39.2	36.1	25.3	18.2	12.0	9.49	10.6
MAX	50.7	47.7	51.5	56.0	71.5	82.5	63.6	98.1	84.0	48.2	25.6	42.3	
(WY)	1982	1993	1988	1993	1976	1982	1974	1956	1989	1968	1968	1986	
MIN	1.48	2.11	1.88	2.18	2.21	7.59	10.4	5.82	4.33	1.42	1.58	1.42	
(WY)	1965	1965	1964	1963	1963	1964	1963	1958	1966	1966	1954	1963	

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1950 - 1993
ANNUAL TOTAL	10894.4	11636.1	
ANNUAL MEAN	29.8	31.9	(a)20.1
HIGHEST ANNUAL MEAN			35.6
LOWEST ANNUAL MEAN			4.55
HIGHEST DAILY MEAN	206	261	902
LOWEST DAILY MEAN	6.5	6.1	.20
ANNUAL SEVEN-DAY MINIMUM	8.0	7.5	.34
INSTANTANEOUS PEAK FLOW		428	1390
INSTANTANEOUS PEAK STAGE		4.56	8.70
INSTANTANEOUS LOW FLOW		5.6	.10
ANNUAL RUNOFF (CFSM)	.89	.96	.60
ANNUAL RUNOFF (INCHES)	12.17	13.00	8.22
10 PERCENT EXCEEDS	52	61	42
50 PERCENT EXCEEDS	22	24	12
90 PERCENT EXCEEDS	13	11	3.0

(a) Annual mean, water years 1951-70, 15.3 ft<sup>3</sup>/s, 5.63 in/yr; water years 1971-93, 24.3 ft<sup>3</sup>/s, 9.91 in/yr.

(b) Aug. 8, 9, 1963.



## STREAMS TRIBUTARY TO DETROIT RIVER

## 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 above sea level (City of Southfield bench mark). Prior to Sept. 30, 1958, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	32	41	66	195	77	e48	455	85	45	52	28	27
2	31	345	65	104	70	65	492	72	36	48	28	164
3	30	306	64	116	65	104	234	67	33	43	25	271
4	29	114	59	870	67	128	179	68	31	39	28	142
5	27	82	56	1150	66	94	168	238	116	35	25	57
6	27	69	52	966	71	87	139	99	57	32	23	71
7	27	60	51	195	62	97	116	74	140	40	28	58
8	27	56	50	155	55	140	106	65	463	31	25	40
9	123	52	49	126	53	145	231	60	156	41	23	35
10	48	57	58	e95	52	104	378	56	77	42	42	55
11	36	69	72	e92	52	87	168	53	53	33	34	32
12	33	455	80	e90	53	74	223	50	43	29	26	32
13	31	1090	75	177	59	e62	143	47	39	27	32	36
14	41	254	67	164	54	e60	114	46	35	60	27	31
15	460	149	62	122	52	e58	109	48	35	36	29	378
16	228	113	86	102	54	e67	241	44	32	28	97	89
17	97	101	67	88	53	111	129	42	30	25	32	49
18	68	90	58	75	e51	75	103	41	29	23	26	39
19	62	80	55	e70	e49	66	131	56	86	27	29	35
20	60	76	65	e70	e48	75	461	45	233	25	188	32
21	79	82	52	205	e52	101	171	41	615	23	45	320
22	58	93	50	532	e55	108	118	39	128	21	29	98
23	52	366	49	239	e51	204	100	38	73	20	78	54
24	50	158	44	215	e47	261	91	69	55	20	99	42
25	46	147	e41	163	e45	279	189	50	50	196	44	38
26	45	115	e39	107	e47	307	141	40	51	131	32	117
27	43	93	e38	98	e46	368	98	35	84	43	29	228
28	43	80	e40	92	e45	348	86	35	240	40	25	371
29	42	72	91	e74	---	263	117	33	116	58	30	94
30	40	68	381	e70	---	192	115	31	62	61	40	61
31	39	---	724	73	---	148	---	51	---	33	29	---
TOTAL	2054	4933	2806	6290	1551	4326	5546	1818	3243	1362	1275	3096
MEAN	66.3	164	90.5	203	55.4	140	185	58.6	108	43.9	41.1	103
MAX	460	1090	724	1150	77	368	492	238	615	196	188	378
MIN	27	41	38	70	45	48	86	31	29	20	23	27
CFSM	.75	1.87	1.03	2.31	.63	1.59	2.10	.67	1.23	.50	.47	1.17
IN.	.87	2.09	1.19	2.66	.66	1.83	2.35	.77	1.37	.58	.54	1.31

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1958 - 1993, BY WATER YEAR (WY)

	MEAN	40.8	56.5	68.3	63.0	77.0	132	118	75.2	60.1	36.5	31.3	38.1
MAX	207	164	178	203	254	327	225	191	241	118	92.1	147	
(WY)	1982	1993	1988	1993	1976	1982	1977	1983	1989	1968	1968	1986	
MIN	4.08	7.24	6.92	8.95	9.14	38.9	38.5	19.6	13.7	5.52	3.77	3.37	
(WY)	1964	1964	1964	1961	1963	1964	1963	1958	1971	1964	1963	1963	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1958 - 1993

ANNUAL TOTAL	32137		38300									
ANNUAL MEAN	87.8		105							66.8		
HIGHEST ANNUAL MEAN										105		1993
LOWEST ANNUAL MEAN										20.4		1964
HIGHEST DAILY MEAN	1090		1150		Nov 13			Jan 5		3210		Jun 26 1968
LOWEST DAILY MEAN	23		20		Jun 16			Jul 23		.30		Jul 31 1964
ANNUAL SEVEN-DAY MINIMUM	25		23		Jul 1			Jul 18		.66		Jul 26 1964
INSTANTANEOUS PEAK FLOW			1460					Jan 4		4900		Jun 26 1968
INSTANTANEOUS PEAK STAGE			11.84					Jan 4		19.04		Jun 26 1968
INSTANTANEOUS LOW FLOW			19					(a)		.10		Aug 2 1964
ANNUAL RUNOFF (CFSM)	1.00		1.19							.76		
ANNUAL RUNOFF (INCHES)	13.60		16.21							10.33		
10 PERCENT EXCEEDS	152		229							130		
50 PERCENT EXCEEDS	57		62							36		
90 PERCENT EXCEEDS	33		30							10		

(a) July 23, 24.

(e) Estimated.

## 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.

REVISED RECORDS.--WSP 1912: 1963.

GAGE.--Water-stage recorder. Datum of gage is 615.07 ft above sea level (City of Southfield bench mark).

REMARKS.--Records good. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.5	10	4.6	12	5.9	3.4	71	5.8	3.5	3.3	1.5	2.0
2	1.4	95	4.5	6.9	4.0	8.7	34	5.3	2.7	3.0	1.5	50
3	1.4	14	4.0	19	4.1	13	18	5.2	2.4	2.7	1.4	33
4	1.3	9.6	3.9	243	4.2	11	15	6.6	2.4	2.5	1.6	5.6
5	1.3	5.8	3.8	122	4.4	8.9	12	18	25	2.3	1.5	2.9
6	1.3	4.9	3.5	21	4.3	12	9.8	5.9	3.2	2.2	1.7	10
7	1.4	4.2	3.5	14	3.7	14	8.5	5.0	95	9.6	2.1	3.3
8	1.9	3.9	3.4	11	3.7	22	8.0	4.6	30	2.7	1.5	2.4
9	32	4.0	3.3	8.1	3.6	16	42	4.5	15	6.1	1.5	2.5
10	1.6	7.8	7.5	6.7	4.0	13	29	4.2	5.4	2.1	7.5	6.5
11	1.3	6.2	9.1	6.7	4.5	10	16	4.0	4.1	1.9	1.9	2.1
12	1.2	212	6.7	6.7	4.1	8.1	20	3.8	3.6	1.8	1.4	3.1
13	2.5	40	5.1	31	4.7	7.3	10	3.7	3.4	1.7	1.9	2.2
14	20	12	4.4	14	4.2	5.7	8.2	3.5	3.6	25	9.7	4.5
15	140	8.1	4.5	9.5	3.9	5.1	12	4.4	3.1	2.2	41	96
16	20	6.4	10	7.5	4.5	14	26	3.2	2.8	1.8	51	4.3
17	6.2	6.0	4.3	6.6	4.0	16	9.6	3.6	2.6	1.6	2.9	3.0
18	6.0	5.1	3.8	5.1	3.5	8.1	7.9	3.4	2.6	1.7	2.1	2.7
19	5.1	4.6	3.9	4.5	3.2	6.6	29	6.9	24	2.5	1.9	2.7
20	8.8	4.4	6.7	4.4	3.1	16	44	3.0	34	1.6	45	2.5
21	6.6	6.2	3.4	54	3.1	16	12	2.8	83	1.4	2.7	60
22	4.1	24	3.4	56	3.6	19	8.8	2.8	5.5	1.4	2.1	4.9
23	3.8	45	3.4	20	3.7	33	7.5	4.8	3.9	1.3	24	3.6
24	3.8	11	2.8	29	3.2	29	7.1	15	3.4	1.4	9.6	3.0
25	3.5	13	2.6	13	2.9	26	22	4.7	35	46	2.4	3.6
26	3.5	8.5	2.4	7.7	2.9	26	8.4	3.0	8.2	3.7	2.0	18
27	3.7	6.1	2.3	6.9	3.0	24	6.6	2.8	22	1.9	2.0	88
28	4.0	5.4	2.4	8.3	3.0	20	6.0	3.1	53	4.5	1.9	15
29	4.0	5.0	16	6.1	---	15	14	2.7	6.3	13	4.0	5.4
30	3.8	4.6	85	4.7	---	12	10	2.6	4.0	3.2	2.3	4.3
31	3.7	---	46	5.9	---	9.6	---	10	---	1.6	2.3	---
TOTAL	300.7	592.8	270.2	771.3	107.0	448.5	532.4	158.9	492.7	157.7	270.1	447.1
MEAN	9.70	19.8	8.72	24.9	3.82	14.5	17.7	5.13	16.4	5.09	8.71	14.9
MAX	140	212	85	243	5.9	33	71	18	95	46	51	96
MIN	1.2	3.9	2.3	4.4	2.9	3.4	6.0	2.6	2.4	1.3	1.4	2.0
CFSM	1.02	2.08	.92	2.62	.40	1.52	1.87	.54	1.73	.54	.92	1.57
IN.	1.18	2.32	1.06	3.02	.42	1.76	2.09	.62	1.93	.62	1.06	1.75

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1958 - 1993, BY WATER YEAR (WY)

	MEAN	5.82	7.89	9.22	7.31	9.41	14.4	13.5	8.89	8.98	6.94	6.41	6.53
	MAX	23.3	19.8	25.4	26.7	32.1	32.6	27.4	27.1	30.5	23.7	21.4	20.0
	(WY)	1982	1993	1968	1974	1971	1974	1977	1968	1968	1992	1968	1986
	MIN	.44	1.13	.71	.49	.79	5.28	3.27	2.35	1.68	.73	1.35	.58
	(WY)	1964	1964	1964	1963	1963	1964	1971	1962	1959	1962	1960	1965

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1958 - 1993

ANNUAL TOTAL	4087.2	4549.4	8.78
ANNUAL MEAN	11.2	12.5	16.9
HIGHEST ANNUAL MEAN			1968
LOWEST ANNUAL MEAN			1963
HIGHEST DAILY MEAN	212	243	442
LOWEST DAILY MEAN	1.2	1.2	.00
ANNUAL SEVEN-DAY MINIMUM	1.4	1.4	.27
INSTANTANEOUS PEAK FLOW		595	(b)1200
INSTANTANEOUS PEAK STAGE		10.73	(c)15.03
ANNUAL RUNOFF (CFSM)	1.18	1.31	.92
ANNUAL RUNOFF (INCHES)	16.02	17.83	12.56
10 PERCENT EXCEEDS	21	29	18
50 PERCENT EXCEEDS	4.4	4.7	3.4
90 PERCENT EXCEEDS	2.3	2.0	1.1

(a) June 13-15, 1986, caused by regulation of unknown source.

(b) From rating curve extended above 410 ft<sup>3</sup>/s.

(c) From floodmark.

## 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 sea level.

REMARKS.--Records good except for estimated daily discharges during the winter period, which are fair and estimated daily discharges during July through September, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.9	8.3	12	44	e13	e9.5	71	18	9.9	13	e6.5	e6.5
2	5.7	74	12	e28	e12	e12	66	16	8.4	11	e6.0	e19
3	5.4	50	11	e25	e11	e17	45	15	7.4	9.8	e5.8	e55
4	5.0	26	11	168	e11	e22	39	23	6.9	8.7	e5.6	e25
5	4.9	19	10	147	e12	e16	44	73	30	7.3	e5.4	e12
6	5.1	15	9.3	62	e12	e15	37	33	15	6.3	e5.6	e17
7	5.1	12	9.4	40	e12	e18	30	23	44	6.2	e7.2	e13
8	5.5	11	9.2	33	11	e22	26	18	77	5.9	e7.5	e9.0
9	26	11	9.1	26	9.8	e23	46	16	44	6.8	e5.5	e7.0
10	11	13	9.9	e20	10	e19	61	14	22	8.8	e11	e12
11	8.2	15	12	e19	10	e17	38	13	14	5.8	e10	e8.0
12	6.9	124	15	e18	e10	e14	39	12	11	5.5	e7.0	e7.0
13	6.2	155	15	28	e11	e13	29	11	9.0	4.7	e6.0	e6.7
14	12	51	14	26	e10	e12	23	11	8.1	12	e5.5	6.4
15	95	32	13	21	10	e11	24	12	7.7	7.3	e10	57
16	53	24	17	18	10	e14	47	10	7.0	5.7	e17	20
17	27	20	14	16	9.5	21	31	9.9	6.5	4.9	e8.5	13
18	18	19	12	e13	9.6	15	23	9.5	6.0	4.9	e6.0	8.6
19	14	17	11	e12	e9.4	13	29	12	13	6.0	e7.0	7.7
20	14	15	12	e11	e9.0	14	78	10	57	5.4	e30	7.0
21	17	15	9.6	45	e9.0	19	42	9.7	105	4.7	e10	34
22	12	21	9.5	e75	e9.5	21	29	9.2	36	4.5	e6.5	17
23	11	49	9.4	46	e9.3	36	23	9.7	19	3.9	e14	11
24	10	32	8.1	41	e9.0	49	20	14	13	4.1	e18	8.6
25	9.6	30	e7.7	30	e8.7	57	38	11	11	47	e11	8.2
26	8.8	21	e7.4	25	e8.6	67	30	9.2	11	38	e7.0	28
27	8.1	17	e6.9	20	e8.4	79	21	8.5	13	13	e6.2	38
28	7.6	15	e9.5	17	e8.4	77	18	8.3	40	e10	e5.8	45
29	7.4	14	21	14	---	62	25	7.6	35	e13	e17	19
30	7.1	13	71	e12	---	47	24	6.6	17	e15	e12	13
31	6.8	---	98	e13	---	38	---	10	---	e10	e7.0	---
TOTAL	439.3	938.3	496.0	1113	283.2	869.5	1096	463.2	703.9	309.2	287.6	538.7
MEAN	14.2	31.3	16.0	35.9	10.1	28.0	36.5	14.9	23.5	9.97	9.28	18.0
MAX	95	155	98	168	13	79	78	73	105	47	30	57
MIN	4.9	8.3	6.9	11	8.4	9.5	18	6.6	6.0	3.9	5.4	6.4
CFSM	.81	1.79	.91	2.05	.58	1.60	2.09	.85	1.34	.57	.53	1.03
IN.	.93	1.99	1.05	2.37	.60	1.85	2.33	.98	1.50	.66	.61	1.15

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1958 - 1993, BY WATER YEAR (WY)

	7.42	10.6	12.3	12.4	16.0	27.4	23.9	15.2	12.3	6.66	5.87	6.95
MEAN	7.42	10.6	12.3	12.4	16.0	27.4	23.9	15.2	12.3	6.66	5.87	6.95
MAX	42.2	31.3	29.0	39.8	51.6	63.6	42.3	38.7	63.9	24.8	22.9	28.5
(WY)	1982	1993	1991	1974	1976	1982	1977	1983	1989	1992	1991	1975
MIN	1.10	1.69	1.70	2.06	2.20	6.81	9.10	3.46	2.13	1.00	.97	1.00
(WY)	1965	1965	1964	1961	1963	1964	1971	1971	1971	1964	1963	1964

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1958 - 1993

ANNUAL TOTAL	6963.6	7537.9	13.2
ANNUAL MEAN	19.0	20.7	21.2
HIGHEST ANNUAL MEAN			4.54
LOWEST ANNUAL MEAN			1968
HIGHEST DAILY MEAN	155	Nov 13	653
LOWEST DAILY MEAN	4.4	Jul 7	.30
ANNUAL SEVEN-DAY MINIMUM	5.0	Jul 1	.61
INSTANTANEOUS PEAK FLOW			1500
INSTANTANEOUS LOW FLOW			8.70
ANNUAL RUNOFF (CFSM)	1.09		(b).07
ANNUAL RUNOFF (INCHES)	14.80		.75
10 PERCENT EXCEEDS	39		10.21
50 PERCENT EXCEEDS	12		27
90 PERCENT EXCEEDS	6.5		6.9
			2.1

(a) Result of freezeup.

(b) Result of regulation.

(c) Estimated.

## 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.

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 sea level. Prior to Oct. 16, 1948, nonrecording gage at site 1 mi downstream at datum 4.6 ft lower.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	56	79	120	519	e130	e82	642	149	87	94	52	48
2	51	687	112	218	e115	109	998	123	63	81	47	153
3	49	867	114	230	e110	172	487	113	52	75	42	621
4	46	263	103	1210	e110	258	335	121	49	69	39	294
5	44	179	99	2470	111	215	318	597	244	59	42	119
6	42	137	87	1090	125	167	262	231	127	52	37	120
7	41	110	88	391	94	205	216	149	185	66	42	141
8	41	97	85	279	e92	285	191	120	999	84	42	78
9	336	90	82	231	91	346	430	106	371	92	36	61
10	140	99	102	e170	90	229	730	97	177	84	68	92
11	76	155	144	e165	90	191	327	91	107	60	99	62
12	63	680	156	e160	87	162	357	83	82	49	48	53
13	54	1950	142	312	104	130	258	78	70	43	46	65
14	106	823	126	335	e92	e115	197	75	66	168	70	67
15	929	279	114	232	e90	e105	190	74	60	102	82	689
16	795	197	164	188	92	e130	436	73	56	53	281	224
17	288	169	130	164	93	277	253	66	49	42	76	96
18	161	152	107	130	e90	163	186	64	47	36	47	70
19	144	137	98	e125	e87	132	223	98	131	55	80	59
20	122	124	128	e125	e84	161	869	77	327	45	562	53
21	195	137	94	363	e92	239	356	65	1070	38	112	290
22	143	172	87	1030	e96	237	221	61	343	38	58	208
23	110	669	83	534	e90	399	181	58	142	33	128	95
24	106	326	78	386	e82	501	157	121	100	29	231	71
25	100	274	e74	346	e82	512	311	129	161	206	101	58
26	92	216	e70	e185	e81	493	284	70	153	451	60	213
27	85	174	67	e170	e81	601	173	58	214	108	52	258
28	81	148	66	e160	e81	599	146	55	267	65	46	594
29	81	132	116	e140	---	456	197	53	297	95	67	177
30	75	123	593	e120	---	339	205	46	122	151	81	101
31	71	---	1290	e125	---	267	---	78	---	70	52	---
TOTAL	4722	9645	4919	12303	2662	8277	10136	3379	6218	2698	2826	5210
MEAN	152	321	159	397	95.1	267	338	109	207	86.9	91.2	174
MAX	929	1950	1290	2470	190	601	998	597	1070	451	562	689
MIN	41	79	66	120	81	82	146	46	47	29	36	48
CFSM	.81	1.72	.85	2.12	.51	1.43	1.81	.58	1.11	.46	.49	.93
IN.	.94	1.92	.98	2.45	.53	1.65	2.02	.67	1.24	.54	.56	1.04

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	64.9	88.3	113	119	165	237	233	166	106	64.3	53.4	57.2
MAX	450	321	321	456	519	488	965	683	478	385	183	274	274
(WY)	1982	1993	1968	1950	1938	1950	1947	1943	1968	1957	1968	1975	1975
MIN	8.35	16.3	16.6	13.6	18.2	59.5	49.3	23.9	7.92	6.46	5.58	7.03	7.03
(WY)	1964	1954	1940	1961	1963	1931	1931	1934	1934	1934	1931	1931	1931

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1931 - 1993

ANNUAL TOTAL	68651	72990	122	1968
ANNUAL MEAN	188	200	222	1931
HIGHEST ANNUAL MEAN			25.7	1931
LOWEST ANNUAL MEAN				
HIGHEST DAILY MEAN	1950	Nov 13	2470	Jan 5
LOWEST DAILY MEAN	39	Jun 16	29	Jul 24
ANNUAL SEVEN-DAY MINIMUM	44	Jun 11	39	Jul 18
INSTANTANEOUS PEAK FLOW			2730	Jan 5
INSTANTANEOUS PEAK STAGE			15.82	Jan 5
INSTANTANEOUS LOW FLOW			27	Jul 24
ANNUAL RUNOFF (CFSM)	1.00	1.07	1.8	(a)23.00
ANNUAL RUNOFF (INCHES)	13.66	14.52	8.85	(b)
10 PERCENT EXCEEDS	414	432	259	
50 PERCENT EXCEEDS	108	119	60	
90 PERCENT EXCEEDS	58	52	16	

(a) From floodmark, site and datum then in use.

(b) Aug. 1, 2, 1964.

(c) Estimated.



## STREAMS TRIBUTARY TO DETROIT RIVER

## 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.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 600.95 ft above sea level. 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.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	38	55	79	361	93	56	374	95	51	62	35	35
2	36	293	78	180	82	71	414	83	43	57	33	122
3	35	254	75	164	74	104	250	79	40	52	32	315
4	33	127	71	672	74	148	231	93	39	46	30	140
5	32	91	69	1220	77	119	216	396	123	41	29	66
6	30	76	63	655	81	110	201	165	72	37	30	94
7	31	67	60	309	75	126	167	109	121	36	40	70
8	31	63	59	199	69	171	138	90	346	42	41	47
9	141	62	58	151	63	210	250	78	207	105	30	38
10	64	72	72	120	62	166	353	72	109	56	62	38
11	47	86	87	109	63	133	241	68	70	39	53	37
12	42	421	87	106	64	112	191	64	56	35	39	39
13	37	918	83	187	71	94	143	59	48	32	32	37
14	84	494	81	158	68	83	117	56	44	148	30	e50
15	460	248	80	125	63	71	119	55	43	66	51	e300
16	347	165	102	109	65	96	226	53	40	42	96	131
17	158	135	95	100	64	148	176	51	38	34	47	66
18	100	116	82	89	59	101	129	50	37	31	34	47
19	80	103	77	80	e57	83	148	62	67	53	38	39
20	73	93	89	76	e54	114	358	54	149	36	73	36
21	75	100	71	249	57	131	244	50	342	32	84	56
22	66	147	63	426	63	139	161	47	145	31	46	59
23	60	311	62	311	60	241	121	48	82	27	74	46
24	57	185	59	267	e56	300	102	66	62	26	99	36
25	54	162	54	215	e52	323	186	65	64	192	62	41
26	52	133	51	140	e54	314	160	50	65	206	39	131
27	50	109	47	116	e52	343	118	44	114	85	33	184
28	48	96	47	112	e51	357	100	44	154	51	32	245
29	47	87	79	102	---	312	112	42	94	46	93	108
30	45	82	338	83	---	245	113	40	69	53	67	67
31	44	---	622	83	---	195	---	54	---	41	40	---
TOTAL	2497	5351	3040	7274	1823	5216	5899	2382	2934	1840	1524	2720
MEAN	80.5	178	98.1	235	65.1	168	197	76.8	97.8	59.4	49.2	90.7
MAX	460	918	622	1220	93	357	414	396	346	206	99	315
MIN	30	55	47	76	51	56	100	40	37	26	29	35
CFSM	.81	1.79	.98	2.35	.65	1.68	1.97	.77	.98	.59	.49	.91
IN.	.93	1.99	1.13	2.71	.68	1.94	2.20	.89	1.09	.69	.57	1.01

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1931 - 1993, BY WATER YEAR (WY)

	MEAN	38.9	56.2	74.1	80.9	105	148	133	90.5	62.4	40.7	33.7	41.4
MAX	124	178	177	269	324	313	313	310	225	179	83.8	171	171
(WY)	1955	1993	1988	1952	1976	1976	1950	1956	1968	1957	1956	1975	1975
MIN	7.83	9.46	10.4	9.65	14.2	42.3	32.6	21.9	17.8	8.85	5.64	4.97	4.97
(WY)	1932	1965	1964	1961	1963	1931	1931	1958	1959	1931	1931	1931	1931

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1931 - 1993

ANNUAL TOTAL	37763	42500	75.1
ANNUAL MEAN	103	116	133
HIGHEST ANNUAL MEAN			20.8
LOWEST ANNUAL MEAN			2060
HIGHEST DAILY MEAN	918	Nov 13	1220
LOWEST DAILY MEAN	27	Jul 1	26
ANNUAL SEVEN-DAY MINIMUM	30	Jun 28	33
INSTANTANEOUS PEAK FLOW			1460
INSTANTANEOUS PEAK STAGE			9.38
INSTANTANEOUS LOW FLOW			25
ANNUAL RUNOFF (CFSM)	1.03		1.17
ANNUAL RUNOFF (INCHES)	14.06		15.83
10 PERCENT EXCEEDS	213		248
50 PERCENT EXCEEDS	69		75
90 PERCENT EXCEEDS	36		37

(a) From floodmark.

(e) Estimated.

## 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 sea level. Prior to Oct. 20, 1948, nonrecording gage at same site and datum.

REMARKS.--Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	27	e42	314	58	23	353	46	10	12	2.5	6.9
2	11	223	e40	e70	38	36	540	38	8.0	11	2.4	34
3	9.5	314	39	e85	35	70	290	34	e7.4	8.9	6.7	147
4	8.1	123	33	650	33	126	195	47	e7.0	8.5	8.2	52
5	7.3	77	31	1610	35	74	163	392	40	8.6	2.6	20
6	6.2	57	24	666	42	81	123	159	16	7.0	2.1	43
7	8.0	45	27	197	30	99	100	80	49	5.7	8.9	e27
8	7.6	38	25	133	31	180	77	54	135	5.1	7.1	e16
9	64	34	23	98	22	298	174	42	82	48	1.9	9.1
10	29	38	29	e55	26	198	390	e32	43	14	8.9	9.7
11	17	52	40	e52	e24	129	175	e28	23	7.2	9.0	6.6
12	13	368	48	e50	22	111	126	27	16	6.6	5.5	6.1
13	13	958	54	105	27	76	89	22	12	4.3	3.1	6.1
14	49	435	59	97	29	57	70	21	10	68	2.3	5.3
15	319	149	56	80	26	51	70	20	9.7	32	5.9	145
16	346	93	92	66	e24	64	189	18	8.6	10	37	43
17	133	74	78	61	e22	138	129	16	7.2	5.8	11	15
18	71	65	53	40	20	110	80	15	7.2	4.1	6.9	9.4
19	51	55	45	40	e20	74	93	18	48	9.7	11	6.7
20	43	47	59	32	19	97	379	14	46	6.2	6.4	5.6
21	43	51	42	145	20	152	182	13	138	4.4	5.5	26
22	37	89	e38	421	27	207	91	13	49	3.1	3.0	13
23	32	370	e35	286	23	384	65	12	e26	2.7	3.6	8.8
24	31	184	28	237	21	501	53	24	15	2.4	19	7.8
25	30	127	e22	173	20	436	113	19	48	81	6.0	12
26	25	103	e19	87	20	365	123	13	14	57	3.5	53
27	23	77	17	76	20	377	72	10	21	16	2.3	90
28	21	62	16	64	19	395	54	8.8	43	9.2	1.2	92
29	20	53	33	50	---	278	52	8.4	31	6.8	39	31
30	19	46	249	40	---	195	55	8.1	16	4.5	25	19
31	17	---	751	43	---	138	---	12	---	3.1	9.9	---
TOTAL	1514.7	4434	2147	6123	753	5520	4665	1264.3	986.1	472.9	267.4	966.1
MEAN	48.9	148	69.3	198	26.9	178	155	40.8	32.9	15.3	8.63	32.2
MAX	346	958	751	1610	58	501	540	392	138	81	39	147
MIN	6.2	27	16	32	19	23	52	8.1	7.0	2.4	1.2	5.3
CFSM	.59	1.78	.83	2.37	.32	2.14	1.87	.49	.40	.18	.10	.39
IN.	.68	1.98	.96	2.74	.34	2.47	2.09	.57	.44	.21	.12	.43

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1947 - 1993, BY WATER YEAR (WY)

	MEAN	20.2	37.2	61.9	57.2	87.2	134	112	56.6	33.9	18.6	13.5	19.8
MAX	110	176	179	294	307	301	280	183	221	95.8	65.7	99.5	99.5
(WY)	1982	1986	1968	1952	1976	1982	1950	1983	1968	1969	1975	1975	1975
MIN	2.11	3.23	2.32	1.86	4.18	19.4	22.2	4.47	2.75	2.26	.83	1.86	1.86
(WY)	1949	1964	1964	1961	1964	1964	1958	1958	1949	1948	1950	1952	1952

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1947 - 1993
ANNUAL TOTAL	25570.4	29113.5	
ANNUAL MEAN	69.9	79.8	54.2
HIGHEST ANNUAL MEAN			98.8
LOWEST ANNUAL MEAN			15.9
HIGHEST DAILY MEAN	958	1610	2520
LOWEST DAILY MEAN	1.1	1.2	.30
ANNUAL SEVEN-DAY MINIMUM	2.2	3.9	.53
INSTANTANEOUS PEAK FLOW		1880	3600
INSTANTANEOUS PEAK STAGE		11.44	13.62
INSTANTANEOUS LOW FLOW		.58	.20
ANNUAL RUNOFF (CFSM)	.84	.96	.65
ANNUAL RUNOFF (INCHES)	11.43	13.02	8.85
10 PERCENT EXCEEDS	156	191	120
50 PERCENT EXCEEDS	33	35	16
90 PERCENT EXCEEDS	8.7	6.7	2.6

(a) Aug. 28, 29.

(b) Sept. 13, 1955, Jan. 23, 1961.

(c) Estimated.

## STREAMS TRIBUTARY TO LAKE ERIE

## 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 sea level. Prior to Apr. 1, 1970, at site 240 ft upstream at same datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	138	109	161	233	159	125	269	199	82	216	69	65
2	132	149	156	203	153	127	278	189	76	210	67	75
3	126	161	150	188	149	135	272	182	74	202	63	110
4	119	150	149	229	148	142	263	181	72	189	62	120
5	114	141	142	304	148	141	260	196	103	166	58	106
6	113	141	139	326	149	139	256	196	107	149	56	101
7	112	141	135	300	141	141	246	185	112	137	57	105
8	112	138	133	265	138	149	233	169	178	129	55	101
9	143	138	131	239	133	156	230	157	200	122	56	97
10	138	141	133	221	131	156	237	148	187	120	63	92
11	121	147	135	214	132	150	234	132	168	110	67	88
12	109	188	139	207	133	146	226	118	150	100	61	88
13	94	249	141	216	134	142	218	106	127	95	58	90
14	92	264	142	220	134	136	207	97	116	92	57	95
15	148	244	145	213	132	134	200	83	108	91	62	151
16	172	219	149	204	133	134	221	76	100	84	67	158
17	162	203	150	195	132	143	225	71	91	80	63	140
18	143	196	147	186	130	137	216	71	85	81	60	134
19	133	188	145	176	129	133	199	74	101	83	61	132
20	129	183	142	169	127	137	227	73	209	80	87	130
21	132	180	139	174	130	141	238	72	380	75	75	165
22	126	183	134	203	133	147	222	71	408	64	65	164
23	123	200	132	210	132	159	203	73	359	55	67	149
24	119	206	129	206	130	169	195	86	295	55	89	142
25	114	203	123	203	129	182	199	88	256	72	84	138
26	114	196	118	190	128	198	210	80	252	100	77	159
27	111	190	117	180	126	220	201	74	251	89	75	174
28	105	182	115	173	125	246	191	77	267	80	72	198
29	99	174	129	166	---	264	194	77	268	75	71	194
30	96	166	173	161	---	264	201	72	241	75	73	181
31	93	---	228	159	---	260	---	81	---	72	69	---
TOTAL	3782	5370	4401	6533	3798	5053	6771	3554	5423	3348	2066	3842
MEAN	122	179	142	211	136	163	226	115	181	108	66.6	128
MAX	172	264	228	326	159	264	278	199	408	216	89	198
MIN	92	109	115	159	125	125	191	71	72	55	55	65
CFSM	.92	1.36	1.08	1.60	1.03	1.23	1.71	.87	1.37	.82	.50	.97
IN.	1.07	1.51	1.24	1.84	1.07	1.42	1.91	1.00	1.53	.94	.58	1.08

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1948 - 1993, BY WATER YEAR (WY)

	MEAN	78.8	93.2	106	105	112	155	166	115	86.6	64.2	52.2	64.9
MAX	283	179	218	211	226	337	389	340	181	233	142	247	
(WY)	1982	1993	1951	1993	1951	1976	1950	1956	1993	1968	1968	1975	
MIN	32.6	34.0	35.8	42.5	42.0	66.9	79.4	51.8	28.8	19.3	26.5	27.2	
(WY)	1965	1964	1964	1964	1963	1964	1963	1988	1988	1988	1971	1964	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1948 - 1993

ANNUAL TOTAL	44279	53941	99.8	
ANNUAL MEAN	121	148	157	1974
HIGHEST ANNUAL MEAN			44.6	1964
LOWEST ANNUAL MEAN			632	Oct 3 1981
HIGHEST DAILY MEAN	317	408	5.2	Oct 21 1971
LOWEST DAILY MEAN	34	55	11	Jul 9 1988
ANNUAL SEVEN-DAY MINIMUM	36	58	648	Oct 3 1981
INSTANTANEOUS PEAK FLOW		412	8.26	Jun 28 1968
INSTANTANEOUS PEAK STAGE		7.15		
INSTANTANEOUS LOW FLOW		54		
ANNUAL RUNOFF (CFSM)	.92	1.12	.76	
ANNUAL RUNOFF (INCHES)	12.48	15.20	10.27	
10 PERCENT EXCEEDS	169	228	185	
50 PERCENT EXCEEDS	120	139	82	
90 PERCENT EXCEEDS	65	73	37	

(a) July 23, 24, 25, Aug. 8, 9, 19.

## 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 sea level (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 observed, 10.77 ft, Dec. 23, 1992, but may have been lower during period of no gage-height record Nov. 13, 1992, to Jan. 22, 1993, due to repairs on dam structure.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 16.33 ft, June 22; minimum observed, 10.77 ft, Dec. 23, but may have been lower during period of no gage-height record Nov. 13 to Jan. 22, due to repairs on dam structure.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.99	13.54	--	--	12.83	12.81	13.18	15.65	15.71	16.13	15.66	15.67
2	15.98	13.26	--	--	12.80	12.71	13.19	15.69	15.70	16.09	15.65	15.69
3	15.98	13.22	--	--	12.78	12.70	13.19	15.70	15.70	16.06	15.63	15.76
4	15.97	13.08	--	--	12.77	12.73	13.19	15.73	15.70	16.03	15.64	15.80
5	15.95	12.90	--	--	12.77	12.74	13.20	15.77	15.76	15.99	15.62	15.80
6	15.93	12.40	--	--	12.76	12.74	13.37	15.79	15.78	15.95	15.62	15.79
7	15.93	12.27	--	--	12.75	12.73	13.57	15.77	15.82	15.92	15.62	15.79
8	15.92	12.22	--	--	12.74	12.75	13.81	15.75	15.93	15.88	15.62	15.78
9	15.94	12.09	--	--	12.73	12.77	13.95	15.72	15.98	15.86	15.61	15.75
10	15.84	11.91	--	--	12.72	12.78	14.04	15.68	16.00	15.86	15.64	15.75
11	15.77	11.75	--	--	12.72	12.78	14.07	15.65	15.99	15.84	15.67	15.73
12	15.72	11.70	--	--	12.73	12.77	14.13	15.60	15.95	15.81	15.66	15.72
13	15.63	--	--	--	12.73	12.76	14.38	15.53	15.90	15.78	15.65	15.72
14	15.40	--	--	--	12.73	12.73	14.50	15.53	15.85	15.77	15.63	15.73
15	15.21	--	--	--	12.72	12.72	14.58	15.59	15.82	15.76	15.63	15.87
16	15.10	--	--	--	12.73	12.72	14.86	15.60	15.80	15.75	15.65	15.89
17	15.04	--	--	--	12.73	12.74	15.07	15.60	15.78	15.73	15.65	15.89
18	14.99	--	--	--	12.72	12.73	15.18	15.60	15.76	15.72	15.64	15.87
19	14.86	--	--	--	12.73	12.72	15.24	15.61	15.80	15.72	15.64	15.86
20	14.56	--	--	--	12.74	12.73	15.29	15.61	15.99	15.71	15.71	15.85
21	14.42	--	--	--	12.74	12.73	15.32	15.62	16.23	15.70	15.71	15.91
22	14.34	--	--	--	12.74	12.74	15.31	15.62	16.31	15.68	15.68	15.92
23	14.30	--	--	13.54	12.74	12.78	15.29	15.64	16.28	15.65	15.67	15.91
24	14.29	--	--	13.54	12.75	12.81	15.26	15.66	16.22	15.63	15.70	15.89
25	14.26	--	--	13.50	12.77	12.85	15.27	15.71	16.17	15.67	15.72	15.88
26	14.24	--	--	13.38	12.79	12.90	15.28	15.70	16.18	15.72	15.71	15.90
27	14.24	--	--	13.30	12.80	12.95	15.26	15.69	16.19	15.73	15.69	15.92
28	14.22	--	--	13.24	12.82	13.01	15.24	15.69	16.19	15.71	15.69	15.97
29	14.12	--	--	13.14	--	13.07	15.29	15.69	16.19	15.69	15.69	15.97
30	13.87	--	--	12.96	--	13.11	15.51	15.67	16.16	15.69	15.68	15.96
31	13.67	--	--	12.87	--	13.14	--	15.71	--	15.67	15.68	--
MEAN	15.09	--	--	--	12.75	12.80	14.50	15.66	15.96	15.80	15.66	15.83
MAX	15.99	--	--	--	12.83	13.14	15.51	15.79	16.31	16.13	15.72	15.97
MIN	13.67	--	--	--	12.72	12.70	13.18	15.53	15.70	15.63	15.61	15.67







## 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 1992 TO SEPTEMBER 1993

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE LAB (US/CMO (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)
DEC 01...	1705	634	4.0	9.2	<0.3	<0.030	<0.3	<0.01	<0.01
MAR 23...	1855	619	2.0	9.3	<0.1	<0.010	<0.1	<0.01	<0.01
MAY 07...	0820	592	15.5	10	<0.1	<0.010	<0.1	<0.01	<0.01
JUN 15...	1905	630	22.0	8.5	<0.1	<0.010	<0.1	<0.01	<0.01
JUL 30...	0910	612	22.0	7.8	<0.1	<0.010	<0.1	<0.01	<0.01
SEP 16...	0730	627	16.5	9.0	<0.1	<0.010	<0.1	<0.01	<0.01

DATE	DDD, TOTAL (UG/L) (39360)	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) (39388)	ENDO- SULFAN, TOTAL (UG/L) (39388)	ENDRIN WATER UNPLTRD REC (UG/L) (39390)	ETHION, TOTAL (UG/L) (39398)
DEC 01...	<0.030	<0.030	<0.030	<0.01	<0.01	<0.030	<0.030	<0.030	<0.01
MAR 23...	<0.010	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010	<0.01
MAY 07...	<0.010	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010	<0.01
JUN 15...	<0.010	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010	<0.01
JUL 30...	<0.010	<0.010	<0.010	0.01	<0.01	<0.010	<0.010	<0.010	<0.01
SEP 16...	<0.010	<0.010	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010	<0.01

DATE	PONOFOS (DY- FONATE) WATER WHOLE TOT.REC (UG/L) (82614)	HEPTA- CHLOR, TOTAL (UG/L) (39410)	HEPTA- CHLOR EPOXIDE TOTAL (UG/L) (39420)	LINDANE TOTAL (UG/L) (39340)	MALA- TION, TOTAL (UG/L) (39530)	METH- OXY- CHLOR, TOTAL (UG/L) (39480)	METHYL PARA- THION, TOTAL (UG/L) (39600)	MIREX, TOTAL (UG/L) (39755)	NAPH- THA- LENES, POLY- CHLOR. TOTAL (UG/L) (39250)
DEC 01...	<0.01	<0.030	<0.030	<0.030	<0.01	<0.03	<0.01	<0.03	<0.30
MAR 23...	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.10
MAY 07...	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.10
JUN 15...	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.10
JUL 30...	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.10
SEP 16...	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.10

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)
DEC 01...	<0.01	<0.3	<0.01	<3	<0.01	0.02	<0.01	<0.01	<0.01
MAR 23...	<0.01	<0.1	<0.01	<1	<0.01	<0.01	<0.01	<0.01	<0.01
MAY 07...	<0.01	<0.1	<0.01	<1	<0.01	0.11	<0.01	<0.01	<0.01
JUN 15...	<0.01	<0.1	<0.01	<1	<0.01	0.49	<0.01	<0.01	<0.01
JUL 30...	<0.01	<0.1	<0.01	<1	<0.01	0.10	<0.01	<0.01	<0.01
SEP 16...	<0.01	<0.1	<0.01	<1	<0.01	0.02	<0.01	<0.01	<0.01

## STREAMS TRIBUTARY TO LAKE ERIE

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 February 1904 to September 1914 and October 1947 to July 1948, 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 sea level (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.--Records good. Prior to 1955, diversion upstream from station for Ann Arbor municipal supply had negligible effect on natural flow; annual mean discharge and runoff figures adjusted for diversion from 1955 to 1991. 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. National Weather Service gage-height telemeter at station.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	380	497	902	1170	869	498	1720	999	357	764	203	240
2	387	661	871	981	818	500	1860	943	346	825	196	315
3	400	834	831	942	785	509	1840	840	295	892	209	445
4	380	829	808	1620	749	617	1740	837	299	749	215	317
5	339	835	782	2380	728	602	1670	1200	411	715	209	283
6	317	780	744	2300	722	591	1570	1340	436	662	219	348
7	322	747	722	1920	682	620	1400	1110	504	468	288	513
8	328	723	694	1690	657	743	1260	909	735	511	195	317
9	378	715	669	1560	629	863	1300	876	850	551	186	322
10	370	775	681	1450	613	852	1310	881	883	669	236	329
11	401	997	666	1360	609	790	1270	844	805	447	320	325
12	375	1360	643	1300	615	763	1230	805	575	421	242	335
13	375	1470	630	1300	605	743	1090	666	592	413	242	326
14	447	1370	580	1240	593	687	924	497	644	482	242	334
15	692	1360	581	1180	585	676	840	620	637	444	244	677
16	932	1290	661	1130	583	689	1200	583	608	324	257	557
17	922	1180	715	1090	581	738	1000	425	398	318	210	483
18	880	1100	705	1010	550	722	941	435	392	325	210	444
19	806	1030	703	912	546	683	855	435	460	344	200	424
20	781	984	679	899	538	684	1190	412	567	342	201	515
21	876	963	639	967	574	693	1580	322	940	306	227	476
22	692	1000	613	1130	565	791	1390	269	1110	255	199	452
23	561	1230	605	1160	555	1010	1150	333	1170	249	95	416
24	623	1290	603	1110	534	1370	630	451	1220	206	304	419
25	663	1230	554	1110	513	1420	1150	382	1180	347	277	440
26	647	1170	512	985	519	1420	1260	324	997	435	222	526
27	644	1120	514	976	515	1450	1160	323	1090	282	227	602
28	484	1060	493	970	497	1730	1070	326	1160	242	226	725
29	481	1000	493	949	---	1870	1010	317	1070	268	283	700
30	480	946	749	882	---	1820	1030	276	863	308	266	648
31	474	---	1160	866	---	1760	---	286	---	284	250	---
TOTAL	16837	30546	21202	38539	17329	28904	37641	19266	21594	13848	7100	13253
MEAN	543	1018	684	1243	619	932	1255	621	720	447	229	442
MAX	932	1470	1160	2380	869	1870	1860	1340	1220	892	320	725
MIN	317	497	493	866	497	498	630	269	295	206	95	240

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1915 - 1993, BY WATER YEAR (WY)

	MEAN	263	375	419	446	541	862	872	599	397	237	174	213
MAX	904	1018	1080	1257	1431	2308	2647	2085	1341	1130	569	919	
(WY)	1962	1993	1951	1950	1976	1918	1947	1943	1943	1968	1968	1975	
MIN	71.6	109	123	131	145	189	274	187	72.0	31.5	21.1	55.8	
(WY)	1935	1935	1935	1925	1934	1934	1931	1925	1934	1934	1934	1934	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1915 - 1993

ANNUAL TOTAL	210285	266059	
ANNUAL MEAN	575	729	(a)449
HIGHEST ANNUAL MEAN			824
LOWEST ANNUAL MEAN			171
HIGHEST DAILY MEAN	1810	2380	5840
LOWEST DAILY MEAN	136	95	(b)4.0
ANNUAL SEVEN-DAY MINIMUM	147	192	13
INSTANTANEOUS PEAK FLOW		2730	
INSTANTANEOUS PEAK STAGE		15.15	
10 PERCENT EXCEEDS	908	1280	929
50 PERCENT EXCEEDS	517	661	322
90 PERCENT EXCEEDS	286	283	118

(a) Does not include water year 1948.

(b) Plant leakage, but doubtful due to possible change in leakage.

(c) Aug. 2, Sept. 11, 1931.



## 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 sea level, from topographic map.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	461	570	1080	1550	1130	683	2100	1270	512	860	247	286
2	461	879	1050	1300	1070	724	2220	1210	499	928	236	465
3	480	983	997	1260	1030	760	2140	1090	449	1010	253	569
4	451	939	981	2620	992	893	2000	1090	439	850	257	411
5	405	933	937	3290	976	856	1960	1480	628	805	261	338
6	375	862	905	2800	963	842	1820	1540	600	758	266	418
7	371	820	880	2250	915	876	1600	1380	726	552	348	566
8	380	788	841	1930	889	1070	1520	1150	962	584	238	398
9	549	781	813	1720	855	1260	1600	1100	1060	645	222	378
10	433	830	851	1600	828	1210	1630	1110	1040	740	306	383
11	474	1070	836	1540	803	1100	1550	1050	944	514	380	378
12	443	1900	812	1500	826	1050	1520	1020	721	490	298	415
13	443	2220	811	1520	816	1010	1420	882	714	483	292	392
14	534	1720	757	1480	800	939	1270	684	764	594	282	394
15	1050	1630	760	1440	779	905	1160	801	755	520	289	856
16	1140	1510	879	1410	789	958	1510	777	741	399	314	610
17	1060	1370	931	1380	777	1030	1340	602	553	372	252	533
18	992	1260	904	1270	763	996	1250	613	539	377	249	500
19	895	1190	911	1240	734	943	1160	609	632	416	241	469
20	856	1130	894	1160	724	960	1530	591	732	399	241	552
21	977	1130	837	1310	774	980	1760	497	1110	357	262	539
22	778	1200	803	1520	759	1120	1560	414	1240	299	226	511
23	635	1530	790	1500	743	1430	1430	490	1290	290	123	466
24	685	1530	772	1470	715	1690	881	647	1290	234	366	462
25	726	1480	753	1430	669	1800	1390	564	1320	563	310	489
26	706	1420	737	1300	707	1780	1500	488	1110	524	267	615
27	710	1330	661	1280	663	1840	1430	474	1210	363	266	717
28	558	1260	644	1280	676	2110	1370	485	1300	289	262	775
29	544	1200	672	1230	--	2230	1300	465	1210	309	395	738
30	541	1120	1170	1140	--	2120	1320	408	996	345	324	695
31	533	--	1760	1130	--	2020	--	435	--	329	299	--
TOTAL	19646	36585	27429	48850	23165	38185	46241	25416	26086	16198	8572	15318
MEAN	634	1219	885	1576	827	1232	1541	820	870	523	277	511
MAX	1140	2220	1760	3290	1130	2230	2220	1540	1320	1010	395	856
MIN	371	570	644	1130	663	683	881	408	439	234	123	286

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1974 - 1993, BY WATER YEAR (WY)

	435	620	652	628	717	1122	1127	793	517	326	273	383
MEAN	435	620	652	628	717	1122	1127	793	517	326	273	383
MAX	1145	1219	1053	1576	1535	1925	1541	1301	870	528	524	960
(WY)	1982	1993	1991	1993	1976	1976	1993	1983	1993	1979	1992	1975
MIN	198	315	273	210	225	742	874	520	274	170	140	145
(WY)	1980	1979	1977	1977	1979	1983	1981	1982	1979	1984	1984	1978

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1974 - 1993

ANNUAL TOTAL	265121	331691	632	
ANNUAL MEAN	724	909	909	1993
HIGHEST ANNUAL MEAN			419	1977
LOWEST ANNUAL MEAN				
HIGHEST DAILY MEAN	2330	3290	3920	Mar 5 1976
LOWEST DAILY MEAN	176	123	62	Jun 28 1984
ANNUAL SEVEN-DAY MINIMUM	204	228	72	Sep 1 1978
INSTANTANEOUS PEAK FLOW		3680	4500	May 2 1983
INSTANTANEOUS PEAK STAGE		12.04	12.64	May 2 1983
10 PERCENT EXCEEDS	1130	1530	1200	
50 PERCENT EXCEEDS	656	826	508	
90 PERCENT EXCEEDS	374	347	200	

## 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 sea level, from topographic map.

REMARKS.--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, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	69	39	29	31	26	22
2	---	---	---	---	---	---	63	38	28	34	29	42
3	---	---	---	---	---	---	50	38	31	32	30	57
4	---	---	---	---	---	---	49	56	30	30	30	29
5	---	---	---	---	---	---	51	63	40	28	26	28
6	---	---	---	---	---	---	50	44	28	29	28	33
7	---	---	---	---	---	---	47	43	50	31	27	26
8	---	---	---	---	---	---	47	40	42	31	27	26
9	---	---	---	---	---	---	59	37	37	40	27	30
10	---	---	---	---	---	---	57	37	31	32	34	26
11	---	---	---	---	---	---	48	39	32	29	28	27
12	---	---	---	---	---	---	44	38	31	29	29	27
13	---	---	---	---	---	---	45	37	29	28	29	27
14	---	---	---	---	---	---	45	37	28	63	28	30
15	---	---	---	---	---	---	49	35	30	32	32	72
16	---	---	---	---	---	---	58	34	30	31	31	29
17	---	---	---	---	---	---	45	36	31	30	28	28
18	---	---	---	---	---	---	41	35	31	26	30	28
19	---	---	---	---	---	---	55	37	59	29	28	27
20	---	---	---	---	---	---	62	34	39	31	29	27
21	---	---	---	---	---	---	48	33	49	27	29	32
22	---	---	---	---	---	---	45	31	33	28	26	30
23	---	---	---	---	---	---	44	32	32	28	24	28
24	---	---	---	---	---	---	45	40	30	26	35	26
25	---	---	---	---	---	---	53	32	31	68	29	29
26	---	---	---	---	---	---	45	33	31	29	31	30
27	---	---	---	---	---	---	42	31	32	29	24	38
28	---	---	---	---	---	---	41	32	60	31	33	30
29	---	---	---	---	---	---	42	29	33	29	36	28
30	---	---	---	---	---	---	41	27	28	31	24	27
31	---	---	---	---	---	---	---	27	---	27	30	---
TOTAL	---	---	---	---	---	---	1480	1144	1035	999	897	939
MEAN	---	---	---	---	---	---	49.3	36.9	34.5	32.2	28.9	31.3
MAX	---	---	---	---	---	---	69	63	59	68	36	72
MIN	---	---	---	---	---	---	41	27	28	26	24	22

## 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 sea level, from topographic map. Prior to July 30, 1970, nonrecording gage at same site and datum.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	78	119	201	259	e170	e115	372	196	76	89	56	47
2	73	166	194	236	e160	e120	387	180	73	86	53	54
3	70	236	188	224	e155	132	373	173	71	82	50	88
4	65	229	179	319	153	152	360	189	70	80	52	94
5	61	215	174	449	149	154	344	255	96	75	50	80
6	59	193	155	421	149	157	328	234	107	71	47	77
7	56	174	168	388	e140	166	315	206	107	69	46	81
8	55	161	147	368	135	189	302	183	143	67	44	75
9	90	152	137	350	131	209	301	165	193	96	43	71
10	116	147	136	345	129	207	306	150	190	114	44	68
11	103	152	134	326	131	201	294	139	171	114	50	62
12	96	185	137	330	132	196	285	129	149	111	50	57
13	87	302	140	326	134	191	270	116	132	101	51	58
14	92	292	139	317	136	183	252	108	125	107	46	56
15	200	270	158	302	133	e170	240	101	125	107	43	93
16	292	244	158	286	132	e175	255	93	116	95	42	103
17	278	220	150	275	133	188	255	89	110	85	41	90
18	247	205	141	e250	e125	185	238	84	102	77	40	77
19	220	193	141	e235	e125	176	228	84	109	86	37	72
20	198	185	142	e220	e125	169	257	81	150	92	39	67
21	186	185	122	e240	e130	175	256	78	170	91	38	68
22	175	194	119	267	e130	197	239	75	165	83	34	70
23	167	248	112	264	e125	252	219	74	142	75	34	72
24	163	273	e105	e250	e120	326	202	80	118	69	41	68
25	157	264	e97	e240	e120	332	217	82	104	75	40	65
26	153	252	e92	e225	e120	336	240	75	103	91	39	80
27	147	241	90	e210	e120	340	227	69	106	87	41	103
28	141	226	98	e200	e115	351	210	70	105	80	40	167
29	135	218	160	e190	---	356	206	68	102	76	46	157
30	127	209	233	e180	---	353	209	64	94	70	54	144
31	121	---	266	e180	---	347	---	72	---	62	49	---
TOTAL	4208	6350	4613	8672	3757	6800	8187	3762	3624	2663	1380	2464
MEAN	136	212	149	280	134	219	273	121	121	85.9	44.5	82.1
MAX	292	302	266	449	170	356	387	255	193	114	56	167
MIN	55	119	90	180	115	115	202	64	70	62	34	47
CFSM	1.03	1.60	1.13	2.12	1.02	1.66	2.07	.92	.92	.65	.34	.62
IN.	1.19	1.79	1.30	2.44	1.06	1.92	2.31	1.06	1.02	.75	.39	.69

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1970 - 1993, BY WATER YEAR (WY)

	MEAN	66.4	95.3	112	112	124	205	194	120	89.1	54.8	46.0	59.1
MAX	169	212	160	280	241	356	275	275	191	249	114	116	142
(WY)	1987	1993	1991	1993	1976	1976	1978	1974	1989	1981	1981	1981	1981
MIN	24.8	25.1	30.7	27.6	45.0	123	116	52.7	13.9	10.4	12.4	15.1	
(WY)	1980	1972	1977	1977	1972	1987	1987	1971	1988	1988	1971	1971	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1970 - 1993

ANNUAL TOTAL	41542	56480	107
ANNUAL MEAN	114	155	155
HIGHEST ANNUAL MEAN			1993
LOWEST ANNUAL MEAN			1977
HIGHEST DAILY MEAN	302	Nov 13	690
LOWEST DAILY MEAN	37	Jul 2	5.7
ANNUAL SEVEN-DAY MINIMUM	40	Aug 20	6.1
INSTANTANEOUS PEAK FLOW			869
INSTANTANEOUS PEAK STAGE		5.95	7.21
INSTANTANEOUS LOW FLOW		26	4.5
ANNUAL RUNOFF (CFSM)	.86	1.17	.81
ANNUAL RUNOFF (INCHES)	11.71	15.92	11.02
10 PERCENT EXCEEDS	187	281	217
50 PERCENT EXCEEDS	104	137	85
90 PERCENT EXCEEDS	54	57	25

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE ERIE

## 04175957 SOUTH BRANCH RIVER RAISIN AT ADRIAN, MI

LOCATION.--Lat 41°54'30", long 84°01'42", in SE1/4 NE1/4 sec.35, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, on right bank 600 ft downstream from bridge on State Highway 52 in Adrian, and 1,000 ft downstream from Wolf Creek.

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

PERIOD OF RECORD.--October 1991 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 720 ft above sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair. Some regulation by reservoir upstream from station. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	47	78	153	1320	150	71	674	178	66	60	19	27
2	42	271	145	659	113	78	917	164	65	56	19	31
3	39	565	135	404	128	127	790	156	60	51	18	91
4	34	665	126	1040	113	312	517	159	60	45	19	55
5	72	354	121	2540	112	295	427	382	97	41	17	39
6	46	258	106	2200	118	200	378	763	85	35	17	49
7	21	200	110	1120	107	185	342	477	115	30	19	38
8	32	162	104	695	105	269	315	329	201	30	19	37
9	47	141	92	495	97	480	321	259	348	72	20	31
10	67	130	86	333	93	540	391	211	396	59	26	28
11	74	128	88	315	93	356	381	119	217	149	22	23
12	62	e350	89	281	94	269	326	154	156	367	19	25
13	53	e900	93	263	93	213	281	146	125	311	20	23
14	90	e1200	109	243	90	146	263	113	108	170	18	24
15	261	e900	131	219	85	141	253	105	98	114	16	71
16	509	e500	219	195	85	166	325	99	90	90	18	60
17	543	333	283	177	82	245	354	95	81	71	19	50
18	326	278	186	142	63	312	290	92	71	73	17	40
19	201	236	152	114	77	232	264	89	95	116	19	35
20	159	202	161	133	77	201	329	83	133	91	20	33
21	149	189	180	191	78	252	372	78	191	61	17	37
22	129	232	137	334	80	426	276	74	173	48	17	36
23	117	536	121	418	76	939	218	76	113	40	17	35
24	105	806	109	363	68	1510	183	86	88	35	23	33
25	96	480	76	344	e69	1480	237	85	75	43	17	38
26	87	330	91	224	e68	1250	356	81	93	35	17	41
27	63	269	86	213	e67	1100	294	73	109	30	16	61
28	63	224	84	168	e68	1060	230	71	105	26	16	56
29	62	192	88	151	---	1010	201	66	78	24	33	69
30	60	169	198	109	---	800	191	64	67	21	29	64
31	59	---	861	144	---	610	---	74	---	20	33	---
TOTAL	3715	11278	4720	15547	2549	15275	10636	5001	3759	2414	616	1280
MEAN	120	376	152	502	91.0	493	355	161	125	77.9	19.9	42.7
MAX	543	1200	861	2540	150	1510	917	763	396	367	33	91
MIN	21	78	76	109	63	71	183	64	60	20	16	23
CFSM	.73	2.29	.93	3.06	.56	3.00	2.16	.98	.76	.47	.12	.26
IN.	.84	2.56	1.07	3.53	.58	3.46	2.41	1.13	.85	.55	.14	.29

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1992 - 1993, BY WATER YEAR (WY)

	MEAN	75.9	215	109	284	118	340	278	112	91.1	103	34.6	79.7
MAX	120	376	152	502	145	493	355	161	125	127	49.4	117	117
(WY)	1993	1993	1993	1993	1992	1993	1993	1993	1993	1992	1992	1992	1992
MIN	32.0	53.6	66.4	67.3	91.0	187	201	63.5	57.0	77.9	19.9	42.7	42.7
(WY)	1992	1992	1992	1992	1993	1992	1992	1992	1992	1993	1993	1993	1993

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1992 - 1993

ANNUAL TOTAL	50475	76790	154
ANNUAL MEAN	138	210	210
HIGHEST ANNUAL MEAN			1993
LOWEST ANNUAL MEAN			1992
HIGHEST DAILY MEAN	1200	2540	2540
LOWEST DAILY MEAN	13	16	11
ANNUAL SEVEN-DAY MINIMUM	15	18	14
INSTANTANEOUS PEAK FLOW		2870	2870
INSTANTANEOUS PEAK STAGE		10.45	10.45
INSTANTANEOUS LOW FLOW		12	9.4
ANNUAL RUNOFF (CFSM)	.84	1.28	.94
ANNUAL RUNOFF (INCHES)	11.45	17.42	12.72
10 PERCENT EXCEEDS	315	478	334
50 PERCENT EXCEEDS	88	109	84
90 PERCENT EXCEEDS	30	26	24

(e) Estimated.



## STREAMS TRIBUTARY TO LAKE ERIE

## 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), 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 sea level.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	251	345	602	2300	e470	e320	1800	569	246	277	160	149
2	238	621	573	1940	e460	359	2160	539	247	268	152	135
3	224	1040	548	1400	e450	434	2090	519	246	244	140	251
4	212	1300	521	1630	e440	799	1770	515	224	243	143	254
5	225	1150	499	3930	e430	903	1480	731	294	230	138	228
6	230	858	468	4360	e420	697	1290	1280	294	217	134	240
7	175	648	447	2680	e410	602	1140	1400	323	206	136	240
8	178	599	440	2060	e400	745	1020	964	472	200	133	204
9	222	524	427	1700	e395	1210	965	707	685	261	129	197
10	227	487	417	1400	e390	1490	1120	609	820	262	135	190
11	275	475	411	e1150	e390	1220	1180	461	640	299	135	171
12	274	654	419	e1000	407	874	1050	423	481	695	130	163
13	259	1610	425	e950	405	705	929	395	421	535	132	157
14	284	2180	455	e900	393	547	834	382	378	405	128	163
15	593	1800	488	e900	e380	e470	772	358	357	319	122	274
16	1080	1290	601	e700	e365	e520	871	340	333	294	119	258
17	1360	1050	754	e500	e350	695	968	328	321	263	117	280
18	1190	882	647	e500	e300	888	870	313	356	241	113	236
19	868	767	552	e450	e320	741	767	310	347	316	108	216
20	692	679	557	e500	e330	626	859	300	365	271	116	197
21	612	632	583	e850	e340	692	1060	291	480	240	106	194
22	550	640	496	e1000	e340	973	919	282	499	218	100	193
23	502	1050	454	e1300	e330	1660	738	278	421	209	98	192
24	474	1490	421	e1150	e310	2650	636	286	363	196	112	187
25	445	1370	e330	e900	e300	2830	667	286	251	205	102	184
26	426	1080	e380	e750	e290	2550	857	281	313	216	99	210
27	414	903	e365	e650	e290	2340	867	270	353	214	98	228
28	374	750	e350	e600	e300	2270	718	263	340	205	100	286
29	409	719	e365	e550	---	2230	634	241	315	197	119	353
30	363	644	472	e510	---	2040	596	242	290	190	121	350
31	345	---	1420	e480	---	1810	---	249	---	175	137	---
TOTAL	13971	28237	15887	39390	10405	36890	31627	14412	11475	8311	3812	6552
MEAN	451	941	512	1271	372	1190	1054	465	382	268	123	218
MAX	1360	2180	1420	4360	470	2830	2160	1400	820	695	160	353
MIN	175	345	330	450	290	320	596	241	224	175	98	135
CFSM	.97	2.03	1.11	2.74	.80	2.57	2.28	1.00	.83	.58	.27	.47
IN.	1.12	2.27	1.28	3.16	.84	2.96	2.54	1.16	.92	.67	.31	.53

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1954 - 1993, BY WATER YEAR (WY)

	MEAN	182	280	362	378	468	725	622	371	266	177	123	136
MAX	576	941	871	1271	1176	1517	1115	939	1025	609	389	420	
(WY)	1991	1993	1988	1993	1976	1986	1978	1956	1989	1968	1968	1992	
MIN	52.1	57.9	66.6	65.6	74.1	179	239	144	69.7	46.1	47.5	46.0	
(WY)	1964	1965	1964	1963	1964	1964	1963	1964	1988	1988	1963	1955	

## SUMMARY STATISTICS

## FOR 1992 CALENDAR YEAR

## FOR 1993 WATER YEAR

## WATER YEARS 1954 - 1993

ANNUAL TOTAL	155046	220969	
ANNUAL MEAN	424	605	
HIGHEST ANNUAL MEAN			340
LOWEST ANNUAL MEAN			605
HIGHEST DAILY MEAN	2180	Nov 14	5350
LOWEST DAILY MEAN	99	Aug 26	25
ANNUAL SEVEN-DAY MINIMUM	106	Aug 20	27
INSTANTANEOUS PEAK FLOW			6660
INSTANTANEOUS PEAK STAGE			14.06
INSTANTANEOUS LOW FLOW			93
ANNUAL RUNOFF (CFSM)	.91		1.31
ANNUAL RUNOFF (INCHES)	12.46		17.75
10 PERCENT EXCEEDS	785	1290	731
50 PERCENT EXCEEDS	338	420	215
90 PERCENT EXCEEDS	170	168	74

(e) Estimated.

## 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 sea level. Prior to Oct. 1, 1953, at site 9 mi downstream at datum 46.26 ft lower.

REMARKS.--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.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	436	503	1220	3730	e900	e450	4250	1040	340	400	192	169
2	406	1330	1110	3700	e850	e470	5070	951	339	373	185	167
3	369	2390	1010	3850	e800	556	4350	897	333	351	178	232
4	339	2370	932	4800	e780	1140	4120	864	329	339	174	268
5	317	2440	872	7280	760	1140	3570	1810	343	312	168	327
6	300	2280	808	7480	735	e1300	2970	2140	350	288	163	326
7	300	1950	763	7470	691	e1350	2440	2140	469	267	155	290
8	311	1450	718	6960	685	1480	2020	1940	587	256	150	299
9	316	1120	684	5260	631	2090	1810	1730	1200	271	150	283
10	373	977	683	3720	607	2570	2340	1370	1590	275	161	237
11	376	889	679	2810	587	2500	2220	1080	1570	333	157	217
12	373	1600	664	2250	562	2410	2220	909	1320	541	154	205
13	391	4330	718	1860	571	2100	2040	752	938	597	158	192
14	479	4040	884	1710	570	e1350	1720	675	734	701	147	191
15	1620	4090	1030	1610	559	e1050	1490	620	635	596	143	210
16	2760	4140	1270	1500	547	1020	1850	576	562	473	142	258
17	2620	3680	1310	1380	532	1360	1990	539	503	371	138	331
18	2540	2950	1300	e1100	e460	e1600	1940	509	464	333	138	314
19	2330	2210	1210	e850	e410	e1650	1720	495	464	306	135	292
20	1960	1640	1170	e900	e460	1750	1940	475	525	307	136	263
21	1500	1370	1090	1050	e470	1990	1870	458	673	330	132	244
22	1160	1280	1040	2140	e480	2740	1840	439	841	294	122	224
23	989	2570	959	2440	e470	4220	1650	418	845	256	124	219
24	882	2780	813	2660	e460	5750	1390	415	725	228	135	213
25	797	2840	e700	2690	e450	6230	1270	411	635	249	126	208
26	741	2880	e650	2370	e440	6750	1480	404	537	269	126	205
27	691	2650	e580	2010	e435	6490	1590	387	431	275	130	222
28	645	2190	605	1540	e430	6030	1570	382	445	257	114	269
29	596	1680	677	1260	---	5220	1360	367	462	239	119	322
30	552	1380	949	e1000	---	4500	1170	346	435	220	123	360
31	540	---	3530	e950	---	3920	---	340	---	209	151	---
TOTAL	28009	67999	30628	90330	16332	83156	67260	25879	19624	10516	4526	7557
MEAN	904	2267	988	2914	583	2682	2242	835	654	339	146	252
MAX	2760	4330	3530	7480	900	6750	5070	2140	1590	701	192	360
MIN	300	503	580	850	410	450	1170	340	329	209	114	167
CFSM	.87	2.18	.95	2.80	.56	2.57	2.15	.80	.63	.33	.14	.24
IN.	1.00	2.43	1.09	3.22	.58	2.97	2.40	.92	.70	.38	.16	.27

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1937 - 1993, BY WATER YEAR (WY)

	MEAN	302	496	746	809	1076	1696	1481	925	612	355	213	247
MAX	1678	2267	2618	3058	3296	4440	4055	4678	2770	1453	1161	2666	
(WY)	1982	1993	1968	1952	1976	1982	1947	1943	1989	1951	1980	1981	
MIN	57.2	74.6	87.5	106	107	343	313	248	99.2	60.3	40.3	45.2	
(WY)	1964	1965	1964	1964	1963	1964	1946	1941	1988	1988	1941	1963	

## SUMMARY STATISTICS FOR 1992 CALENDAR YEAR FOR 1993 WATER YEAR WATER YEARS 1937 - 1993

	ANNUAL TOTAL	358316	451816	745
ANNUAL MEAN	979	1238	1374	1943
HIGHEST ANNUAL MEAN			178	1964
LOWEST ANNUAL MEAN			14600	Mar 16 1982
HIGHEST DAILY MEAN	4330	Nov 13	7480	Jan 6
LOWEST DAILY MEAN	165	Aug 26	114	Aug 28
ANNUAL SEVEN-DAY MINIMUM	177	Aug 21	125	Aug 24
INSTANTANEOUS PEAK FLOW			7660	Jan 6
INSTANTANEOUS PEAK STAGE			8.91	Jan 6
INSTANTANEOUS LOW FLOW			112	(b)
ANNUAL RUNOFF (CFSM)	.94		1.19	(c)2.0
ANNUAL RUNOFF (INCHES)	12.79		16.13	.71
10 PERCENT EXCEEDS	2220		2770	1850
50 PERCENT EXCEEDS	676		691	352
90 PERCENT EXCEEDS	298		205	102

(a) Backwater from ice.

(b) Aug. 28, 29.

(c) Approximately, site then in use.

(d) Sept. 4, 1938, Sept. 19, 20, 1941.

(e) Estimated.

## STREAMS TRIBUTARY TO LAKE ERIE

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 1992 TO SEPTEMBER 1993

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00085)	PH WATER WHOLE FIELD (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)
DEC 02...	1215	1110	634	8.4	3.0	7.1	13.0	101	150
MAR 24...	1215	5890	279	7.9	1.0	74	12.6	90	700
JUN 16...	1050	565	636	8.3	20.0	23	8.8	98	K39
SEP 16...	1230	261	696	8.3	18.5	23	8.8	95	K160

DATE	STREP-TOCOC CI FECAL KF AGAR (COLS. PER 100 ML) (31673)	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)
DEC 02...	120	320	85	93	20	12	3.4	276	2
MAR 24...	5600	130	30	38	7.5	5.0	3.2	117	--
JUN 16...	K130	320	98	94	21	13	10	273	--
SEP 16...	600	300	94	85	22	24	15	251	2

DATE	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)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-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)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)
DEC 02...	230	55	29	0.20	8.3	383	0.52	1150	0.020
MAR 24...	96	20	13	0.10	3.6	181	0.25	2880	0.020
JUN 16...	224	72	31	0.20	8.2	415	0.56	633	0.050
SEP 16...	210	86	40	0.30	10	411	0.56	290	<0.010

## STREAMS TRIBUTARY TO LAKE ERIE

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

## WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	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) (00686)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)
DEC 02...	3.00	0.060	0.50	0.060	0.030	0.020	<10
MAR 24...	1.90	0.170	1.0	0.150	0.050	0.080	20
JUN 16...	3.30	0.040	0.40	0.060	0.050	0.050	10
SEP 16...	1.00	0.040	0.50	0.090	0.030	0.030	30

DATE	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)
DEC 02...	46	<3	24	<4	28	10	<1
MAR 24...	18	<3	23	<4	19	<10	<1
JUN 16...	60	<3	10	6	15	10	2
SEP 16...	71	<3	7	10	10	<10	1

DATE	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)	SEDI- MENT, DIS- SOLVED (UG/L AS V) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDEDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
DEC 02...	<1	<1.0	310	<6	13	39	95
MAR 24...	<1	<1.0	120	<6	141	2240	94
JUN 16...	<1	<1.0	500	<6	47	72	98
SEP 16...	<1	<1.0	650	<6	39	27	96

## STREAMS TRIBUTARY TO LAKE ERIE

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>.

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

GAGE.--Water-stage recorder. Elevation of gage is 580 ft above sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges, which are fair and discharges below 1.0 ft<sup>3</sup>/s, which are poor. Several measurements of water temperature were made during the year.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	22	57	351	e45	e25	538	56	11	13	1.3	.79
2	13	265	53	163	e39	e35	560	48	9.2	12	1.1	1.4
3	12	308	48	122	e41	e80	294	46	8.5	10	.97	5.9
4	11	166	44	576	e33	e150	195	48	8.4	8.7	1.8	8.3
5	9.5	119	40	971	e32	e155	147	74	15	6.9	1.6	4.9
6	9.6	88	35	442	31	81	117	86	18	5.7	1.1	3.8
7	10	71	33	246	30	90	96	60	17	4.8	1.1	4.7
8	10	60	30	177	28	213	86	48	69	4.4	1.3	4.1
9	17	53	29	129	25	304	107	42	115	6.2	1.2	3.0
10	21	47	33	e90	25	237	304	38	68	5.7	1.1	2.3
11	20	52	36	e85	24	147	178	37	44	6.8	1.5	2.0
12	18	246	47	79	24	125	143	35	33	17	1.5	1.8
13	16	612	73	100	e26	106	106	31	26	7.5	1.1	1.6
14	44	288	87	114	e25	e80	85	28	22	5.1	.81	1.3
15	328	167	86	100	e24	e60	78	26	20	4.2	.63	1.9
16	288	122	97	85	e23	e90	179	21	16	3.4	.51	2.8
17	178	104	82	73	e22	e140	143	20	13	2.8	.46	2.7
18	107	88	66	56	e22	e100	97	17	12	2.3	.45	2.3
19	76	76	58	e50	e21	e80	82	17	14	2.3	.36	2.1
20	62	67	80	e45	e20	e160	146	16	34	2.2	.44	1.8
21	56	66	69	e110	e22	289	114	14	87	1.8	.37	1.7
22	47	100	55	374	e24	341	83	12	46	1.4	.32	1.8
23	43	324	49	213	e23	565	67	12	28	1.1	.19	2.0
24	42	211	37	233	e22	623	58	15	19	1.0	.13	2.0
25	37	146	e34	177	e21	438	117	15	16	5.3	.09	2.0
26	35	121	e30	110	e20	359	137	12	43	8.5	.06	3.0
27	31	99	e27	83	e20	296	101	10	34	3.9	.04	4.2
28	27	84	e25	e70	e20	267	78	10	23	2.8	.03	5.8
29	25	72	27	e65	---	224	69	8.8	18	4.0	.02	6.4
30	23	63	84	e56	---	179	66	8.0	14	2.6	.02	8.4
31	21	---	640	e60	---	145	---	12	---	1.7	.26	---
TOTAL	1652.1	4307	2191	5605	732	6184	4571	922.8	901.1	165.1	21.86	96.79
MEAN	53.3	144	70.7	181	26.1	199	152	29.8	30.0	5.33	.71	3.23
MAX	328	612	640	971	45	623	560	86	115	17	1.8	8.4
MIN	9.5	22	25	45	20	25	58	8.0	8.4	1.0	.02	.79
CFSM	1.04	2.82	1.39	3.55	.51	3.91	2.99	.58	.59	.10	.01	.06
IN.	1.21	3.14	1.60	4.09	.53	4.51	3.33	.67	.66	.12	.02	.07

## STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1988 - 1993, BY WATER YEAR (WY)

	1988	1989	1990	1991	1992	1993
MEAN	21.0	52.2	72.4	74.7	71.0	91.4
MAX	53.3	144	168	181	186	199
(WY)	1993	1993	1991	1993	1990	1993
MIN	2.36	21.4	5.69	29.1	16.6	24.7
(WY)	1989	1990	1990	1988	1989	1988

SUMMARY STATISTICS	FOR 1992 CALENDAR YEAR	FOR 1993 WATER YEAR	WATER YEARS 1988 - 1993
ANNUAL TOTAL	22818.4	27349.75	
ANNUAL MEAN	62.3	74.9	50.9
HIGHEST ANNUAL MEAN			74.9
LOWEST ANNUAL MEAN			30.1
HIGHEST DAILY MEAN	640	971	1480
LOWEST DAILY MEAN	2.1	.02	.00
ANNUAL SEVEN-DAY MINIMUM	2.4	.06	.00
INSTANTANEOUS PEAK FLOW		1170	(c)2050
INSTANTANEOUS PEAK STAGE		9.53	10.73
INSTANTANEOUS LOW FLOW		.02	.00
ANNUAL RUNOFF (CFSM)	1.22	1.47	1.00
ANNUAL RUNOFF (INCHES)	16.64	19.95	13.56
10 PERCENT EXCEEDS	143	179	120
50 PERCENT EXCEEDS	37	33	23
90 PERCENT EXCEEDS	5.7	1.6	.75

(a) Aug. 29, 30.

(b) On several days in water years 1988, 1991, 1992.

(c) From rating curve extended above 700 ft<sup>3</sup>/s.

(d) Aug. 28-31.

(e) Estimated.



## 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	Date	Water year 1993 maximum		Period of record maximum		
				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 SUPERIOR								
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 down- stream from end of Trail Road, 3.2 mi upstream from mouth, and 20 mi northwest of Paradise. Drainage area is 200 mi <sup>2</sup> .	1973-93	05-06-93	9.99	1,080	04-25-85	a8.42	3,210
West Branch Waika 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 mi <sup>2</sup> .	1973-93	04-09-93	7.25	440	04-18-74	b9.19	1,200
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 sea level. Drainage area is approxi- mately 28 mi <sup>2</sup> .	1951-78†, 1979-93	05-04-93	4.69	154	05-07-60	8.55	860

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	Date	Water year 1993 maximum		Period of record maximum		
				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								
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 Perron- ville, and 11.5 mi upstream from Ford River. Drainage area is 38.4 mi <sup>2</sup> .	1971-77†, 1978-93	05-05-93	4.55	356	04-24-75	c5.42	810
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 north- west of Hillsdale. Drainage area is 42.4 mi <sup>2</sup> .	1974-78†, 1979-91	--	--	--	03-20-82	--	d620
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 sea level. Drainage area is 68.2 mi <sup>2</sup> .	1946-51†, 1965-80†, 1980-93	01-05-93	5.16	224	06-02-89	e5.81	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, Hydro- logic Unit 04050003, at State Highway 40 in Hamilton. Drainage area is 274 mi <sup>2</sup> .	1979-93	04-20-93	15.99	2,740	06-01-89	f18.2	5,260
Sycamore Creek near Mason, MI (04112700)	Lat 42°36'40", 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. Drain- age area is 39.5 mi <sup>2</sup> .	1975-93	04-20-93	9.97	416	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> .	1975-93	04-20-93	7.68	245	06-12-86	10.01	465

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	Date	Water year 1993 maximum		Period of record maximum		
				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								
Flat River at Smyrna, MI (04116500)	Lat 43°03'10", long 85°15'53", in NW1/4 sec.28, T.8 N., R.8 W., Ionia County, Hydrologic Unit 04050006, on right bank at downstream side of bridge on Ingalls Road, 0.5 mi south of Smyrna. Datum of gage is 729.53 ft above sea level. Drainage area is 528 mi <sup>2</sup> .	1951-86†, 1993	04-20-93	5.90	1,580	09-13-86	9.05	4,700
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, Hydro- logic Unit 04050007, on left bank 150 ft upstream from culvert on Clark Road, 500 ft upstream from small tribu- tary, and 2.5 mi south of Nashville. Datum of gage is 821.89 ft above sea level. Drainage area is 7.60 mi <sup>2</sup> .	1954-75†, 1976-93	04-20-93	6.52	212	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> .	1974-93	01-05-93	10.06	1,040	03-04-79	--	g1,700
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> .	1974-93	01-05-93	8.62	892	05-12-81	10.30	1,580
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 northeast of Pentwater. Drainage area is 42.3 mi <sup>2</sup> .	1975-93	04-20-93	3.13	239	09-11-86	6.33	2,860
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., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 1.2 mi south of Benzonia. Datum of gage is 602.15 ft above sea level. Drainage area is approximately 170 mi <sup>2</sup> .	1975-93	04-16-93	h3.73	638	03-28-89	5.46	993

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	Date	Water year 1993 maximum		Period of record maximum		
				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								
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, Hydrologic Unit 04080101, at State Road in Selkirk. Datum of gage is 828.47 ft above sea level. Drainage area is 117 mi <sup>2</sup> .	1950-82†, 1983-93	04-21-93	13.48	858	05-20-59	6.76	2,760
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> .	1987-93	04-06-87 12-21-87 06-01-89 03-13-90 03-29-91 03-31-93	11.83 13.34 13.05 14.04 13.64 14.96	k640 k951 k887 k1,110 k1,020 1,340	03-31-93	14.96	1,340
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, Hydro- logic Unit 04080204, at South Ballenger Highway in Flint, 3.6 mi upstream from mouth. Datum of gage is 727.05 ft above sea level. Drainage area is 115 mi <sup>2</sup> .	1970-84†, 1991-93	04-20-93	7.56	1,480	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, Hydrologic 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 sea level. Drainage area is 54.4 mi <sup>2</sup> .	1970-84†, 1991-93	04-20-93	5.11	290	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, Hydro- logic Unit 04090001, at Gratiot Road, 1.9 mi north- east of Rattle Run. Drainage area is 135 mi <sup>2</sup> .	1974-93	01-05-93	18.67	2,270	04-19-75	23.87	5,400
STREAMS TRIBUTARY TO LAKE ST. CLAIR								
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, Hydro- logic Unit 04090003, at Huron-Clinton Metropoli- tan Park Road, 3.4 mi west of Washington. Drainage area is 22.5 mi <sup>2</sup> .	1965-93	06-21-93	3.20	129	04-19-75	14.42	470

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	Date	Water year 1993 maximum		Period of record maximum		
				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								
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, Hydro- logic Unit 04090003, at State Highway 53 in Almont. Drainage area is 9.56 mi <sup>2</sup> .	1959-62, 1963-68†, 1969-93	03-28-93	3.95	188	09-06-85	m8.60	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, Hydro- logic Unit 04090003, at 33 Mile Road, 2.2 mi north- east of Romeo. Drainage area is 49.7 mi <sup>2</sup> .	1959-64, 1965-69†, 1970-93	01-04-93	3.83	761	04-19-75	n5.44	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, Hydro- logic Unit 04090003, at 27 Mile Road, 1.9 mi northwest of Meade. Drainage area is 89.6 mi <sup>2</sup> .	1959-67, 1968-72†, 1973-93	01-04-93	6.92	1,830	04-19-75	o7.76	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, Hydro- logic Unit 04090003, at North Road, 3.4 mi south of Armada. Drainage area is 10.0 mi <sup>2</sup> .	1959-65, 1966-70†, 1971-93	01-04-93	5.78	218	04-19-75	p6.25	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, Hydro- logic Unit 04090003, at 32 Mile Road, 3.0 mi southeast of Armada. Drainage area is 14.9 mi <sup>2</sup> .	1959-65, 1965-70†, 1971-93	11-13-92	15.89	736	09-06-85	16.77	2,240
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, Hydro- logic 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†, 1973-93	06-21-93	8.39	1,080	04-19-75	q8.95	2,700
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, Hydro- logic Unit 04090003, at 25 1/2 Mile Road, 0.9 mi southeast of Meade. Drain- age area is 12.7 mi <sup>2</sup> .	1959-60, 1960-65†, 1966-93	01-04-93	7.59	429	09-06-85	8.90	691

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	Date	Water year 1993 maximum		Period of record maximum		
				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								
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†, 1965-93	01-04-93	7.68	151	02-10-65	r8.82	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, Hydro- logic Unit 04090003, at Schoenherr Road, 2.0 mi west of Macomb. Drainage area is 22.2 mi <sup>2</sup> .	1959-64, 1965-69‡, 1971-93	01-04-93	9.81	474	06-26-68	s12.17	1,400
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‡, 1965-93	01-04-93	16.32	289	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> .	1972-93	01-05-93	8.30	310	09-07-90	9.55	655
STREAMS TRIBUTARY TO LAKE ERIE								
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‡, 1978-93	01-06-93	11.47	1,510	06-26-68	13.37	3,990

† Operated as a continuous-record gaging station.

a Maximum gage height, 12.36 ft, Apr. 9, 1991, site and datum then in use.

b Maximum gage height, 9.84 ft, Apr. 6, 1988.

c Maximum gage height, 8.94 ft, Mar. 30, 1977, backwater from ice.

d Estimated; not previously published.

e Maximum gage height, 5.86 ft, Dec. 31, 1988, backwater from ice.

f From floodmark.

g Estimated.

h Maximum gage height, 4.16 ft, Jan. 12, backwater from ice.

i Maximum gage height, 3.89 ft, backwater from ice, date not determined.

j Maximum gage height, 12.32 ft, Mar. 2, 1987, backwater from ice.

k Revised.

l Maximum gage height, 5.93 ft, Jan. 27, 1974, backwater from ice.

m Maximum gage height, 8.62 ft, Apr. 19, 1975.

n Maximum gage height, 7.1 ft, Mar. 12 or 13, 1962, backwater from ice, site and datum then in use.

o Maximum gage height, 7.85 ft, Mar. 12, 1962, backwater from ice.

p Maximum gage height, 6.95 ft, Sept. 6, 1985.

q Maximum gage height, 9.48 ft, Sept. 6, 1985.

r Maximum gage height, 9.55 ft, June 26, 1968.

s Maximum gage height, 15.89 ft, Mar. 14, 1972, 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 1993

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 MICHIGAN						
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	1969-93	12-21-92	2.22
					02-01-93	1.92
					06-04-93	1.36
					08-31-93	1.86
04114594	Maple River near St. Johns, MI	Lat 43°02'43", long 84°28'11", in SW1/4 SE1/4 sec.30, T.6 N., R.1 W., Clinton County, Hydrologic Unit 04050005, at Colony Road, 4.5 mi northeast of St. Johns.	--	1981-93	10-02-92	40.6
					05-26-93	66.4
					07-15-93	39.1
					08-31-93	a57.1

a Not base flow.

## 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 1993

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (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, 1987-92	06-14-93	a41.7
04044400	Carp River	Lake Superior	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†, 1987-92b	10-22-92 06-22-93 08-04-93 09-13-93	a41.4 a71.8 a30.5 a34.3
04044721	Au Train Dam Spillway Channel	Lake Superior	Lat 46°20'24", long 86°51'04", in NW1/4 SE1/4 sec.31, T.46 N., R.20 W., Alger County, Hydrologic Unit 04020201, 400 ft downstream from Au Train Falls powerplant, 0.6 mi northwest of Forest Lake.	--	--	09-13-90	a6.82
04044722	Au Train Dam Power Canal	Au Train River	Lat 46°20'21", long 86°50'04", in NW1/4 SE1/4 sec.31, T.46 N., R.20 W., Alger County, Hydrologic Unit 04020201, 150 ft downstream from Au Train Falls powerplant, 0.6 mi northwest of Forest Lake.	--	--	06-14-90 07-25-90	a74.0 a65.3
04044724	Au Train River	Lake Superior	Lat 46°20'27", long 86°51'00", in SE1/4 NE1/4 sec.31, T.46 N., R.20 W., Alger County, Hydrologic Unit 04020201, 800 ft downstream from Au Train Falls powerplant, 0.6 mi northwest of Forest Lake.	--	--	09-15-93	a50.1
STREAMS TRIBUTARY TO LAKE MICHIGAN							
04057004	Manistique River	Lake Michigan	Lat 45°58'18", long 86°14'35", in SE1/4 SE1/4 sec.1, T.41 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, at Wyman State Nursery, 1.8 mi upstream from mouth.	c1,445	1976-86d	10-20-92 12-02-92 01-08-93 06-23-93 08-10-93 09-16-93	a2,190 a3,170 a1,820 a2,460 a1,890 a2,130

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 1993--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04057005	Manistique River	Lake Michigan	Lat 45°57'10", long 86°14'54", in NW1/4 NE1/4 sec.13, T. 41 N., R. 16 W., Schoolcraft County, Hydrologic Unit 04060106, at U.S. Highway 2, in Manistique.	--	--	08-25-93	a1,410
04058120	Green Creek	Middle Branch Escanaba River	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, 1970-92b	10-21-92 05-13-93 06-21-93 08-03-93 09-15-93	a2.74 a20.1 a22.4 a3.38 a3.46
04059034	Escanaba River	Lake Michigan	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 north-west of Wells, and 2.5 mi upstream from mouth.	c920	1981-92b	07-13-93 08-03-93 08-30-93 09-21-93	a604 a469 a456 a781
04062085	Peshekee River	Lake Michigamme	Lat 46°36'35", long 88°01'20", in SW1/4 SE1/4 sec.26, T.49 N., R.30 W., Marquette County, Hydrologic Unit 04030107, at Huron Bay Peshekee Grade Road, 5.4 mi northwest of Martins Land-ing.	43.9	1992	04-13-93 04-28-93 05-04-93 05-18-93 06-16-93 06-23-93 07-06-93 07-28-93 08-18-93 09-01-93 09-14-93	193 465 643 58.8 *49.5 *48.7 *28.0 7.92 19.6 *13.4 42.5
04103500	Kalamazoo River	Lake Michigan	Lat 42°15'55", long 84°57'55", in SE1/4 SE1/4 sec.26, T.2 S., R.6 W., Calhoun County, Hydrologic Unit 04050003, at former gaging station, at South Kalamazoo Avenue in Marshall.	449	1949-82†, 1988	08-17-93	e290
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.	--	1990-91	04-20-93 04-21-93 05-21-93 06-09-93	e20.9 e7.73 *e0.71 e6.07
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.	--	1990-92	04-20-93 04-21-93 05-21-93 06-09-93	e14.4 e7.45 *e2.82 e5.39

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 1993--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
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.	—	1990-91	04-21-93	e1.58
						05-21-93	*e0.19
						06-08-93	e0.43
						06-09-93	e2.00
						06-10-93	e0.47
04117018	Thornapple River	Grand River	Lat 42°36'39", long 85°07'33", in SE1/4 SW1/4 sec.27, T.3 N., R.7 W., Barry County, Hydrologic Unit 04050007, at Greggs Crossing Road, 1.5 mi west of Nashville.	—	—	05-06-93	e410
						06-30-93	e291
04117150	Mud Creek	Thornapple River	Lat 42°41'00", long 85°06'46", in NW1/4 NW1/4 sec.2, T.3 N., R.7 W., Barry County, Hydrologic Unit 04050007, at Coats Grove Road, 5.9 mi northwest of Vermontville.	—	—	03-31-93	e120
						05-06-93	e49.9
						06-30-93	e47.5
04117300	High Bank Creek	Thornapple River	Lat 42°37'17", long 85°10'47", in NE1/4 sec.30, T.3 N., R.7 W., Barry County, Hydrologic Unit 04050007, at Thornapple Lake Road in Morgan.	33.9	1964, 1989	05-06-93	e47.1
						06-30-93	e55.2
04117450	Cedar Creek	Thornapple River	Lat 42°36'37", long 85°13'53", in NW1/4 NW1/4 sec.35, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, at State Highway 79, 0.3 mi west of Quimby.	—	1964, 1988	05-06-93	e74.5
						06-30-93	e98.2
04117545	Unnamed Tributary	Tillotson Lake	Lat 42°33'57", long 85°21'27", in NE1/4 NW1/4 sec.15, T.2 N., R.9 W., Barry County, Hydrologic Unit 04050007, at private drive, 2.3 mi northeast of Cloverdale.	—	—	06-15-93	e7.38
04120500	Higgins Lake Outlet	Marl Lake	Lat 44°25'59", long 84°40'12", in NW1/4 NW1/4 sec.34, T.24 N., R.3 W., Roscommon County, Hydrologic Unit 04060102, at county road, 5.9 mi southwest of Roscommon.	49.2	1942-50†, 1973	04-14-93	74.4
04120590	Backus Creek ("The Cut")	Houghton Lake	Lat 44°21'47", long 84°40'48", in NW1/4 NE1/4 sec.28, T.23 N., R.3 W., Roscommon County, Hydrologic Unit 04060102, 0.4 mi upstream from Houghton Lake, 4.7 mi north of Prudenville.	90.0	1971-73	04-14-93	197

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 1993--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04120740	Denton Creek	Houghton Lake	Lat 44°17'08", long 84°38'07", in SE1/4 NE1/4 sec.14, T.22 N., R.3 W., Roscommon County, Hydrologic Unit 04060102, 200 ft downstream of Lake James control, 0.9 mi east of Prudenville.	47.3	1971-73	04-14-93	45.6
04120780	Knappen Creek	Houghton Lake	Lat 44°17'58", long 84°39'02", in SW1/4 NW1/4 sec.14, T.22 N., R.3 W., Roscommon County, Hydrologic Unit 04060102, at State Highway 55 in Prudenville.	4.60	1971-73	04-14-93	6.46
04120900	Muskegon River	Muskegon Lake	Lat 44°24'16", long 84°47'27", in NW1/4 NW1/4 sec.10, T.23 N., R.4 W., Roscommon County, Hydrologic Unit 04060102, 1,000 ft downstream from old U.S. Highway 27, 5.4 mi north of Houghton Lake Heights.	222	1953, 1971-73	04-14-93	271
04121239	Clam River	Muskegon River	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.	c48	1983-84b, 1986-92b	10-21-92 02-23-93 04-07-93 07-26-93	a58.3 a43.2 a57.4 a3.28
04122280	Little South Branch Pere Marquette River	Pere Marquette River	Lat 43°48'05", long 85°46'15", in SE1/4 SW1/4 sec.5, T.16 N., R.12 W., Newaygo County, Hydrologic Unit 04060101, at 17 Mile Road, 6.0 mi south of Idlewild.	--	1970	10-01-92	*e49.6
04122282	Little South Branch Pere Marquette River	Pere Marquette River	Lat 43°49'02", long 85°48'01", in SE1/4 SE1/4 sec.36, T.17 N., R.13 W., Lake County, Hydrologic Unit 04060101, at Forman Road, 4.8 mi south of Idlewild.	--	1970-71	10-01-92	*e67.1
STREAMS TRIBUTARY TO LAKE HURON							
04127985	Sturgeon River	Burt Lake	Lat 45°11'31", long 84°32'51", in NW1/4 SW1/4 sec.3, T.32 N., R.2 W., Otsego County, Hydrologic Unit 04070004, at Timber Bridge, 7.0 mi north-east of Vanderbilt.	--	--	10-01-92	*e87.3
04127987	Sturgeon River	Burt Lake	Lat 45°13'21", long 84°35'18", in NW1/4 SW1/4 sec.29, T.33 N., R.2 W., Cheboygan County, Hydrologic Unit 04070004, at Trowbridge Road, 3.6 mi south of Wolverine.	105	1966	10-01-92	*e93.7

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 1993--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE HURON-Continued							
04142900	Rifle River	Lake Huron	Lat 44°04'19", long 83°53'39", in SW1/4 SE1/4 sec.5, T.19 N., R.5 E., Arenac County, Hydrologic Unit 04080101, 2.7 mi northwest of Omer.	—	—	08-02-93	e165
04149680	Duff Creek	South Branch Cass River	Lat 43°19'47", long 83°03'52", in SE1/4 SE1/4 sec.32, T.11 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Boyne Road, 0.8 mi east of Marlette.	—	1980-81	10-06-92	e0.52
04149685	Duff Creek	South Branch Cass River	Lat 43°20'35", long 83°03'30", in SE1/4 SW1/4 sec.28, T.11 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Mayville Road, 1.5 mi north-east of Marlette.	—	1981	10-06-92	e1.26
04149690	Duff Creek	South Branch Cass River	Lat 43°20'46", long 83°02'42", in SW1/4 SW1/4 sec.27, T.11 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Decker Road, 2.1 mi north-east of Marlette.	8.86	1980-81	10-06-92	e1.64
04149695	Duff Creek	South Branch Cass River	Lat 43°21'29", long 83°01'37", in NE1/4 NE1/4 sec. 27, T.11 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at French Line Road, 3.3 mi northeast of Marlette.	—	1980-81	10-06-92	e1.83
04149700	Duff Creek	South Branch Cass River	Lat 43°21'53", long 83°00'22", in NE1/4 SE1/4 sec.23, T.11 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Germania Road, 4.5 mi north-east of Marlette.	14.3	1970, 1980	10-06-92	e2.38
04149760	South Branch Cass River	Cass River	Lat 43°27'37", long 82°59'02", in SE1/4 SW1/4 sec.18, T.12 N., R.13 E., Sanilac County, Hydrologic Unit 04080205, at Snover Road, 3.3 mi east of Decker.	120	—	10-06-92	e12.0
04149800	South Branch Cass River	Cass River	Lat 43°31'56", long 83°02'37", in SW1/4 SE1/4 sec.22, T.13 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Shabbona Road, 0.5 mi east of Shabbona.	140	1963	10-06-92	e17.9

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 1993—Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi <sup>2</sup> )	Measured previously (water years)	Measurements	
						Date	Dis-charge (ft <sup>3</sup> /s)
STREAMS TRIBUTARY TO LAKE HURON—Continued							
04149950	Middle Branch Cass River	South Branch Cass River	Lat 43°32'41", long 82°58'28", in NE1/4 NE1/4 sec. 19, T.13 N., R.13 E., Sanilac County, Hydrologic Unit 04080205, at Wheeler Road, 5.8 mi north of Snover.	47.1	—	10-06-92	e3.17
04149975	South Branch Cass River	Cass River	Lat 43°32'53", long 83°03'17", in SW1/4 SW1/4 sec. 15, T.13 N., R.12 E., Sanilac County, Hydrologic Unit 04080205, at Decker Road, 6.2 mi north of Decker.	—	—	10-06-92	e22.1
04150400	North Branch Cass River	Cass River	Lat 43°36'06", long 83°08'11", in NE1/4 NE1/4 sec.35, T.14 N., R.11 E., Tuscola County, Hydrologic Unit 04080205, at State Highway 81, 2.0 mi east of Cass City	97.4	—	10-06-92	e13.3
04150560	North Branch White Creek	White Creek	Lat 43°31'15", long 83°13'47", in SE1/4 NE1/4 sec.25, T.13 N., R.10 E., Tuscola County, Hydrologic Unit 04080205, at Dodge Road, 2.0 mi northwest of Deford.	69.7	—	10-06-92	e4.76
04150590	South Branch White Creek	White Creek	Lat 43°29'38", long 83°13'43", in SE1/4 NE1/4 sec.1, T.12 N., R.10 E., Tuscola County, Hydrologic Unit 04080205, at Dodge Road, 3.0 mi northwest of Wilmot.	—	—	10-06-92	e3.35
04150600	White Creek	Cass River	Lat 43°30'47", long 83°18'34", in SE1/4 SE1/4 sec.29, T.13 N., R.10 E., Tuscola County, Hydrologic Unit 04080205, at Murray Road, 4.8 mi north-east of Caro.	146	1963-64, 1974, 1977	10-06-92	e12.1
04154130	Chippewa River	Tittabawassee River	Lat 43°34'49", long 84°26'49", in NW1/4 NW1/4 sec.28, T.14 N., R.1 W., Midland County, Hydrologic Unit 04080202, at Manitou Park, 2.0 mi south-west of Floyd.	—	—	08-02-93	e190

\* Base flow.

‡ Operated as a continuous-record gaging station.

a Affected by regulation and/or diversion.

b Operated as a low-flow partial-record station.

c Approximately.

d Operated as a National Stream Quality Accounting Network station.

e Discharge measurement made by employees of Michigan Department of Natural Resources.

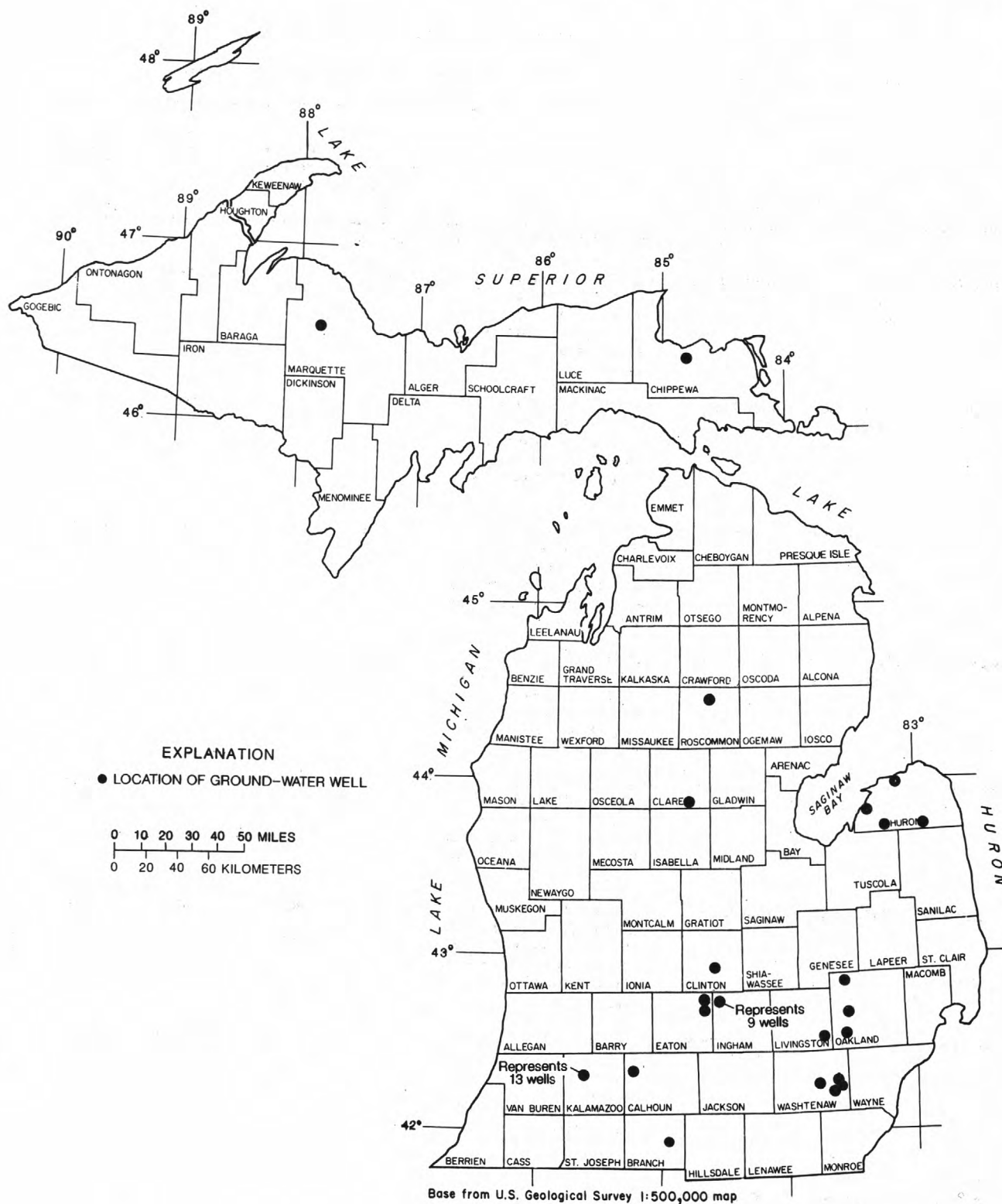


Figure 9.--Location of ground-water wells published in this report.

## GROUND-WATER LEVELS

## 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 sea level, from topographic map. Measuring point: Plywood shelter base, 2.50 ft above land-surface datum.

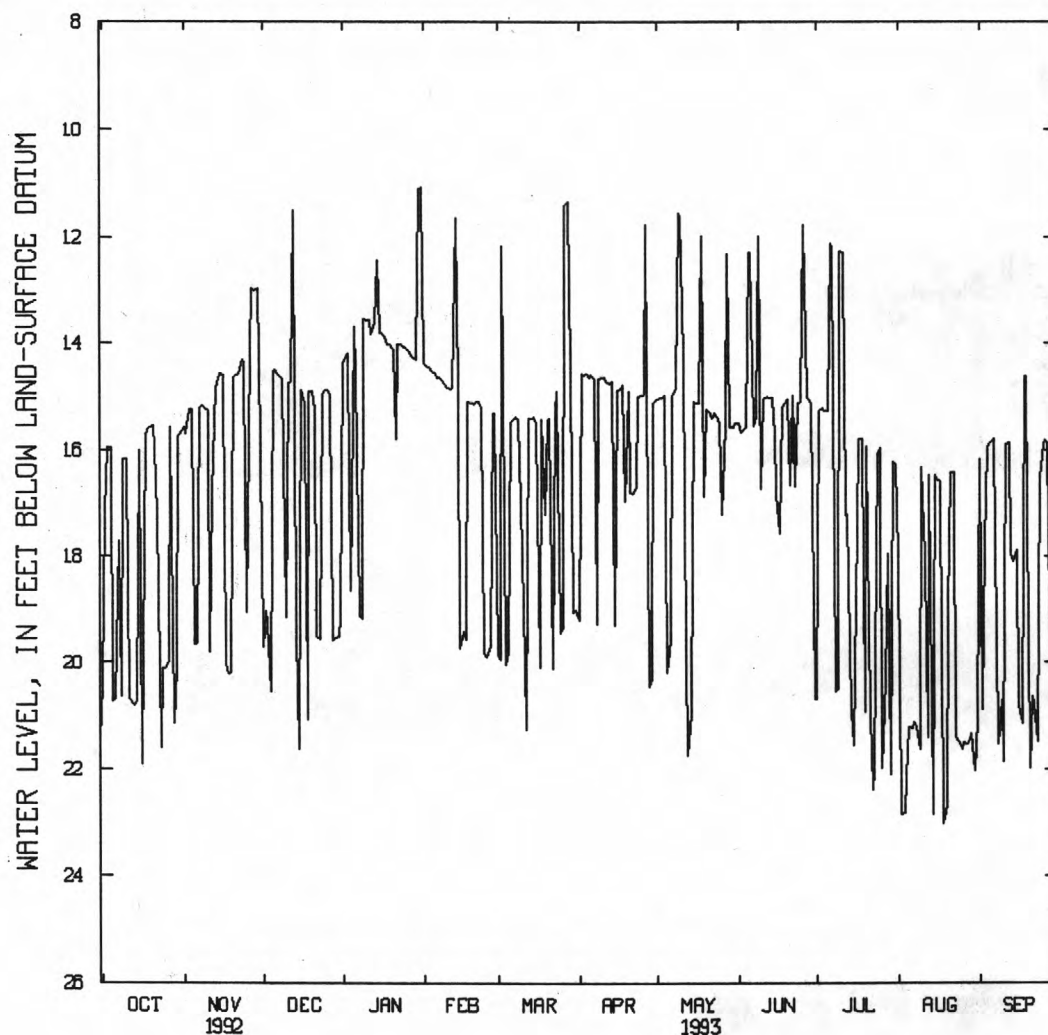
REMARKS.--Water levels affected by nearby pumping.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	20.75	19.66	14.52	13.67	14.56	19.80	14.64	20.18	12.30	15.27	21.21	15.85
10	16.19	15.26	19.14	13.57	14.83	16.98	14.66	11.59	16.73	12.27	16.33	21.87
15	16.00	14.55	21.62	13.78	19.75	15.39	19.29	15.10	15.71	21.55	16.47	17.89
20	15.57	14.64	14.91	14.11	15.14	15.44	14.92	15.24	15.05	15.93	19.02	21.97
25	20.13	19.05	14.87	14.05	19.89	19.45	14.98	15.49	15.09	15.97	21.61	15.87
EOM	15.66	14.27	19.11	11.06	15.32	19.01	15.12	15.50	20.67	16.26	21.10	15.78
WTR YR 1993	HIGHEST			9.72	JAN 7			LOWEST	23.01	AUG 18		





## GROUND-WATER LEVELS

## CALHOUN COUNTY

422032085091801. Local number, 1S 7W 32BDCC1.

LOCATION.--Lat 42°20'32", long 85°09'18", Hydrologic Unit 04050003, at Hopkins Street and State Highway 66, at Battle Creek. Owner: Pennfield Township.

AQUIFER.--Marshall Formation.

WELL CHARACTERISTICS.--Drilled well, diameter 6 in., depth 95 ft, cased to about 40 ft.

INSTRUMENTATION.--Water-level recorder.

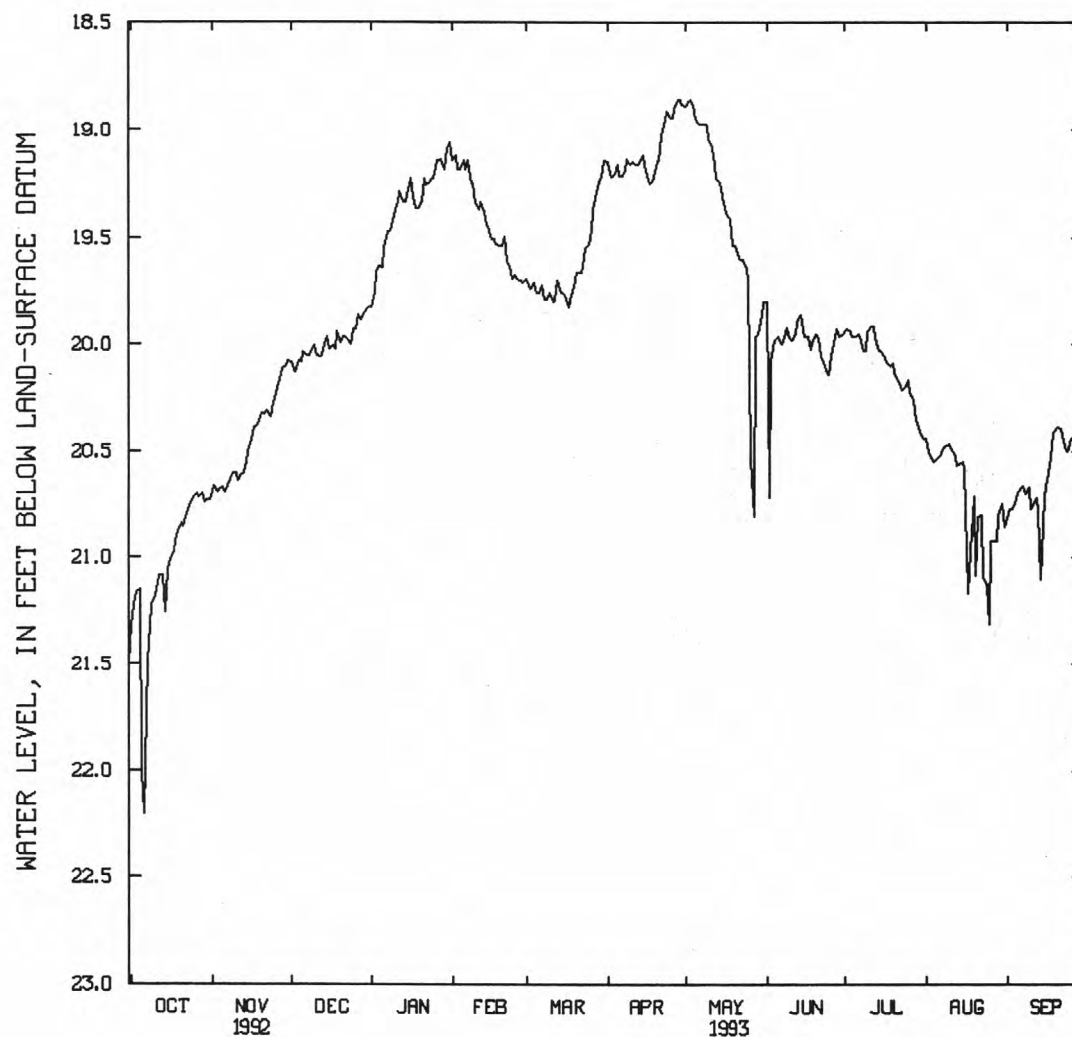
DATUM.--Elevation of land-surface datum is 845 ft above sea level, from topographic map. Measuring point: Top of shelter base, 1.0 ft above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.6 ft below land-surface datum, April 1974; lowest recorded, 27.0 ft, below land-surface datum, August 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	22.01	20.67	20.08	19.64	19.14	19.76	19.16	18.95	19.97	19.96	20.54	20.69
10	21.18	20.60	20.01	19.37	19.34	19.76	19.16	19.04	19.97	19.94	20.46	20.77
15	21.06	20.50	19.96	19.27	19.45	19.76	19.12	19.30	19.93	20.04	20.55	20.72
20	20.84	20.32	19.99	19.33	19.54	19.66	19.14	19.54	19.95	20.13	21.08	20.39
25	20.72	20.25	19.93	19.23	19.68	19.53	18.94	19.69	20.14	20.17	21.31	20.44
EOM	20.73	20.07	19.82	19.06	19.71	19.14	18.88	19.80	19.95	20.44	20.85	20.94
WTR YR 1993	HIGHEST			18.81	APR 29			LOWEST	22.21	OCT 6		



## GROUND-WATER LEVELS

## 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.--Bimonthly readings by observer; periodic readings by U.S.G.S. personnel.

DATUM.--Elevation of land-surface datum is 850 ft above sea level, 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 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	27.40	NOV 21	27.71	FEB 8	27.00	APR 21	27.65	JUN 21	25.35	AUG 23	25.06
7	27.43	DEC 21	26.95	25	27.26	22	27.59	JUL 6	25.11	24	25.08
20	27.60	22	26.95	MAR 10	27.46	MAY 5	26.83	15	25.04	SEP 7	25.31
NOV 6	27.76	JAN 20	26.81	22	27.62	21	25.99	20	24.99	20	25.54
10	27.77	27	26.86	APR 8	27.82	JUN 4	25.60				

## CLARE COUNTY

434900084462501. Local number, 17N 4W 34DCAD.

LOCATION.--Lat 43°49'00", long 84°46'25", Hydrologic Unit 04080201, at Clare. Owner: City of Clare.

AQUIFER.--Gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 4 in., depth 91 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 850 ft above sea level, from topographic map. Measuring point: Top of shelter base, 3.50 ft above land-surface datum.

REMARKS.--Levels affected by nearby pumping.

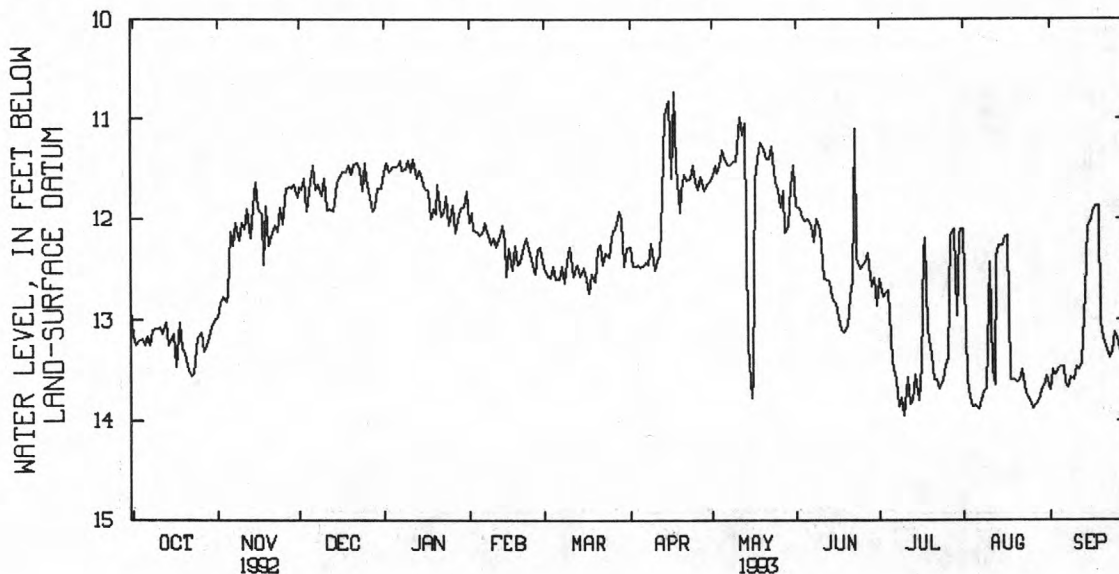
PERIOD OF RECORD.--January 1975 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 7.91 ft below land-surface datum, Mar. 31, 1976; lowest recorded, 24.95 ft below land-surface datum, May 28, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

LOWEST VALUES												
DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	13.26	12.73	11.61	11.48	12.17	12.59	12.48	11.31	11.99	13.16	13.86	13.47
10	13.09	12.04	11.60	11.41	12.19	12.28	12.51	11.43	12.10	13.96	12.43	13.60
15	13.19	11.63	11.63	11.59	12.56	12.48	10.81	13.78	12.84	13.81	12.27	12.08
20	13.34	12.27	11.55	11.95	12.44	12.29	11.72	11.30	12.76	13.36	13.63	13.03
25	13.18	12.05	11.44	12.07	12.55	12.19	11.63	11.71	12.45	13.46	13.83	13.14
EOM	12.99	11.78	11.69	11.73	12.35	12.30	11.63	11.47	12.86	12.09	13.56	11.85

WTR YR 1993      HIGHEST    9.06      MAY 14      LOWEST    13.96      JUL 10



## GROUND-WATER LEVELS

## 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 sea level. 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 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 30	16.64	JAN 4	15.61	FEB 26	15.98	APR 30	14.62	JUN 29	15.33	AUG 30	16.15
NOV 27	15.83	JAN 28	15.21	MAR 31	15.24	MAY 26	15.35	JUL 30	15.92	SEP 29	15.80

## EATON COUNTY

424058084380301. Local number, 3N 3W 2BA.

LOCATION.--Lat 42°40'58", long 84°38'03", Hydrologic Unit 04050004, on Stiefel Farm grounds, 1.6 mi north of Dimondale. Owner: City of Lansing.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 1.25 in., depth 66 ft, screened 63 to 66 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 839 ft above sea level. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

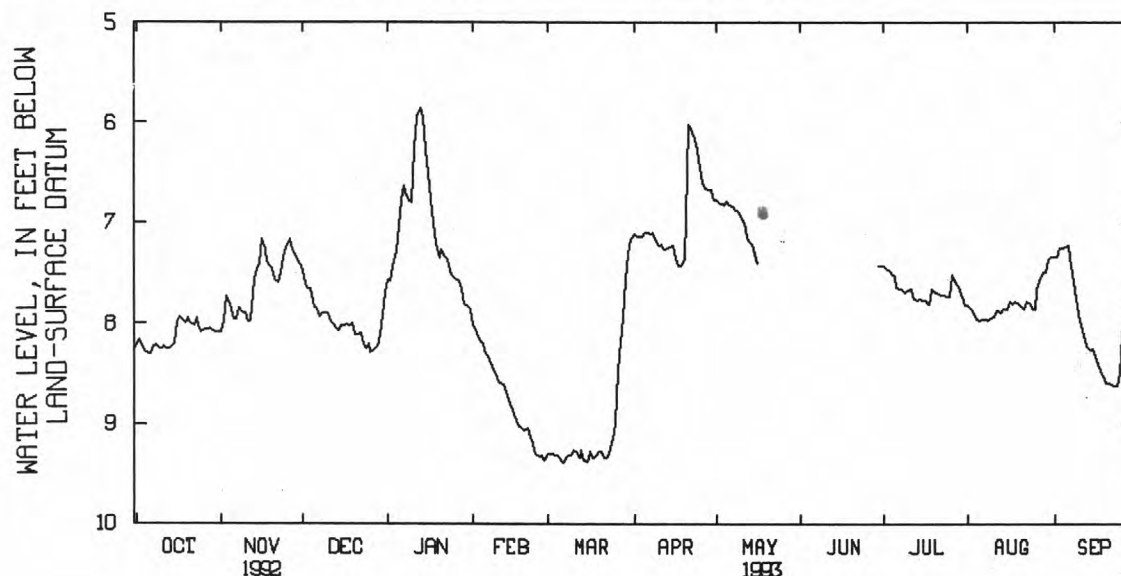
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 2.98 ft below land-surface datum, June 11, 1986; lowest recorded, 18.0 ft below land-surface datum, November 1968.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	8.30	7.87	7.85	7.03	8.20	9.35	7.10	6.78	--	7.53	7.98	7.24
10	8.27	7.91	7.92	6.79	8.55	9.26	7.22	6.93	--	7.68	7.93	7.92
15	8.20	7.41	8.03	6.26	8.80	9.38	7.22	7.35	--	7.78	7.86	8.26
20	7.95	7.45	8.12	7.35	9.08	9.28	6.94	--	--	7.69	7.83	8.60
25	8.09	7.23	8.20	7.54	9.33	9.00	6.45	--	--	7.73	7.87	8.50
EOM	8.09	7.43	7.69	7.86	9.35	7.16	6.76	--	7.44	7.82	7.34	7.45
WTR YR 1993	HIGHEST			5.73	JAN 13			LOWEST	9.39	MAR 6		



## 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 861.91 ft above sea level. Measuring point: Plywood instrument shelf, 1.0 ft above land-surface datum.

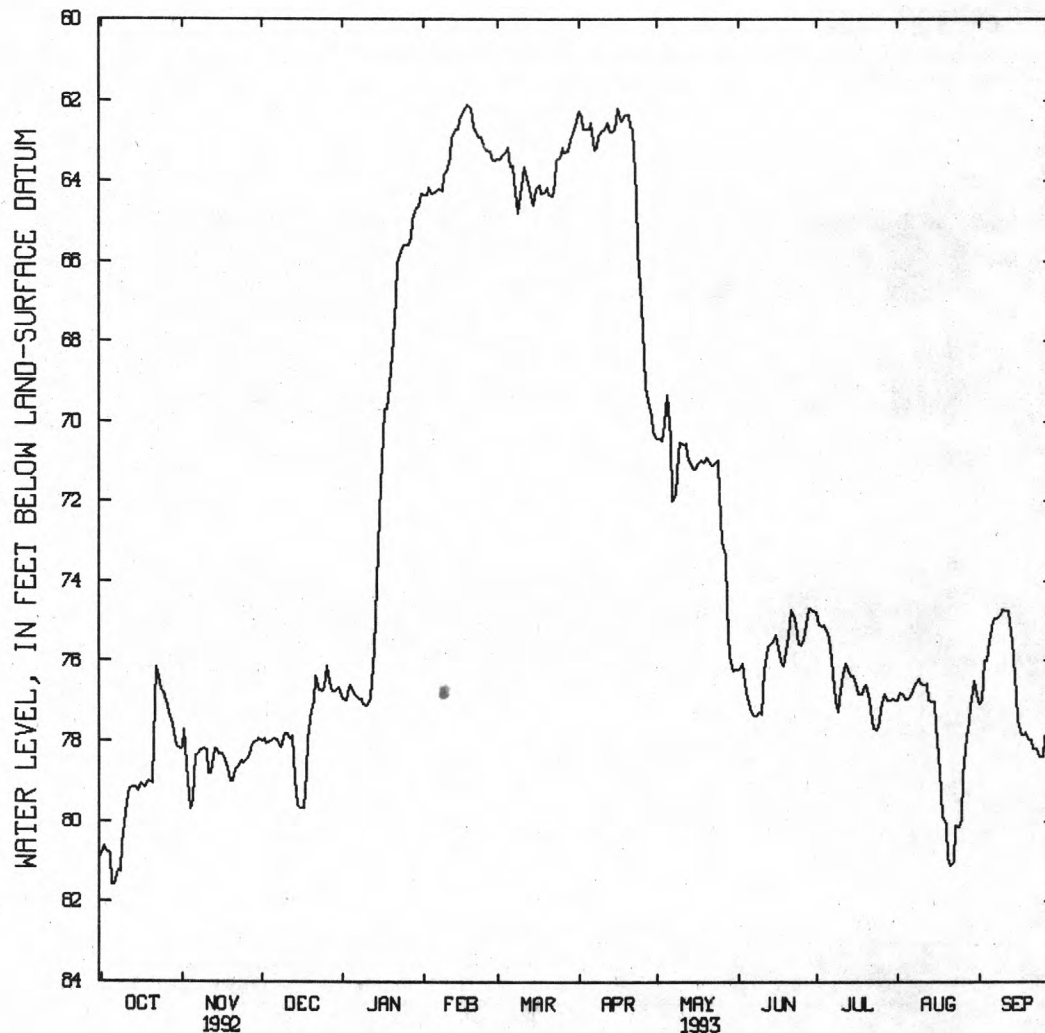
REMARKS.--Water levels affected by pumping.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	81.56	79.44	77.97	76.82	64.29	63.18	62.71	69.33	77.02	75.29	76.95	75.49
10	79.82	78.22	77.82	77.12	63.76	64.34	62.74	70.51	77.33	76.96	76.57	74.70
15	79.25	78.31	79.60	72.27	62.47	64.59	62.69	71.17	75.33	76.37	77.04	76.83
20	79.05	78.99	77.20	67.91	62.68	64.16	62.35	70.91	75.33	76.61	80.89	77.98
25	76.78	78.47	76.66	65.62	63.22	63.41	67.09	71.82	75.60	77.52	79.96	78.39
EOM	78.21	77.93	76.75	64.33	63.47	62.64	70.22	76.18	74.79	76.99	76.82	79.62
WTR YR 1993		HIGHEST	62.01	FEB 18		LOWEST	81.57	OCT 6				



## GROUND-WATER LEVELS

## HURON COUNTY

434103083130301. Local number, 15N 11E 32BBCB.

LOCATION.--Lat 43°41'03", long 83°13'03", Hydrologic Unit 04080103, 2 mi northeast of Gagetown at Gagetown State Game Area. Owner: Huron County.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 91 ft, screened 87 to 91 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 746 ft above sea level, from topographic map. Measuring point: Top of casing, 1.6 ft above land-surface datum.

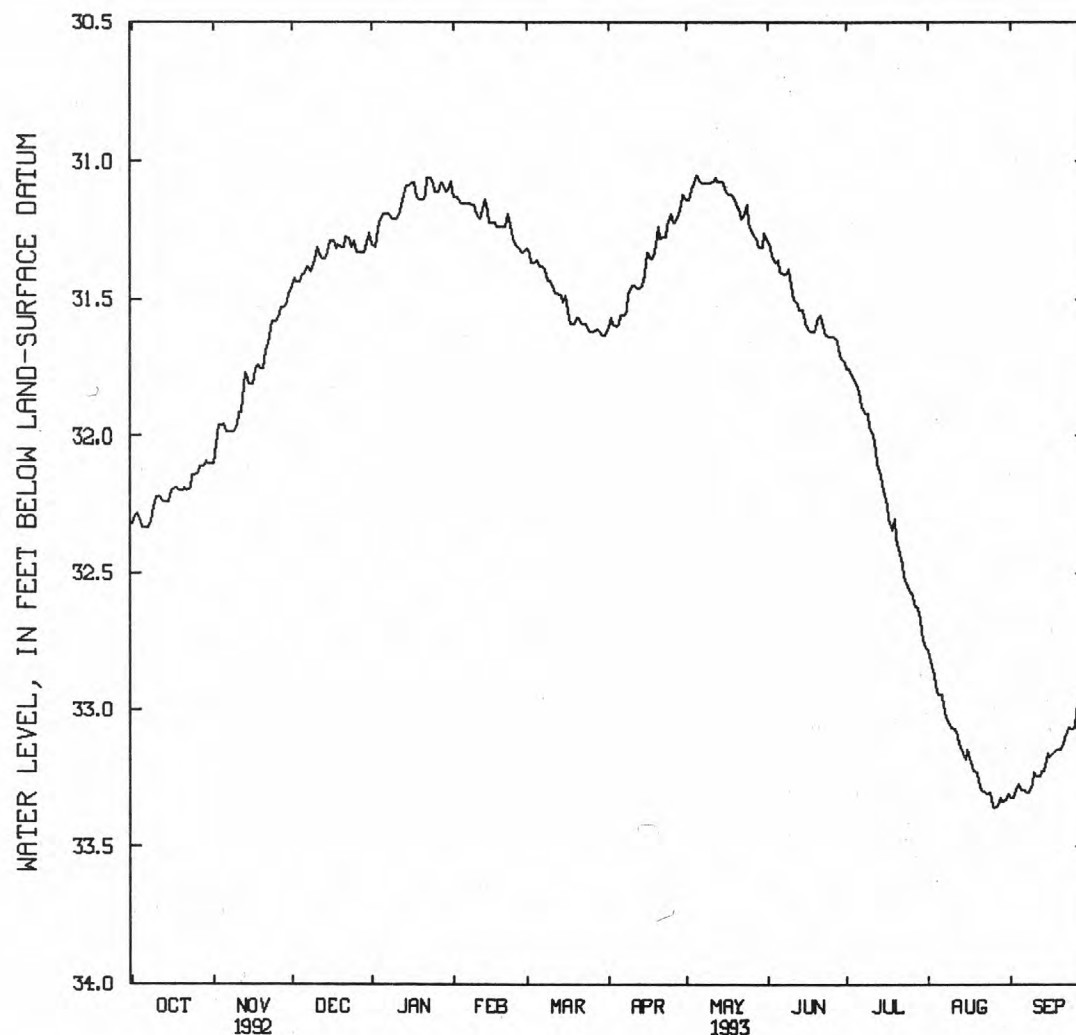
PERIOD OF RECORD.--February 1991 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 30.38 ft below land-surface datum, May 6, 1991; lowest recorded, 34.38 ft below land-surface datum, Sept. 20, 21, 1991.

EXTREMES OUTSIDE PERIOD OF RECORD.--Lowest water level measured, 35.60 ft below land-surface datum, June 2, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	32.33	31.95	31.41	31.19	31.15	31.36	31.59	31.05	31.36	31.82	32.94	33.29
10	32.22	31.96	31.36	31.21	31.19	31.43	31.45	31.08	31.45	31.97	33.06	33.23
15	32.24	31.81	31.33	31.09	31.22	31.51	31.41	31.08	31.58	32.20	33.18	33.16
20	32.20	31.75	31.31	31.14	31.24	31.57	31.24	31.15	31.57	32.37	33.26	33.14
25	32.14	31.58	31.29	31.11	31.30	31.62	31.19	31.22	31.64	32.57	33.35	33.06
EOM	32.10	31.48	31.26	31.07	31.33	31.63	31.12	31.26	31.73	32.77	33.31	32.98
WTR YR 1993	HIGHEST			31.02	JAN 24, 31			LOWEST	33.36	AUG 26		





## GROUND-WATER LEVELS

## HURON COUNTY

434323082561901. Local number, 15N 13E 22BBCC.

LOCATION.--Lat.43°43'23", long 82°56'19", Hydrologic Unit 04080205, on State Highway 19, 1 mi north of Uby. Owner: Huron County.

AQUIFER.--Napoleon Sandstone Member of Marshall Formation.

WELL CHARACTERISTICS.--Rotary drilled observation well, diameter 4 in., depth 70 ft, cased to top of Napoleon Sandstone.

INSTRUMENTATION.--Water-level recorder.

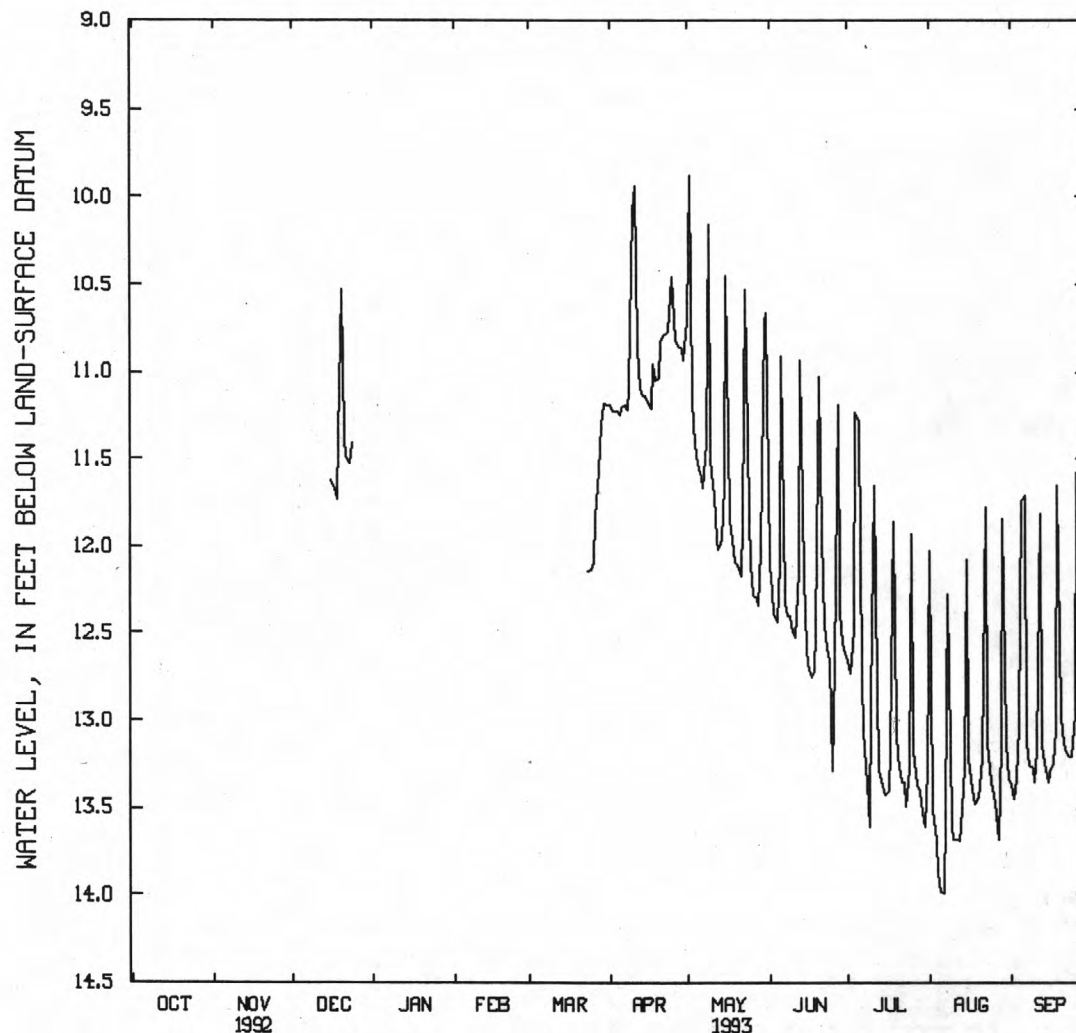
DATUM.--Elevation of land-surface datum is 795 ft above sea level, from topographic map. Measuring point: Top of casing, 2.81 ft above land-surface datum.

PERIOD OF RECORD.--December 1988 to September 1989, December 1992 to September 1993.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.67 ft below land-surface datum, Apr. 25, 1993; lowest recorded, 16.38 ft below land-surface datum, July 26, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	--	--	--	--	--	--	11.25	11.53	12.10	11.28	13.98	11.74
10	--	--	--	--	--	--	10.08	11.51	12.49	12.88	13.68	13.35
15	--	--	--	--	--	--	11.14	11.65	12.59	13.42	12.07	13.35
20	--	--	10.53	--	--	--	11.04	12.11	11.03	13.21	13.38	12.98
25	--	--	--	--	--	12.14	10.46	12.10	13.29	11.93	13.42	12.96
EOM	--	--	--	--	--	11.19	10.93	10.66	12.63	13.28	13.33	12.86
WTR YR 1993		HIGHEST	9.67	APR 25		LOWEST	13.99	AUG 6				



## GROUND-WATER LEVELS

## 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 sea level, from topographic map. Measuring point: Top of casing, 2.2 ft above land-surface datum.

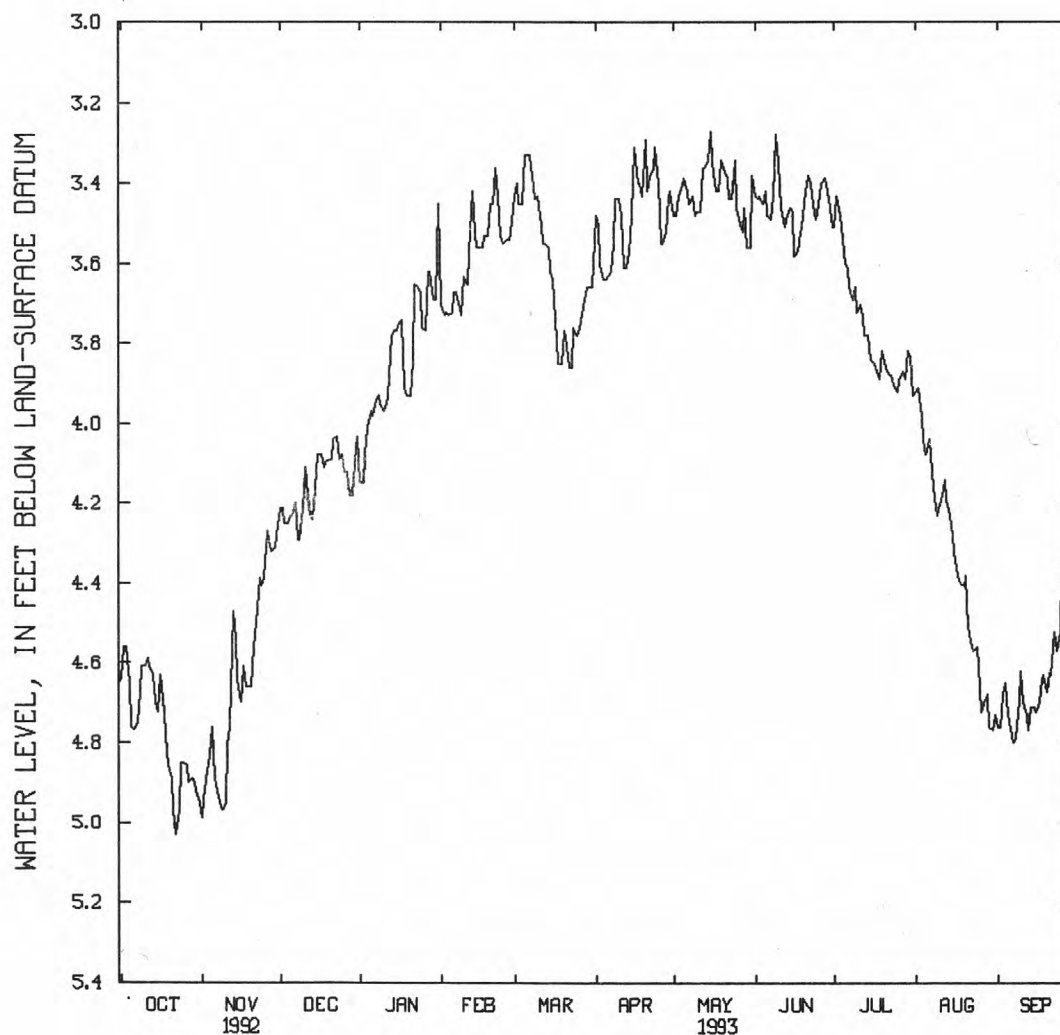
PERIOD OF RECORD.--February 1991 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 3.12 ft below land-surface datum, Apr. 20, 1993; lowest recorded, 6.03 ft below land-surface datum, Sept. 30, 1991.

EXTREMES OUTSIDE PERIOD OF RECORD.--Lowest water level measured, 12.30 ft below land-surface datum, June 2, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	4.76	4.76	4.23	3.97	3.72	3.33	3.64	3.39	3.42	3.60	4.08	4.73
10	4.61	4.95	4.21	3.97	3.63	3.43	3.44	3.47	3.35	3.72	4.21	4.62
15	4.72	4.64	4.16	3.77	3.56	3.62	3.48	3.27	3.47	3.84	4.28	4.71
20	4.89	4.66	4.09	3.93	3.45	3.77	3.29	3.36	3.42	3.83	4.38	4.67
25	4.85	4.39	4.08	3.76	3.55	3.78	3.40	3.46	3.45	3.92	4.66	4.52
EOM	4.95	4.28	4.03	3.45	3.52	3.66	3.42	3.38	3.51	3.93	4.73	4.50
WTR YR 1993	HIGHEST			3.12	APR 20			LOWEST	5.03	OCT 22		



## GROUND-WATER LEVELS

## HURON COUNTY

435736083094801. Local number, 18N 11E 27AADD.

LOCATION.--Lat 43°57'36", long 83°09'48", Hydrologic Unit 04080103, 6 mi northeast of Caseville at Rush Lake State Game Area. Owner: Huron County.

AQUIFER.--Marshall Sandstone, Lower

WELL CHARACTERISTICS.--Rotary drilled observation well, diameter 4 in., depth 200 ft, cased to 178 ft.

INSTRUMENTATION.--Water-level recorder.

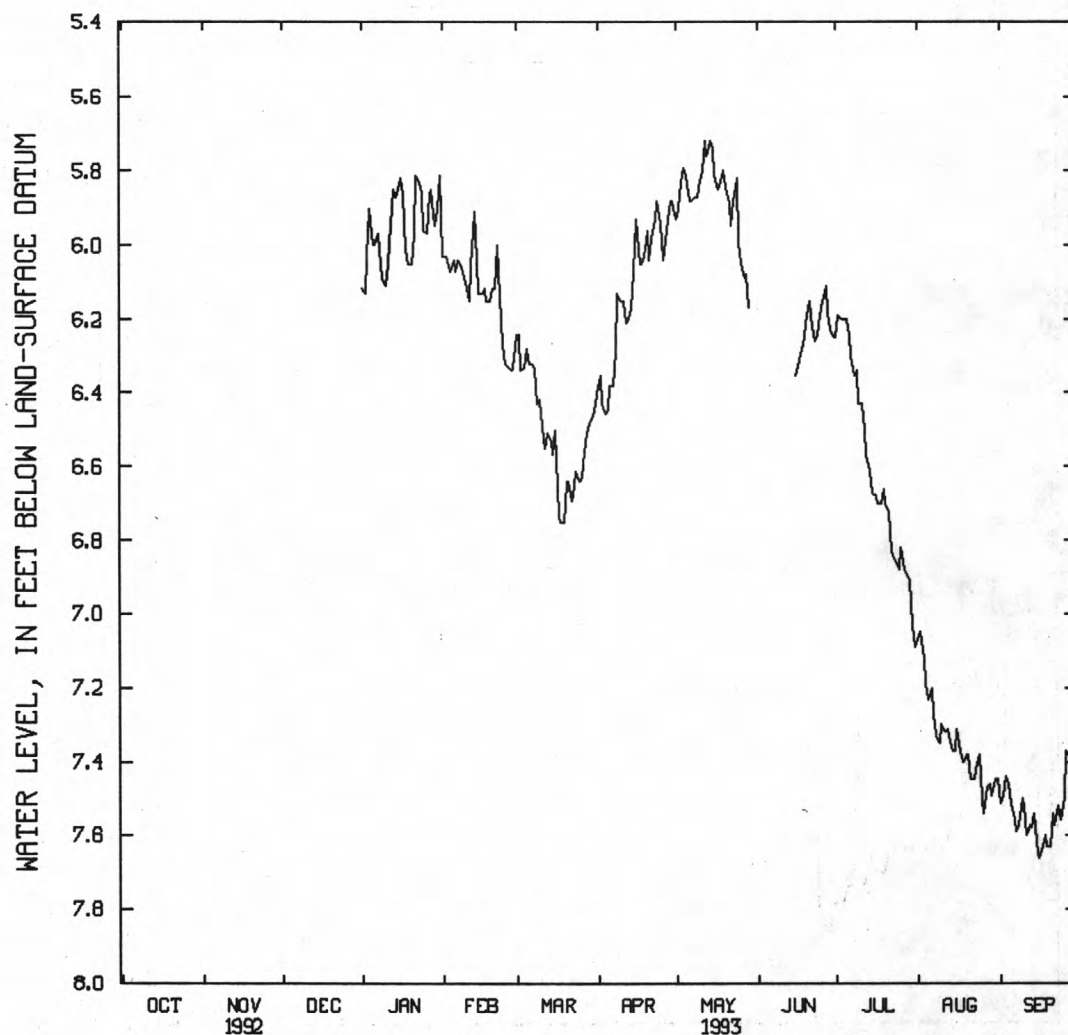
DATUM.--Elevation of land-surface datum is 600 ft above sea level, from topographic map. Measuring Point: Top of casing, 4.03 ft above land-surface datum.

PERIOD OF RECORD.--October 1988 to August 1989, December 1992 to September 1993.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.63 ft below land-surface datum, Jan. 31, 1993; lowest recorded, 8.62 ft below land-surface datum, Aug. 16, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	--	--	--	6.00	6.04	6.28	6.44	5.81	--	6.20	7.23	7.51
10	--	--	--	6.11	6.10	6.42	6.15	5.84	--	6.43	7.30	7.52
15	--	--	--	5.85	6.13	6.57	6.07	5.74	--	6.67	7.37	7.65
20	--	--	6.01	6.05	6.12	6.64	5.96	5.84	6.19	6.70	7.38	7.63
25	--	--	5.94	5.96	6.32	6.64	5.94	5.99	6.19	6.88	7.50	7.50
EOM	--	--	5.99	5.81	6.33	6.45	5.88	--	6.25	7.09	7.45	7.50
WTR YR 1993	HIGHEST			5.63	JAN 31			LOWEST	7.66	SEP 16		



## GROUND-WATER LEVELS

## INGHAM COUNTY

423127084321901. Local number, 4N 2W 16DAAA.

LOCATION.--Lat 42°31'27", long 84°32'19", Hydrologic Unit 04050004, between Cedar Street and Museum Drive, in Lansing Township, in Lansing.

Owner: City of Lansing.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 12 in., depth 417 ft, cased.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 829.10 ft above sea level. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

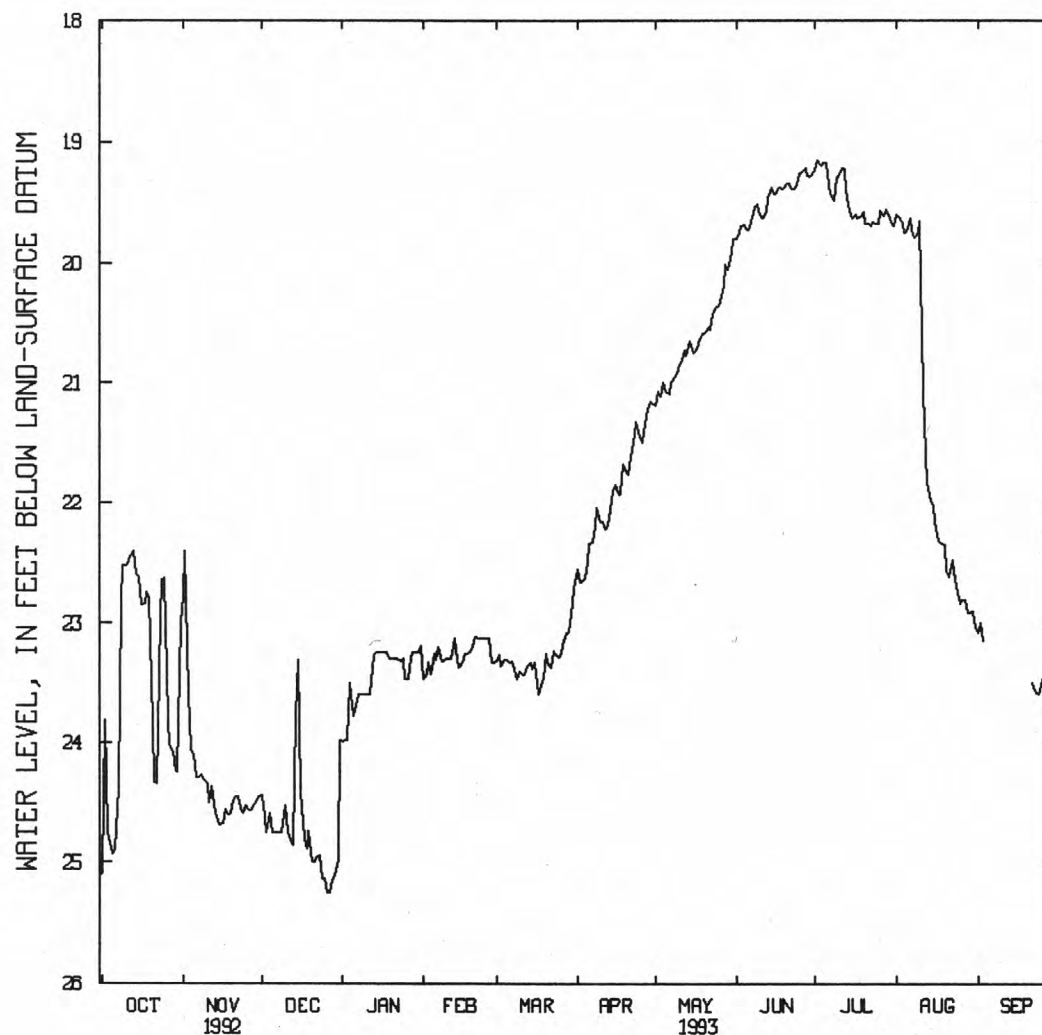
REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--September 1945 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 19.04 ft below land-surface datum, July 5, 6, 1993; lowest recorded, 67.0 ft below land-surface datum, August 1949.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	24.93	24.09	24.74	23.78	23.25	23.31	22.49	21.07	19.72	19.17	19.74	--
10	22.53	24.34	24.52	23.59	23.29	23.40	22.16	20.88	19.59	19.29	19.65	--
15	22.61	24.68	23.31	23.24	23.37	23.38	21.89	20.72	19.43	19.63	22.01	--
20	23.85	24.49	24.99	23.29	23.19	23.26	21.75	20.57	19.34	19.67	22.56	--
25	22.63	24.53	25.12	23.46	23.13	23.28	21.44	20.36	19.25	19.67	22.84	23.46
EOM	22.99	24.44	23.98	23.19	23.34	22.71	21.16	19.81	19.24	19.70	23.04	23.71
WTR YR 1993	HIGHEST			19.04	JUL 5, 6			LOWEST	25.24	DEC 26, 27		



## GROUND-WATER LEVELS

## INGHAM COUNTY

423805084311801. Local number, 3N 2W 23BCBD.

LOCATION.--Lat 42°38'05", long 84°31'18", Hydrologic Unit 04050004, at Holt High School, at Sycamore Street, in Delhi Township, in Holt.

Owner: Holt High School.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 188 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 895 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

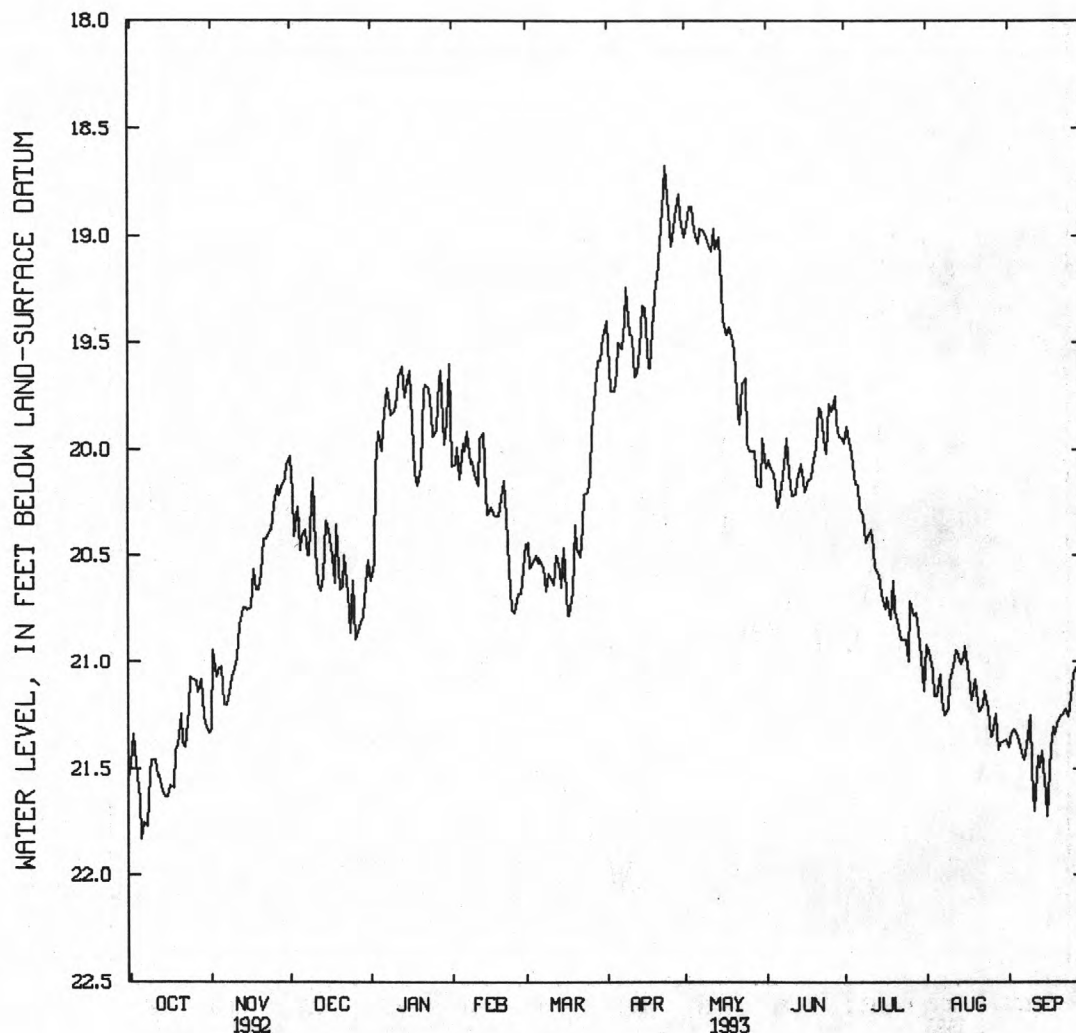
REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--March 1982 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 18.3 ft below land-surface datum, May 1983; lowest recorded, 26.34 ft below land-surface datum, June 5, 1991.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	21.83	21.02	20.48	20.01	19.97	20.50	19.63	18.98	20.22	20.16	21.16	21.37
10	21.46	21.01	20.13	19.82	20.12	20.58	19.46	19.02	20.11	20.42	21.09	21.51
15	21.63	20.76	20.34	19.68	20.31	20.65	19.32	19.24	20.14	20.68	20.97	21.62
20	21.24	20.58	20.66	20.08	20.23	20.35	19.21	19.54	19.99	20.76	21.13	21.27
25	21.08	20.26	20.62	19.94	20.77	20.20	18.89	19.97	19.79	21.00	21.35	21.11
EOM	21.33	20.07	20.52	19.60	20.62	19.47	18.91	19.95	19.95	21.13	21.36	21.11
WTR YR 1993	HIGHEST			18.38	APR 24			LOWEST	21.83	OCT 5		





## GROUND-WATER LEVELS

## INGHAM COUNTY

424040084351401. Local number, 3N 2W 6ACAD1.

LOCATION.--Lat 42°40'40", long 84°35'14", Hydrologic Unit 04050004 at Pleasant Grove Road, in Delhi Township, in Lansing. Owner: City of Lansing.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 870 ft above sea level, from topographic map. Measuring point: Plywood shelter base, 2.4 ft above land-surface datum.

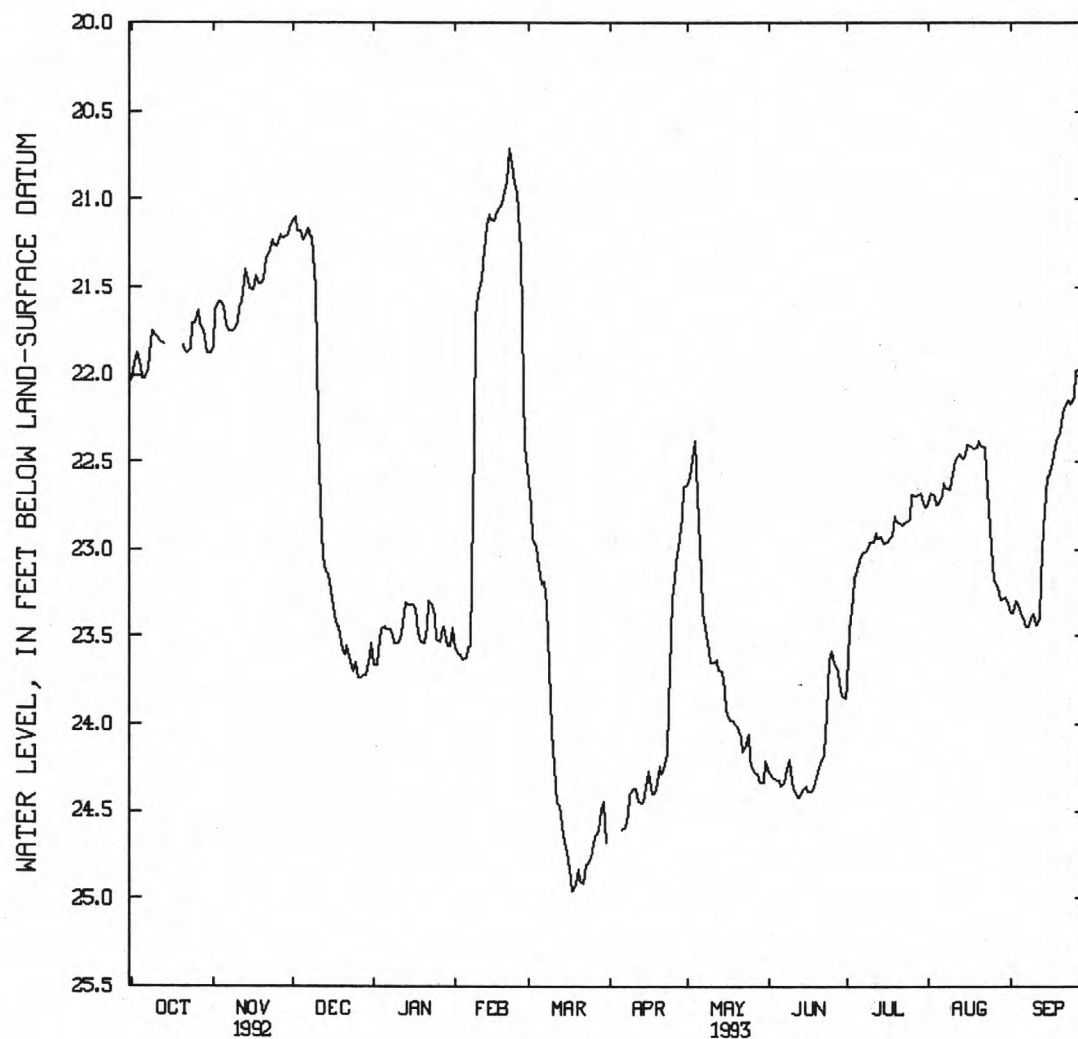
REMARKS.--Water levels affected by nearby pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.65 ft below land-surface datum, Feb. 21, 22, 1993; lowest recorded, 27.52 ft below land surface datum, Dec. 27, 1990.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	22.02	21.61	21.23	23.44	23.62	23.10	--	22.69	24.32	23.09	22.74	23.36
10	21.78	21.70	21.51	23.54	21.54	24.04	24.38	23.65	24.33	22.96	22.61	23.37
15	--	21.51	23.15	23.32	21.11	24.67	24.36	23.80	24.36	22.97	22.46	22.59
20	21.83	21.46	23.59	23.54	20.95	24.84	24.24	24.02	24.25	22.84	22.38	22.33
25	21.71	21.27	23.65	23.51	20.96	24.77	23.29	24.20	23.59	22.83	23.08	22.13
EOM	21.88	21.16	23.54	23.45	22.41	24.68	22.64	24.22	23.86	22.76	23.31	22.09
WTR YR 1993	HIGHEST			20.65	FEB 21, 22			LOWEST	24.96	MAR 18		



## GROUND-WATER LEVELS

## INGHAM COUNTY

424111084360701. Local number, 4N 2W 31CC.

LOCATION.--Lat 42°41'11", long 84°36'07", Hydrologic Unit 04050004 at Maybel Street and Waverly Road, in Lansing. Owner: Carlos Weber.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 3 in., depth 204 ft.

INSTRUMENTATION.--Periodic measurement.

DATUM.--Elevation of land-surface datum is 880.15 ft above sea level. Measuring point: Top of coupling, at land-surface datum.

REMARKS.--Water levels affected by nearby pumping.

PERIOD OF RECORD.--November 1944 to September 1993.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 18.92 ft below land-surface datum, Apr. 26, 1952; lowest measured, 45.89 ft below land-surface datum, July 31, 1980.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 19	28.26	JAN 8	30.64	APR 5	31.47	JUN 23	31.80	AUG 12	31.86	SEP 21	31.92
NOV 25	27.79	MAR 1	29.81	MAY 12	31.91						

424235084311201. Local number, 4N 2W 27BB.

LOCATION.--Lat 42°42'35", long 84°31'12", Hydrologic Unit 04050004, at Fenner Arboretum, in Lansing. Owner: U.S. Geological Survey.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled observation well, diameter 6 in., depth 215 ft, cased to 51 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 835 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.7 ft above land-surface datum.

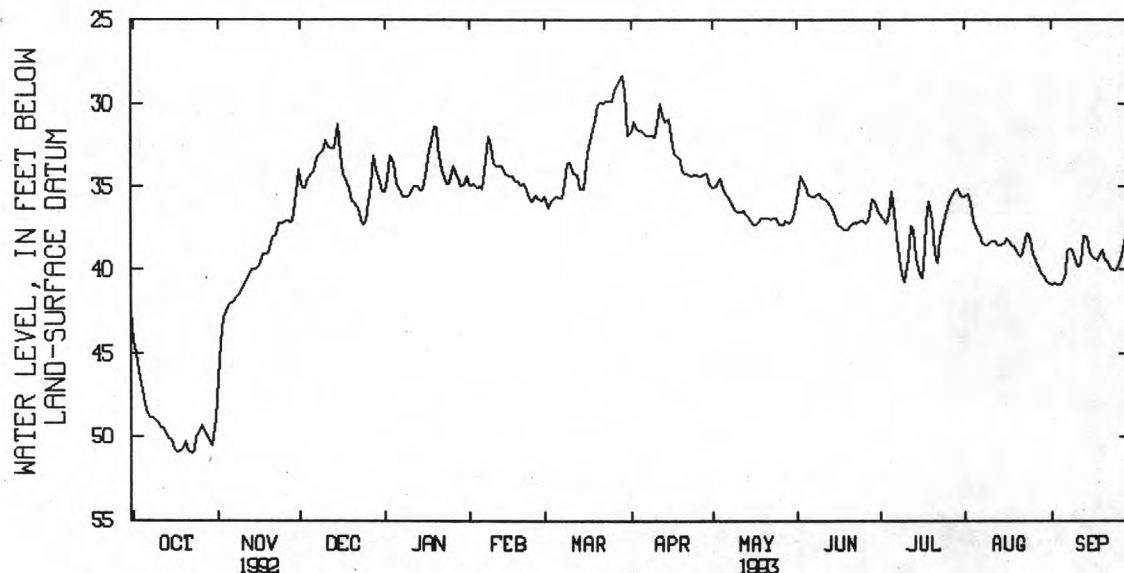
REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--July 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 27.85 ft below land-surface datum, Mar. 29, 1993; lowest recorded, 89.5 ft below land-surface datum, October 1972.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	48.10	42.08	34.23	34.73	35.02	35.63	31.65	35.06	35.47	35.31	37.51	40.85
10	49.21	41.11	32.29	35.53	33.61	33.57	32.02	36.51	35.64	40.75	38.24	39.56
15	50.23	39.85	31.27	35.18	34.35	35.15	31.01	37.16	37.09	40.20	38.45	38.94
20	50.35	38.76	35.96	31.50	34.88	30.10	33.95	36.84	37.41	37.07	39.05	38.86
25	49.80	37.14	37.02	34.70	35.54	29.83	34.30	37.30	37.05	36.50	38.57	39.94
EOM	48.91	34.01	35.35	34.42	35.87	31.89	34.87	36.59	36.38	35.63	40.75	37.61
WTR YR 1993		HIGHEST	27.85	MAR 29		LOWEST	51.00	OCT 22				



## GROUND-WATER LEVELS

## INGHAM COUNTY

424312084321801. Local number, 4N 2W 22BC.

LOCATION.--Lat 42°43'12", long 84°32'18", Hydrologic Unit 04050004, at Pennsylvania Avenue, in Lansing. Owner: City of Lansing.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 12 in., depth 338 ft, cased to 60 ft.

INSTRUMENTATION.--Periodic measurement.

DATUM.--Elevation of land-surface datum is 823.64 ft above sea level. Measuring point: Top of flange, 4.0 ft above land-surface datum.

REMARKS.--Water levels affected by nearby pumping.

PERIOD OF RECORD.--October 1930 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 7.1 ft below land-surface datum, July 1932; lowest measured, 80.49 ft below land-surface datum, Feb. 24, 1970.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 19	22.28	JAN 8	19.47	APR 5	17.32	JUN 28	17.09	AUG 12	19.25	SEP 21	19.62
NOV 25	19.14	MAR 1	18.51	MAY 12	16.61						

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 sea level. Measuring point: Plywood shelter base at land-surface datum.

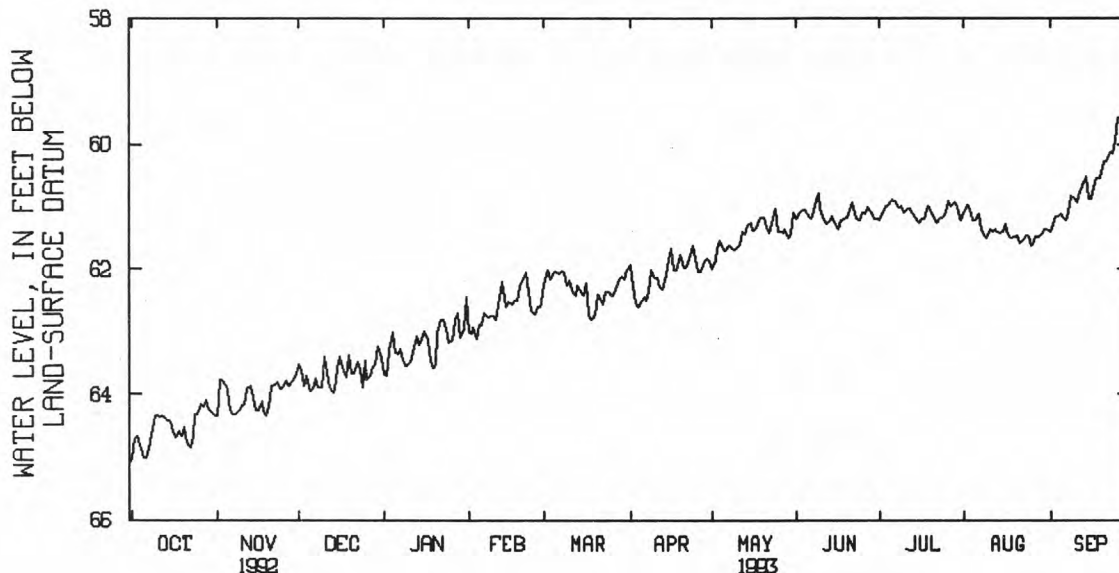
REMARKS.--Water levels affected by regional pumping.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	64.99	63.93	63.94	63.34	62.88	62.03	62.52	61.63	61.12	60.92	61.22	61.13
10	64.35	64.19	63.40	63.52	62.74	62.17	62.12	61.68	61.04	61.09	61.35	60.87
15	64.42	64.25	63.58	63.10	62.61	62.43	61.86	61.26	61.28	61.27	61.40	60.86
20	64.52	64.20	63.66	63.51	62.29	62.39	61.84	61.17	61.06	61.10	61.46	60.43
25	64.32	63.88	63.46	63.18	62.72	62.43	61.83	61.40	61.09	61.10	61.62	59.95
EOM	64.34	63.60	63.43	62.45	62.51	62.02	61.87	61.09	61.19	61.22	61.34	59.84
WTR YR 1993		HIGHEST	59.32	SEP 26, 27		LOWEST	65.01	OCT 1				



## GROUND-WATER LEVELS

## INGHAM COUNTY

424502084331301. Local number, 4N 2W 9BDAD.

LOCATION.--Lat 42°45'02", 84°33'13", Hydrologic Unit 04050004, at North Grand River Avenue, in Lansing Township, in Lansing. Owner: City of Lansing.

AQUIFER.--Saginaw Formation.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 14 in., depth 401 ft, cased to 49 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 828.81 ft above sea level. Measuring point: Plywood instrument shelf, 4.0 ft above land-surface datum.

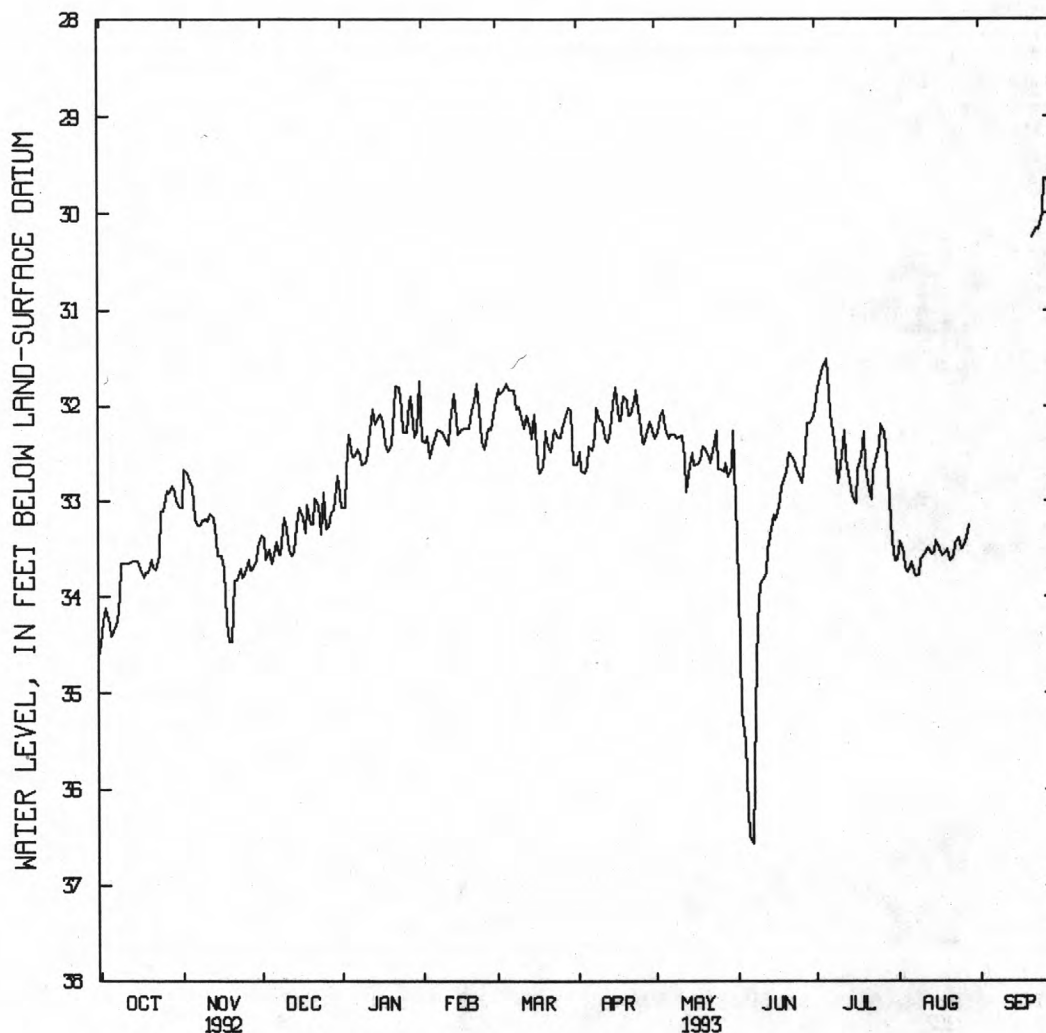
REMARKS.--Water levels affected by regional pumping.

PERIOD OF RECORD.--1929 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.6 ft below land-surface datum, March 1931; lowest recorded, 179.4 ft below land-surface datum, April 1968.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	34.40	32.85	33.66	32.53	32.37	31.78	32.62	32.24	36.18	31.51	33.74	--
10	33.66	33.18	33.17	32.59	32.35	32.00	32.15	32.33	33.87	32.81	33.60	--
15	33.62	33.57	33.24	32.14	32.29	32.34	31.99	32.50	33.15	32.95	33.52	--
20	33.60	34.46	33.23	32.40	32.05	32.27	31.93	32.44	32.69	32.62	33.50	--
25	33.10	33.74	32.91	32.28	32.44	32.33	32.13	32.65	32.73	32.43	33.51	29.99
EOM	33.06	33.48	32.80	31.75	32.16	32.61	32.22	32.27	32.11	33.62	--	29.89
WTR YR 1993	HIGHEST		29.38	SEP 26	LOWEST		36.57	JUN 7				



## GROUND-WATER LEVELS

## INGHAM COUNTY

424521084342101. Local number, 4N 2W 5CDD1.

LOCATION.--Lat 42°45'21", long 84°34'21", Hydrologic Unit 04050004, at Muskegon Street, in Lansing Township, in Lansing. Owner: City of Lansing.

AQUIFER.--Saginaw Formation of Pennsylvanian Age.

WELL CHARACTERISTICS.--Drilled well, diameter 12 in., depth 418 ft, cased to 63 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 840 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

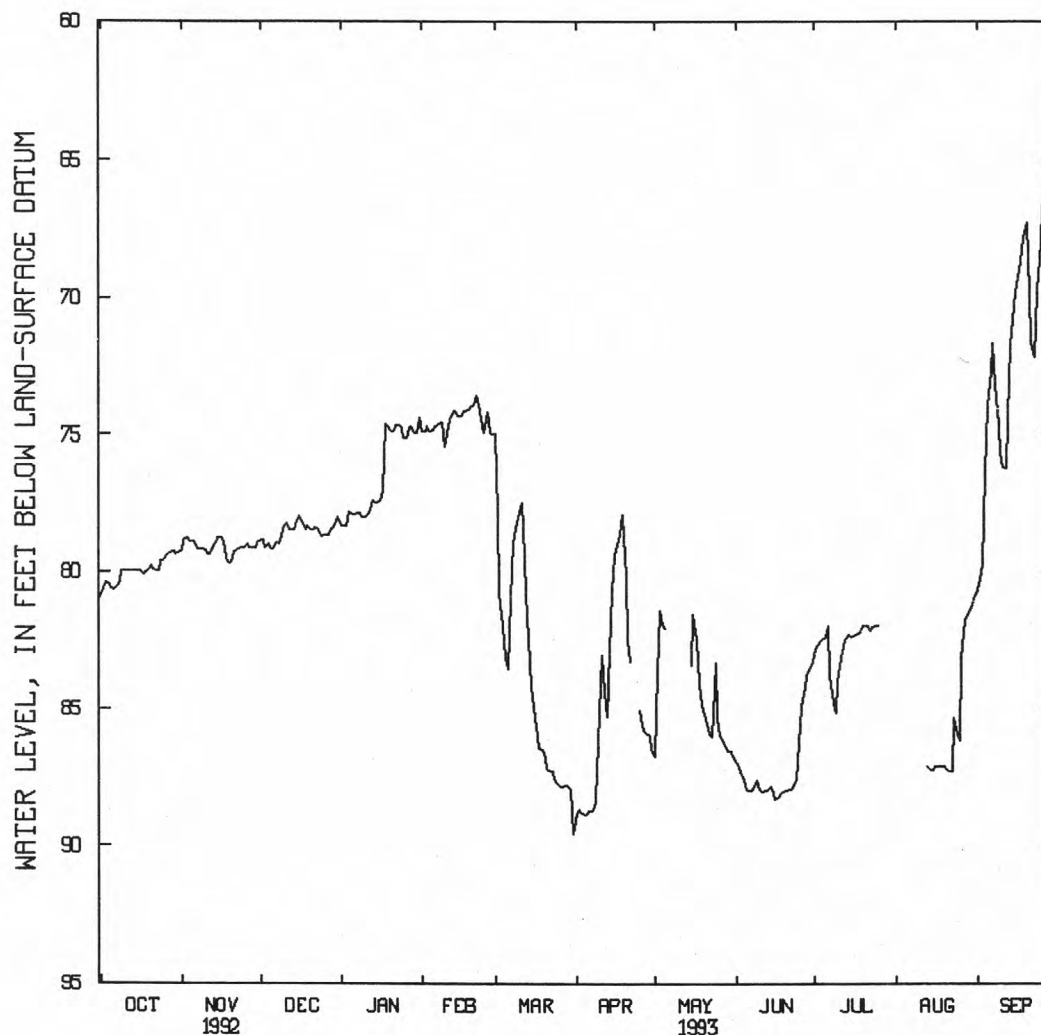
REMARKS.--Water levels affected by nearby pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 53.80 ft below land-surface datum, Jan. 13, 1991; lowest recorded, 101.94 ft below land-surface datum, June 29, 1991.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	80.60	78.90	79.15	77.89	74.79	83.10	88.83	82.06	87.90	82.34	--	73.95
10	79.99	79.24	78.30	78.03	75.44	78.00	85.09	--	87.90	83.94	--	75.68
15	79.95	78.77	78.15	77.44	74.31	84.13	80.72	83.42	88.11	82.35	87.23	70.30
20	79.79	79.64	78.47	74.88	73.97	86.77	80.17	85.18	87.99	81.94	87.18	67.29
25	79.56	79.12	78.66	75.09	74.91	87.76	85.08	85.34	86.17	81.95	86.14	67.94
EOM	79.25	78.95	78.05	74.34	74.98	89.56	86.49	86.73	83.29	--	80.81	68.37
WTR YR 1993	HIGHEST			65.51	SEP 30			LOWEST	89.56	MAR 31		





## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421151085351601. Local number, 3S 11W 22BBCD.

LOCATION.--Lat 42°11'51", long 85°35'16", Hydrologic Unit 04050003, at Portage Central High School, in Kalamazoo Township, in Portage.

Owner: Portage Public Schools.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 12 in., depth 102 ft., screened 87 to 102 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 877 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 2.0 ft above land-surface datum.

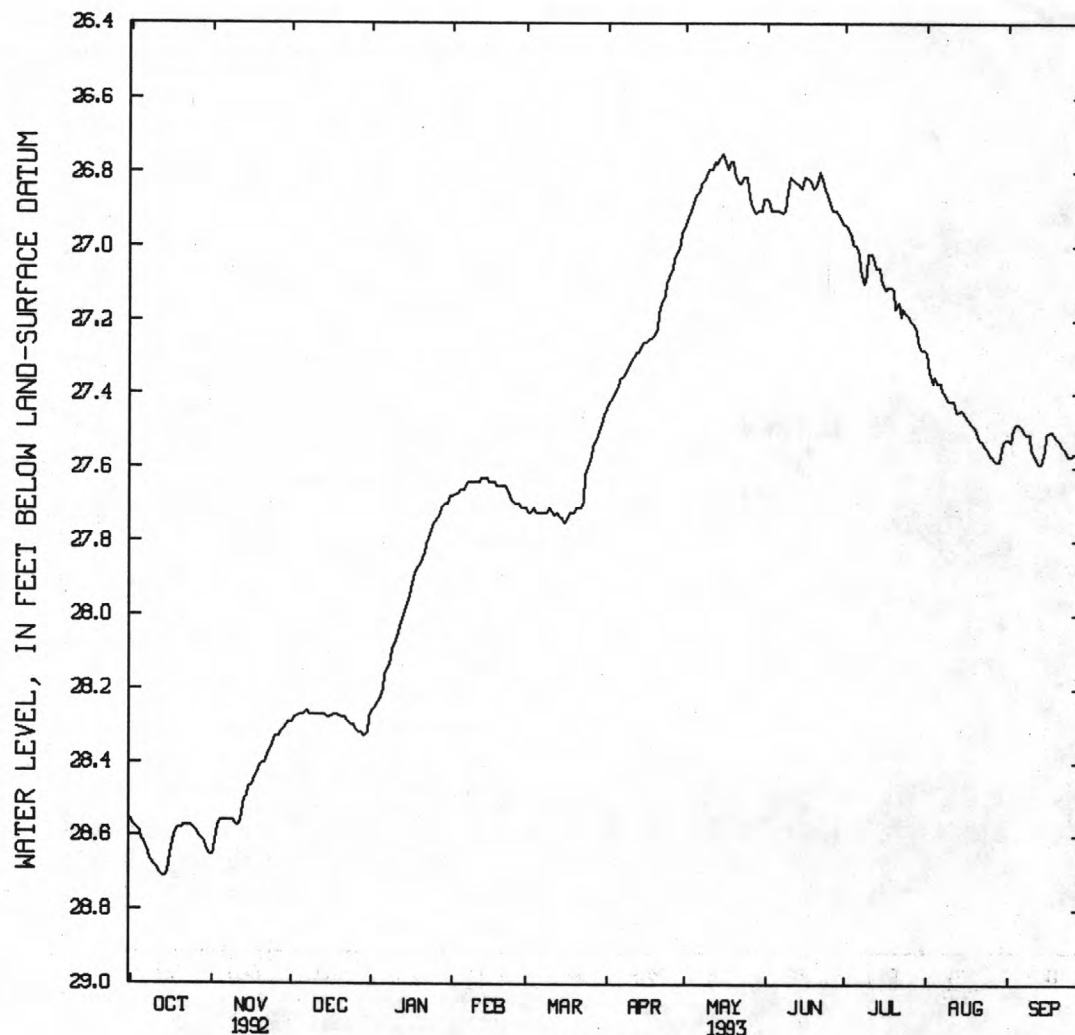
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--June 1982 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 24.8 ft below land-surface datum, April 1985; lowest recorded, 28.71 ft below land-surface datum, Oct. 13, 14, 1992.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	28.61	28.56	28.27	28.20	27.66	27.72	27.38	26.86	26.90	27.00	27.37	27.48
10	28.68	28.57	28.27	28.07	27.64	27.71	27.31	26.79	26.81	27.02	27.42	27.55
15	28.70	28.47	28.28	27.96	27.64	27.74	27.26	26.75	26.81	27.10	27.45	27.55
20	28.58	28.40	28.28	27.85	27.65	27.71	27.22	26.81	26.83	27.17	27.50	27.52
25	28.58	28.33	28.30	27.75	27.70	27.59	27.07	26.84	26.88	27.19	27.57	27.57
EOM	28.65	28.29	28.28	27.68	27.71	27.46	26.96	26.87	26.94	27.28	27.52	27.56
WTR YR 1993	HIGHEST			26.75	MAY 14-16			LOWEST	28.71	OCT 13, 14		



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421325085404801. Local number, 3S 12W 11BDAD.

LOCATION.--Lat 42°13'25", long 85°04'48", Hydrologic Unit 04050003, at Kalamazoo Valley Community College. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 3 in., depth 248 ft, screened 245 to 248 ft.

INSTRUMENTATION.--Water-level recorder.

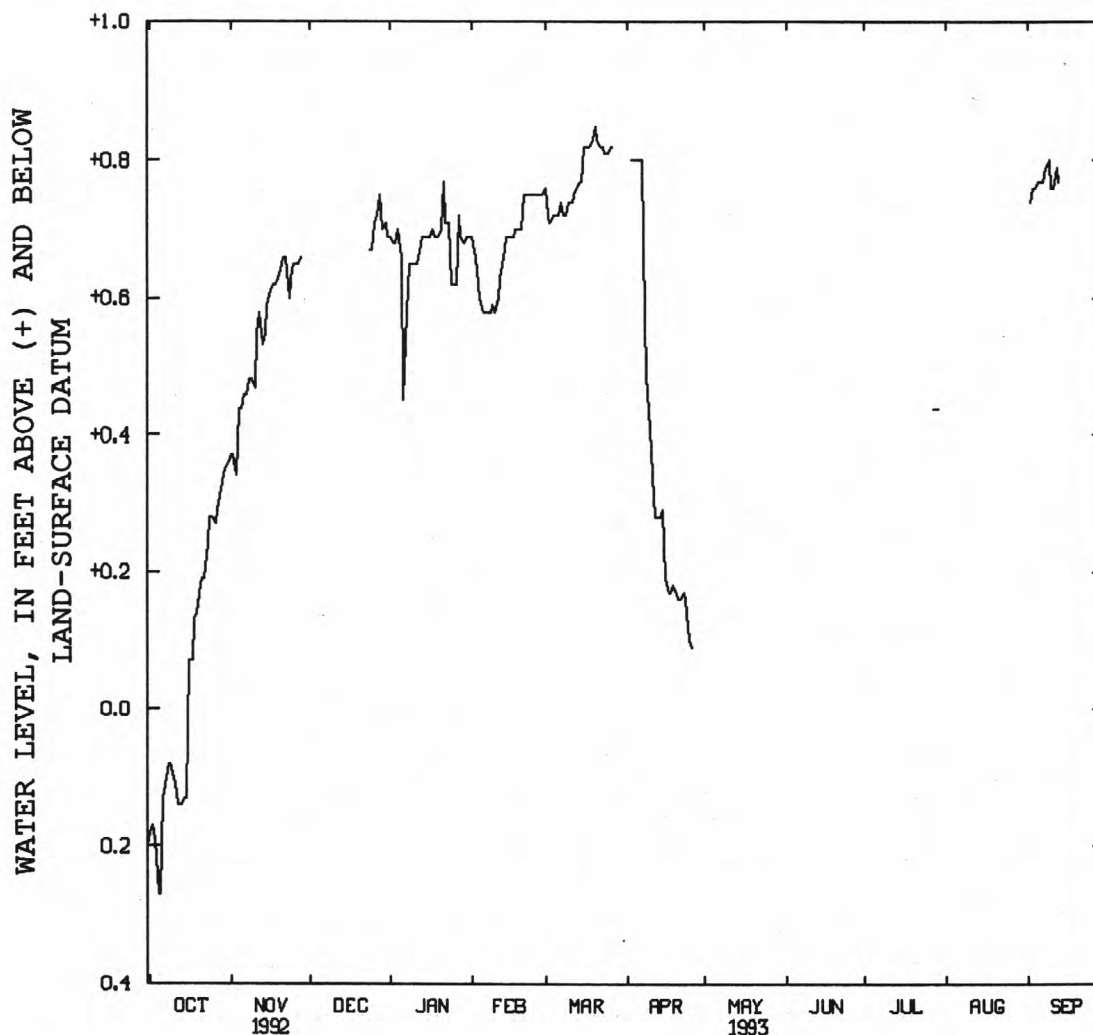
DATUM.--Elevation of land-surface datum is 880 ft above sea level, from topographic map. Measuring point: Top of shelter base, 4.0 ft above land-surface datum.

PERIOD OF RECORD.--March 1961 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, +2.98 ft above land-surface datum, Sept. 4, 1969; lowest recorded, 1.10 ft below land-surface datum, July 14, 15, 1988.

WATER LEVEL, IN FEET ABOVE (+) AND BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	.27	+.44	--	+.66	+.58	+.72	+.80	--	--	--	--	+.77
10	.10	+.47	--	+.65	+.58	+.74	+.41	--	--	--	--	+.76
15	.13	+.59	--	+.69	+.69	+.77	+.29	--	--	--	--	--
20	+.18	+.64	--	+.70	+.70	+.85	+.17	--	--	--	--	--
25	+.28	+.65	+.67	+.62	+.75	+.81	+.10	--	--	--	--	--
EOM	+.36	--	+.69	+.69	+.75	--	--	--	--	--	--	--
WTR YR 1993		HIGHEST	+.85	MAR 19-21		LOWEST	0.27	OCT 4				



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421332085401901. Local number, 3S 12W 11AD1.

LOCATION.--Lat 42°13'32", long 85°40'19", Hydrologic Unit 04050003, at Al Sabo Land Preserve, Texas Township, 3.0 mi west of Portage. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 300 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 877 ft above sea level. Measuring point: Plywood instrument shelf, 2.5 ft above land-surface datum.

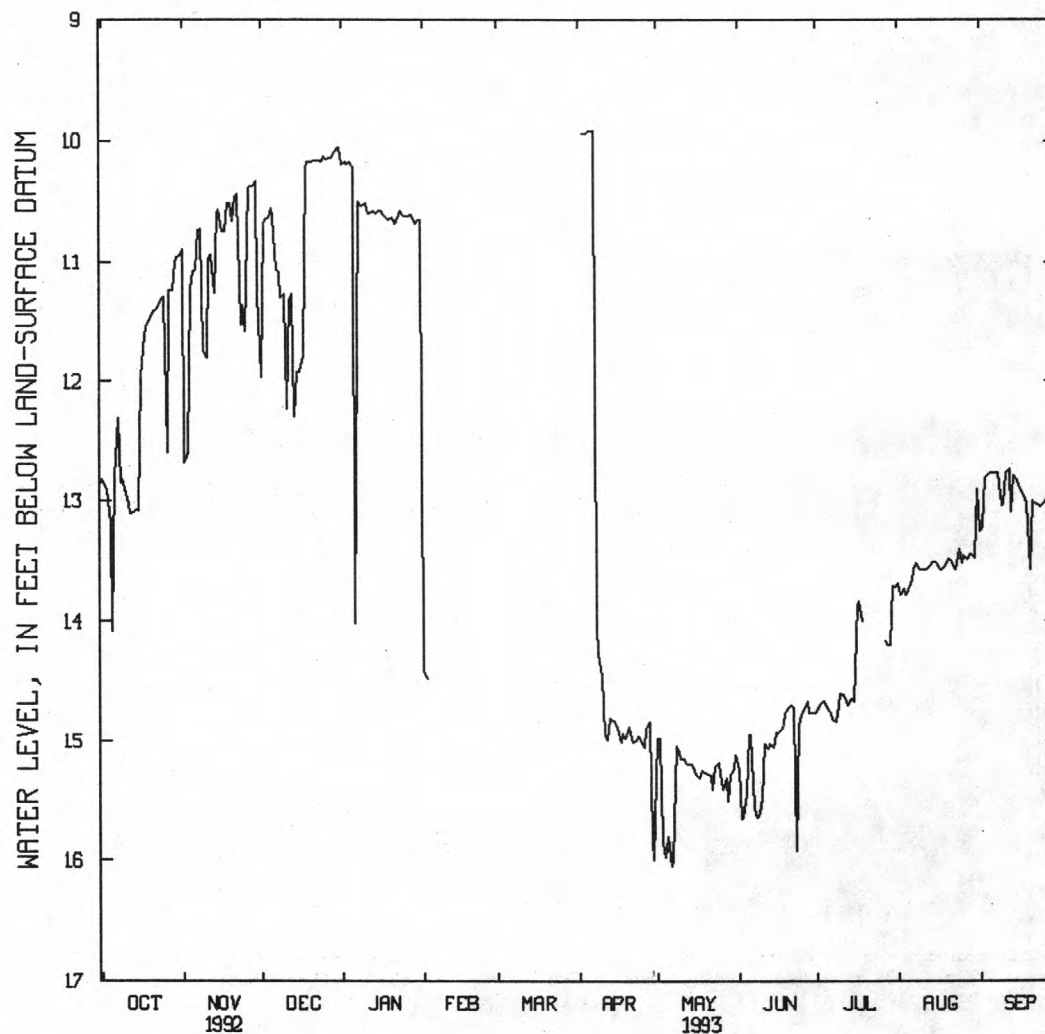
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.5 ft below land-surface datum, July 1973; lowest recorded, 16.6 ft below land-surface datum, July 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.08	11.08	10.55	10.22	--	--	9.91	15.80	14.95	14.74	13.75	12.77
10	12.93	11.80	11.28	10.52	--	--	14.45	15.14	15.49	14.61	13.57	13.01
15	13.08	10.57	11.91	10.58	--	--	14.84	15.23	14.92	14.68	13.51	12.83
20	11.45	10.66	10.17	10.63	--	--	14.88	15.28	14.72	--	13.49	13.58
25	11.29	11.58	10.12	10.62	--	--	15.01	15.26	14.78	--	13.53	13.02
EOM	10.95	11.27	10.06	10.65	--	--	15.99	15.12	14.77	13.72	12.89	12.94
WTR YR 1993	HIGHEST		6.94	JULY 15		LOWEST		16.05	MAY 6			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421332085401902. Local number, 3S 12W 22AD2.

LOCATION.--Lat 42°13'32", long 85°40'19", Hydrologic Unit 04050003, at Al Sabo Land Preserve, Texas Township, 3.0 mi west of Portage. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 6 in., depth 38 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 877 ft above sea level. Measuring point: Plywood instrument shelf, 2.5 ft above land-surface datum.

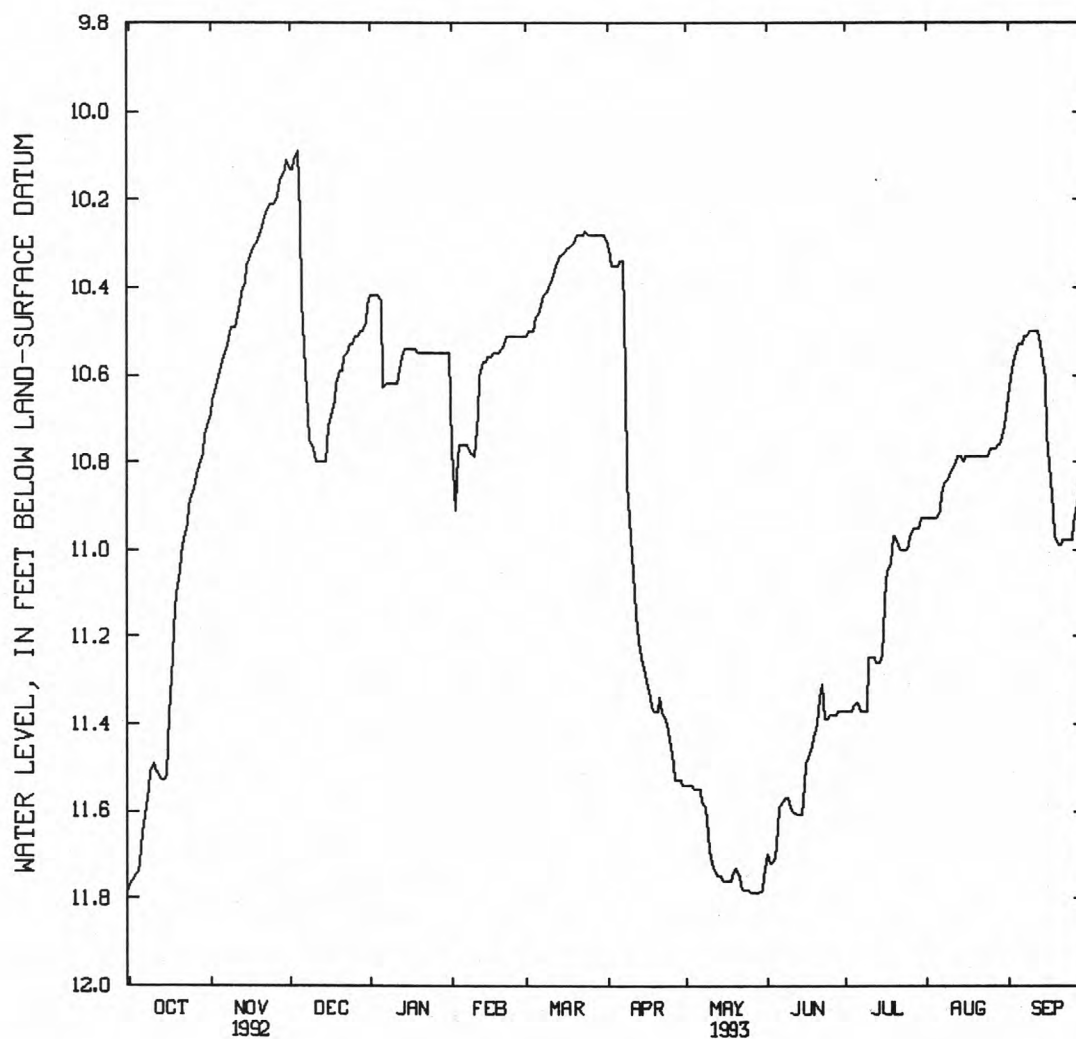
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--January 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.1 ft below land-surface datum, August 1975; lowest recorded, 12.8 ft below land-surface datum, August, 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	11.72	10.58	10.24	10.43	10.76	10.47	10.35	11.55	11.64	11.35	10.93	10.53
10	11.49	10.49	10.77	10.62	10.79	10.40	10.97	11.69	11.59	11.25	10.83	10.50
15	11.52	10.35	10.80	10.54	10.56	10.33	11.27	11.76	11.54	11.24	10.80	10.61
20	11.05	10.27	10.59	10.55	10.54	10.29	11.37	11.73	11.40	10.97	10.79	10.99
25	10.88	10.21	10.53	10.55	10.51	10.28	11.45	11.78	11.38	10.99	10.77	10.98
EOM	10.71	10.11	10.44	10.55	10.51	10.28	11.54	11.75	11.37	10.93	10.70	10.82
WTR YR 1993	HIGHEST		10.06	DEC 4, 5		LOWEST		11.79	MAY 26-28, 29			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421435085353701. Local number, 3S 11W 4ABAD1.

LOCATION.--Lat 42°14'35", long 85°35'37", Hydrologic Unit 04050003, at Kilgore Road pump station No. 9, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 36 ft, screened 33 to 36 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 860 ft above sea level. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

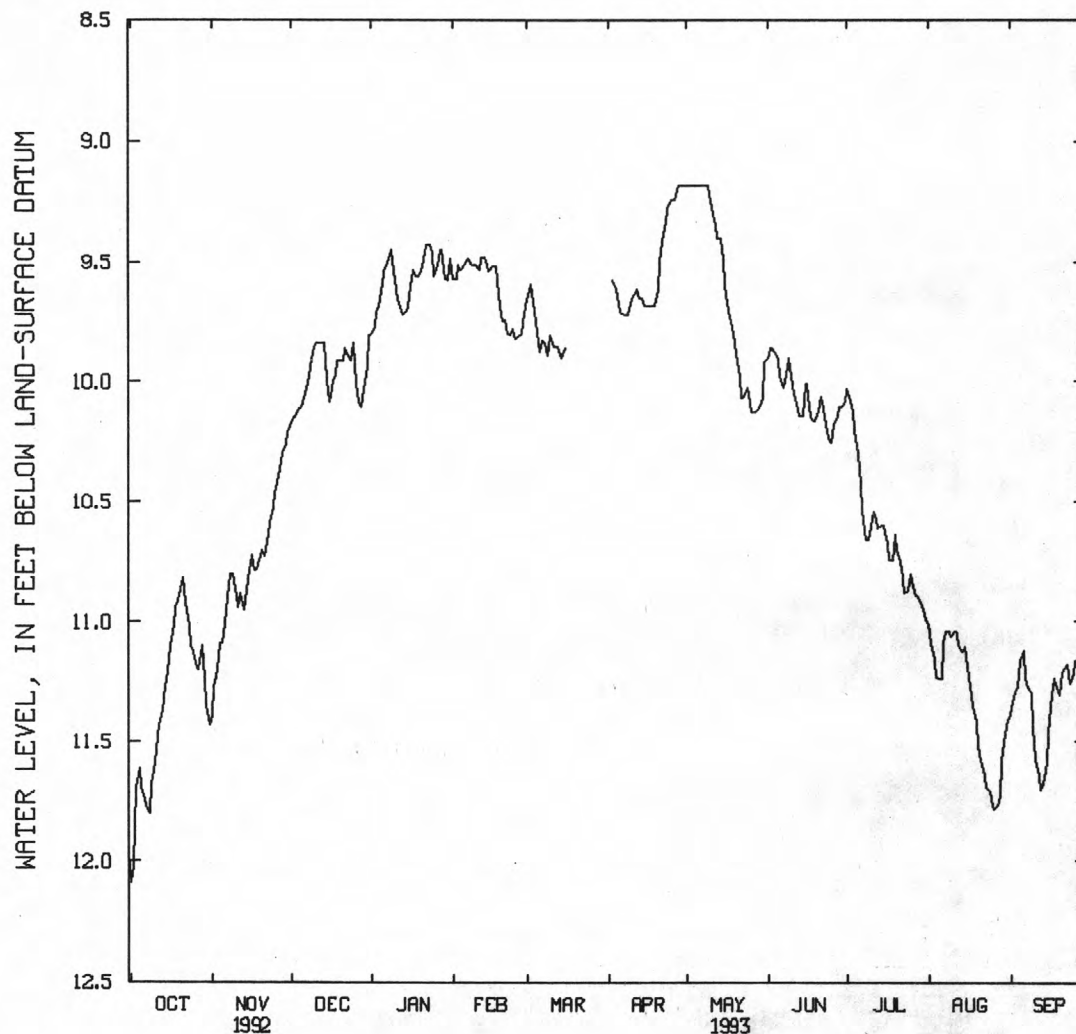
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.17 ft below land-surface datum, Apr. 27, 1993; lowest recorded, 15.86 ft below land-surface datum, Sept. 17, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	11.69	11.09	10.10	9.59	9.51	9.79	9.67	9.18	9.90	10.30	11.24	11.17
10	11.59	10.89	9.85	9.58	9.51	9.81	9.65	9.22	9.98	10.63	11.06	11.44
15	11.21	10.82	9.99	9.69	9.54	9.88	9.68	9.49	10.01	10.60	11.11	11.59
20	10.84	10.70	9.91	9.52	9.75	---	9.61	9.88	10.12	10.70	11.52	11.31
25	11.13	10.47	9.84	9.56	9.82	---	9.24	10.05	10.25	10.80	11.77	11.22
EOM	11.43	10.21	9.81	9.49	9.75	---	9.18	9.92	10.08	10.99	11.41	11.12
WTR YR 1993	HIGHEST		9.17	APR 27		LOWEST		12.09	OCT 1			





## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421435085353702. Local number, 3S 11W 4ABAD2.

LOCATION.--Lat 42°14'35", long 85°35'37", Hydrologic Unit 04050003, at Kilgore Road pump station No.9, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 148 ft, screened 145 to 148 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 860 ft above sea level. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

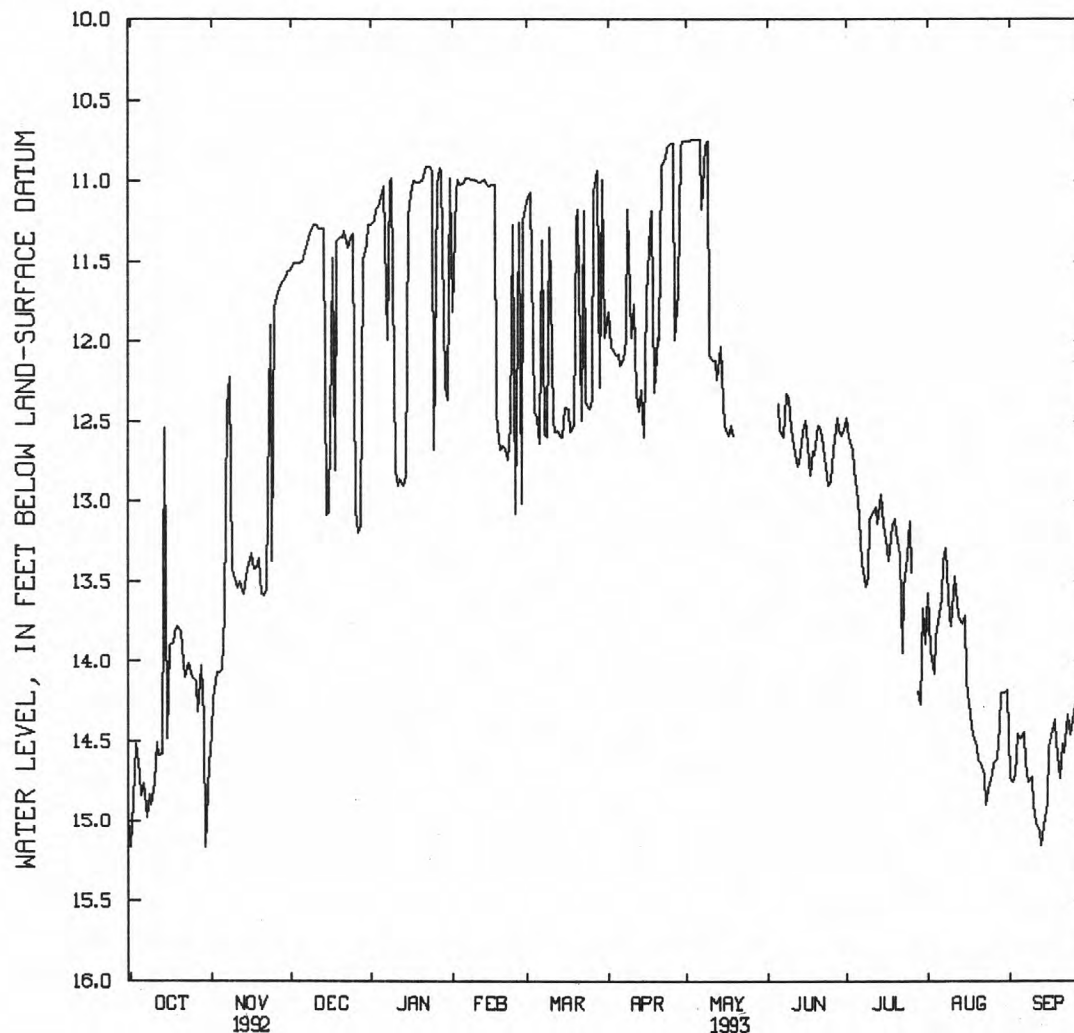
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 10.73 ft below land-surface datum, May 4, 5, 1993; lowest recorded, 18.61 ft below land-surface datum, Sept. 16, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.84	14.05	11.50	11.07	11.01	12.48	12.08	10.74	12.39	12.99	13.75	14.48
10	14.76	13.51	11.27	12.81	11.00	11.28	11.97	12.09	12.54	13.11	13.78	14.90
15	14.48	13.42	13.09	11.23	11.03	12.60	12.60	12.37	12.49	13.14	13.72	14.88
20	13.81	13.58	11.35	11.00	12.66	11.24	11.97	--	12.53	13.19	14.62	14.74
25	14.10	11.78	11.32	12.68	13.08	12.42	10.76	--	12.87	13.13	14.71	14.31
EOM	14.65	11.57	11.27	10.98	11.24	11.97	10.75	--	12.53	13.89	14.18	14.30
WTR YR 1993	HIGHEST		10.73	MAY 4, 5		LOWEST		15.17	OCT 1, 30			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421448085383601. Local number, 2S 11W 31CD.

LOCATION.--Lat 42°14'48", long 85°38'36", Hydrologic Unit 04050003, at city well field, 1,000 ft from U.S. Highway 131, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 226 ft, screened 216 to 226 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 910 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

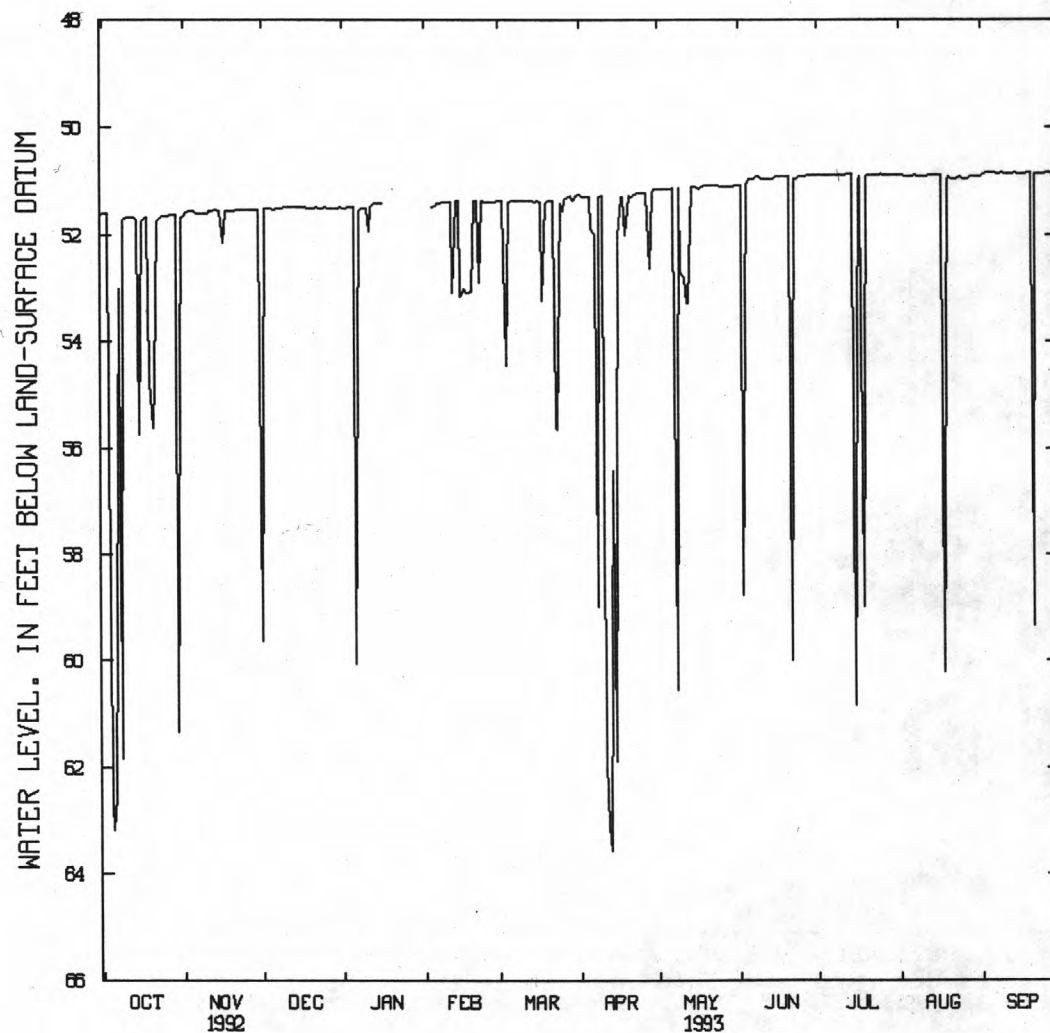
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--August 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 41.39 ft below land-surface datum, Sept. 12, 1982; lowest recorded, 71.75 ft below land-surface datum, May 22, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	63.19	51.56	51.52	51.47	51.45	51.38	51.29	51.14	50.94	50.87	50.92	50.83
10	51.68	51.60	51.47	51.49	51.37	51.36	51.27	52.71	50.93	50.87	50.90	50.85
15	55.74	51.55	51.48	51.40	53.15	51.37	61.89	51.09	50.92	60.82	50.89	50.86
20	55.61	51.55	51.49	---	51.35	51.36	51.27	51.06	50.90	50.88	50.92	50.83
25	51.64	51.52	51.47	---	51.38	51.40	51.21	51.09	50.91	50.86	50.95	50.84
EOM	51.68	51.52	51.48	---	51.37	51.26	51.16	51.06	50.87	50.89	50.90	50.85
WTR YR 1993	HIGHEST		50.70	FEB 19		LOWEST		63.55	APR 13			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421457085325801. Local number, 2S 11W 36CB.

LOCATION.--Lat 42°14'57", long 85°32'58", Hydrologic Unit 04050003, in city well field, 500 ft from Emerald Street, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 226 ft, screened 216 to 226 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 860 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.5 ft above land-surface datum.

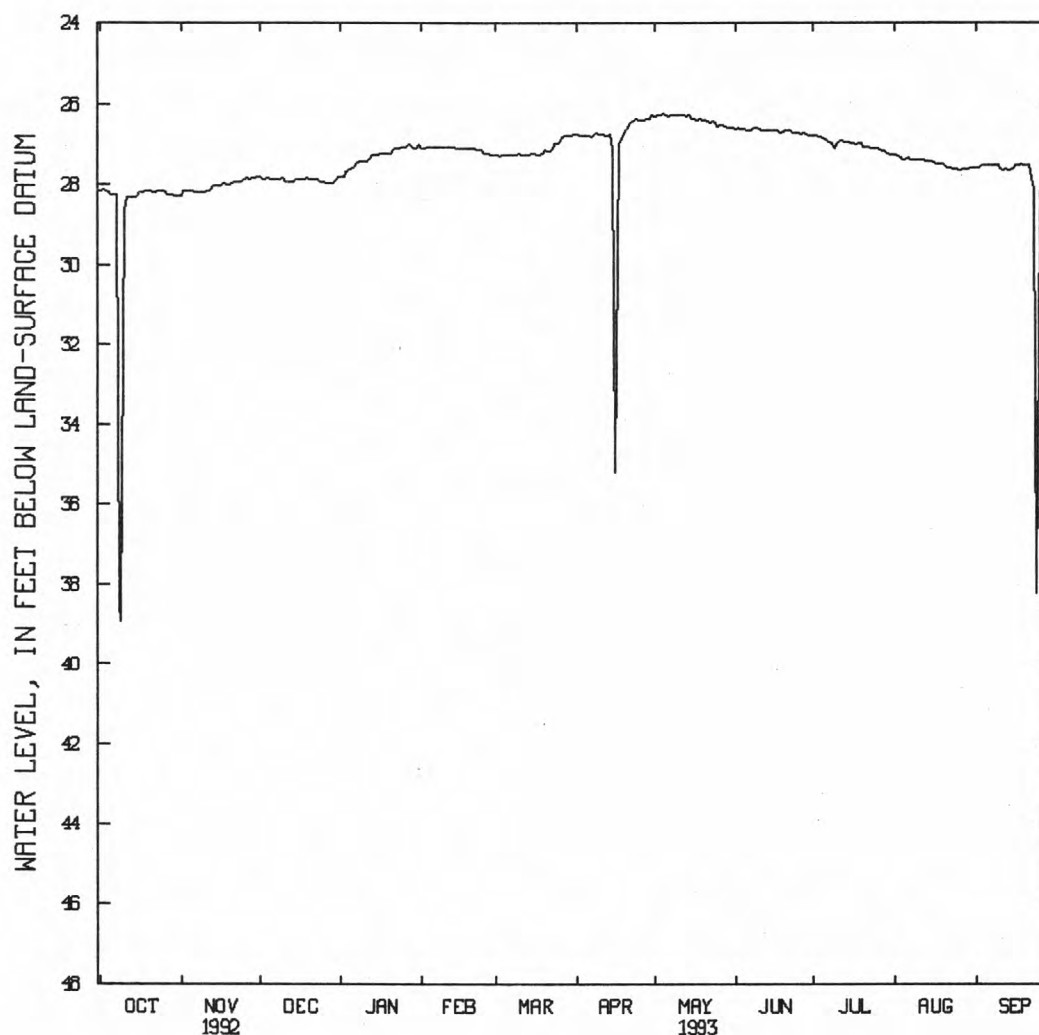
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--August 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 25.35 ft below land-surface datum, April 1985; lowest recorded, 50.4 ft below land-surface datum, June 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	28.22	28.17	27.89	27.57	27.05	27.26	26.77	26.29	26.65	26.85	27.39	27.52
10	28.63	28.19	27.86	27.40	27.05	27.22	26.75	26.27	26.63	27.00	27.37	27.61
15	28.28	28.03	27.87	27.25	27.11	27.23	27.11	26.35	26.67	26.98	27.43	27.56
20	28.14	27.95	27.88	27.23	27.11	27.14	26.64	26.40	26.67	27.04	27.54	27.52
25	28.17	27.88	27.93	27.07	27.22	26.96	26.39	26.53	26.71	27.08	27.63	28.59
EOM	28.28	27.82	27.79	27.00	27.24	26.75	26.29	26.57	26.77	27.27	27.56	29.34
WTR YR 1993	HIGHEST		26.22	MAY 4		LOWEST		44.46	SEP 29			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421614085270801. Local number, 2S 10W 26BBCC.

LOCATION.--Lat 42°16'14", long 85°27'08", Hydrologic Unit 04050003, at end of Miller Road by Morrow Lake, Comstock Township, 4.0 mi east of Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 27 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 790 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 2.5 ft above land-surface datum.

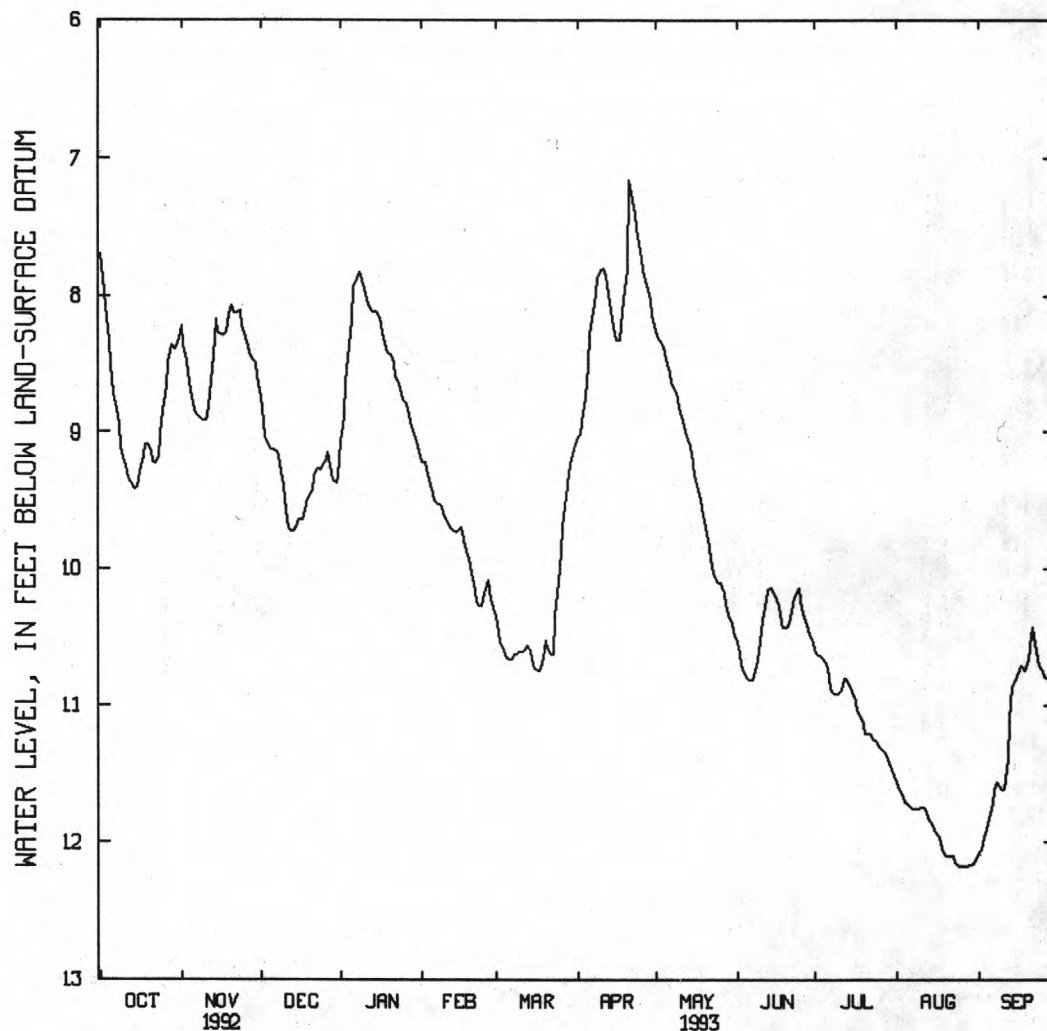
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.9 ft below land-surface datum, April 1988; lowest recorded, 13.1 ft below land-surface datum, September 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	8.51	8.75	9.12	8.17	9.44	10.66	8.51	8.46	10.80	10.69	11.72	11.82
10	9.22	8.91	9.39	7.94	9.62	10.61	7.81	8.81	10.53	10.92	11.74	11.62
15	9.40	8.26	9.69	8.13	9.72	10.66	8.23	9.21	10.17	10.90	11.90	10.81
20	9.13	8.07	9.46	8.44	10.03	10.52	7.80	9.70	10.43	11.20	12.10	10.67
25	8.85	8.28	9.24	8.76	10.17	10.10	7.67	10.11	10.14	11.29	12.18	10.75
EOM	8.31	8.60	9.32	9.13	10.26	9.11	8.14	10.46	10.53	11.51	12.11	10.79
WTY YR 1993	HIGHEST		7.11	APR 21, 22		LOWEST		12.18	AUG 24-27			



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421614085354001. Local number, 2S 11W 28AA.

LOCATION.--Lat 42°16'14", long 85°35'40", Hydrologic Unit 04050003, near intersection of Peeler Street and Crosstown Parkway, in Kalamazoo.

Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 245 ft, screened 235 to 245 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 820 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 4.0 ft above land-surface datum.

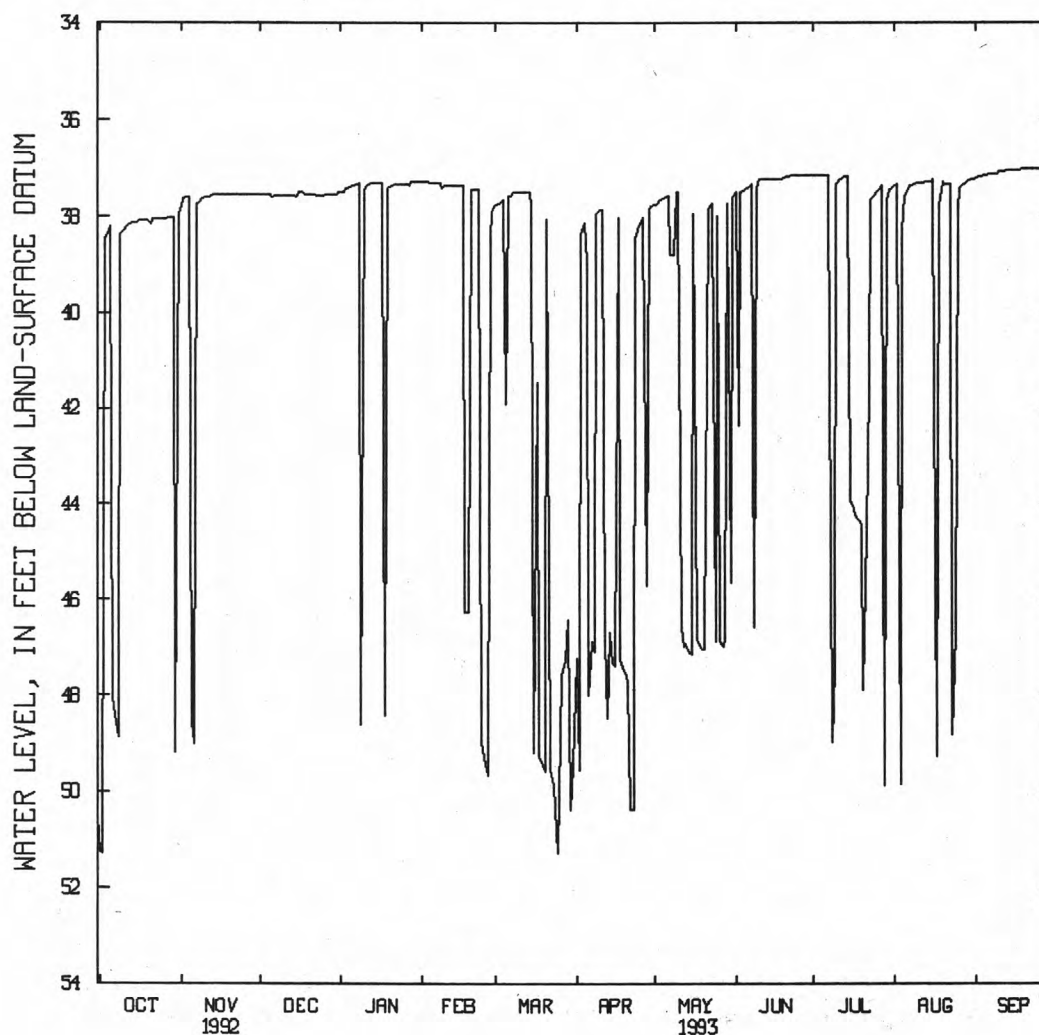
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--August 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 29.0 ft below land-surface datum, May 1988; lowest recorded, 64.63 ft below land-surface datum, July 15, 1986.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	38.20	48.56	37.52	37.36	37.30	41.91	38.95	37.58	37.41	37.12	37.55	37.12
10	38.27	37.61	37.55	37.43	37.36	37.50	37.87	37.50	37.25	37.34	37.31	37.07
15	38.11	37.52	37.59	37.29	37.36	37.77	47.35	47.13	37.22	43.90	37.26	37.05
20	38.15	37.52	37.53	37.35	37.42	49.60	47.60	47.04	37.18	47.90	37.34	37.01
25	38.06	37.52	37.57	37.32	49.30	51.29	38.18	37.99	37.14	37.48	37.86	37.00
EOM	37.94	37.52	37.51	37.28	37.90	49.50	37.78	37.60	37.12	37.40	37.22	36.87
WTR YR 1993	HIGHEST		36.86	SEP 30		LOWEST		51.29	MAR 25			





## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421641085350601. Local number, 2S 11W 22CD.

LOCATION.--Lat 42°16'41", long 85°35'06", Hydrologic Unit 04050003, at intersection of Crosstown Parkway and Stockbridge Avenue, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 137 ft, screened 134 to 137 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 764.7 ft above sea level. Measuring point: Plywood instrument shelf, 2.6 ft above land-surface datum.

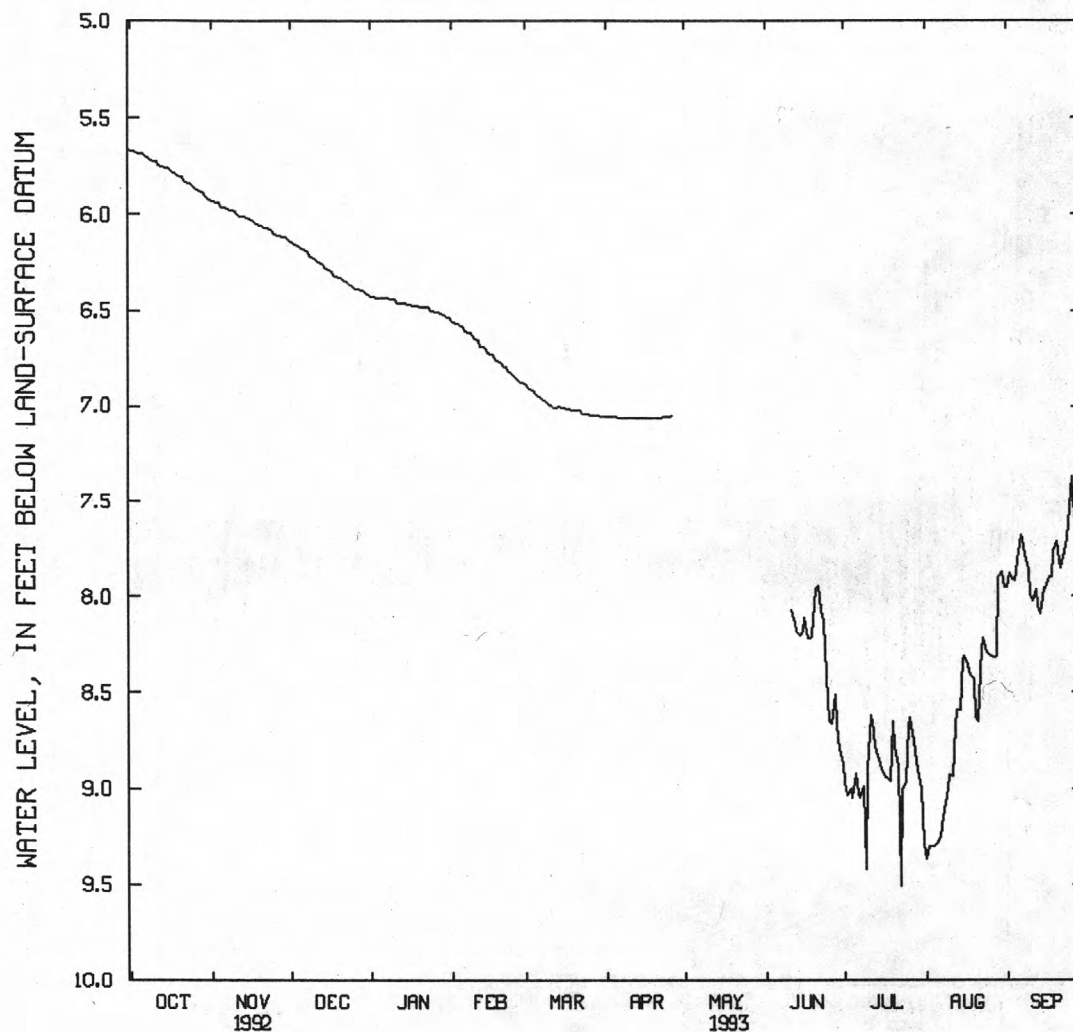
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.8 ft below land-surface datum, February 1975; lowest recorded, 31.1 ft below land surface datum, August 1961.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.69	5.96	6.18	6.44	6.59	6.94	7.06	--	--	8.92	9.29	7.81
10	5.73	5.99	6.23	6.45	6.65	6.99	7.07	--	--	8.90	8.93	7.99
15	5.76	6.02	6.28	6.47	6.72	7.01	7.07	--	8.18	8.90	8.33	7.96
20	5.81	6.06	6.33	6.49	6.78	7.03	7.07	--	7.96	8.78	8.63	7.71
25	5.85	6.10	6.38	6.50	6.85	7.04	7.06	--	8.65	8.67	8.30	7.44
EOM	5.92	6.13	6.42	6.54	6.88	7.06	--	--	8.87	9.29	7.95	7.15
WTR YR 1993	HIGHEST			5.57	SEP 12			LOWEST	9.51	JUL 22		



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421716085373702. Local number, 2S 11W 20BB2.

LOCATION.--Lat 42°17'16", long 85°37'37", Hydrologic Unit 04050003, at intersection of Howard Street and Kendall Street, in Kalamazoo Township, in Kalamazoo. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 106 ft, screened 103 to 106 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 880 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 2.3 ft above land-surface datum.

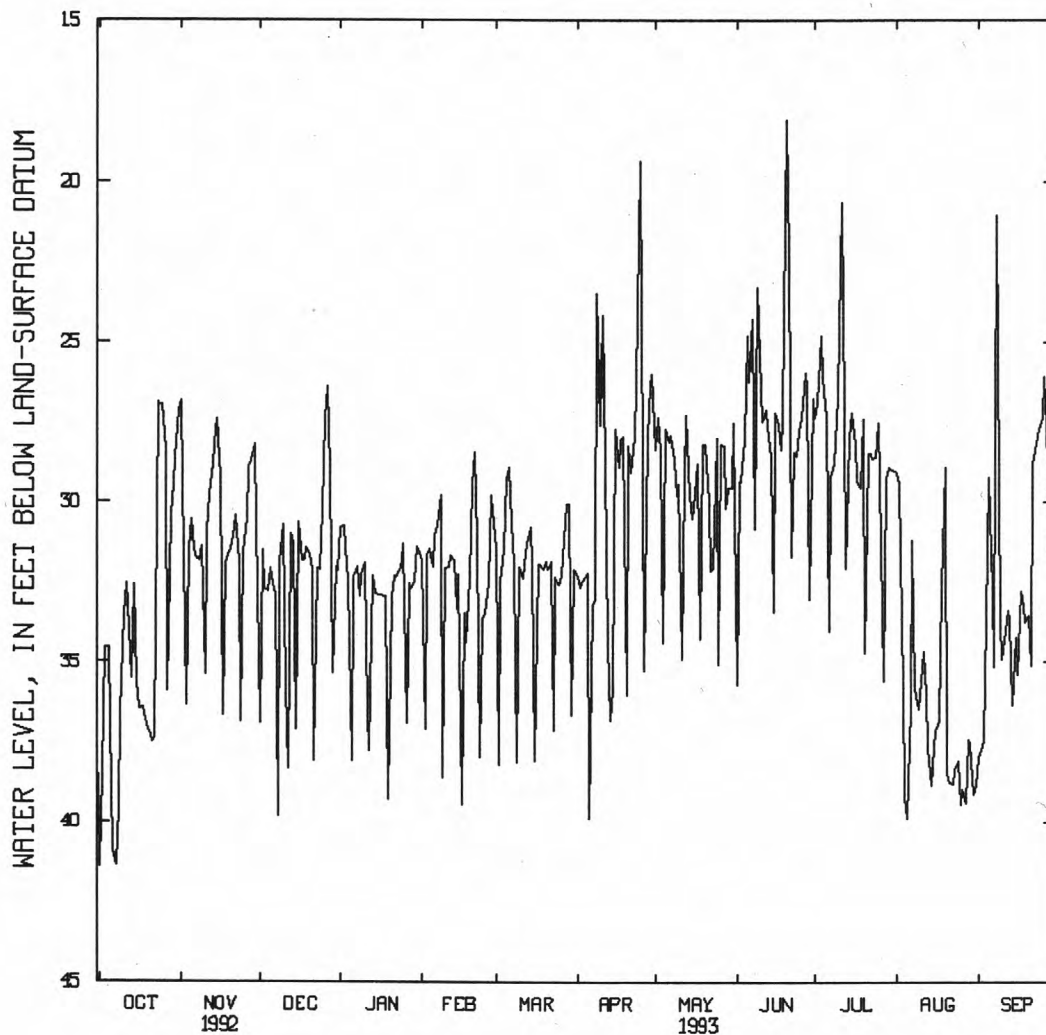
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--May 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.5 ft below land-surface datum, February 1976; lowest recorded, 48.4 ft below land-surface datum, June 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	36.94	30.54	32.08	38.08	32.02	29.24	32.19	27.68	24.80	27.37	39.93	29.20
10	33.52	35.40	30.67	31.92	32.06	32.00	27.61	29.43	25.46	26.66	36.02	34.90
15	35.65	27.40	37.13	32.88	32.25	31.97	35.82	30.48	33.44	27.21	37.64	34.22
20	37.31	31.48	31.61	32.97	29.44	31.88	36.02	28.19	18.07	34.73	38.48	33.51
25	26.98	31.55	30.23	31.33	33.46	32.60	19.34	35.07	27.75	27.52	39.45	27.35
EOM	27.09	30.70	32.18	31.58	30.24	32.11	25.97	27.49	26.78	29.02	38.90	27.87
WTR YR 1993	HIGHEST			17.51	JUN 20, 21			LOWEST	41.41	OCT 1		



## GROUND-WATER LEVELS

## KALAMAZOO COUNTY

421918065283801. Local number, 2S 10W 4D.

LOCATION.--Lat 42°19'18", long 85°28'38", Hydrologic Unit 04050003, at Campbell well field, near Campbell Lake, 2 mi east of Eastwood. Owner: City of Kalamazoo.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 4 in., depth 13 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 836.50 ft above sea level. Measuring point: Plywood instrument shelf, 1.0 ft above land-surface datum.

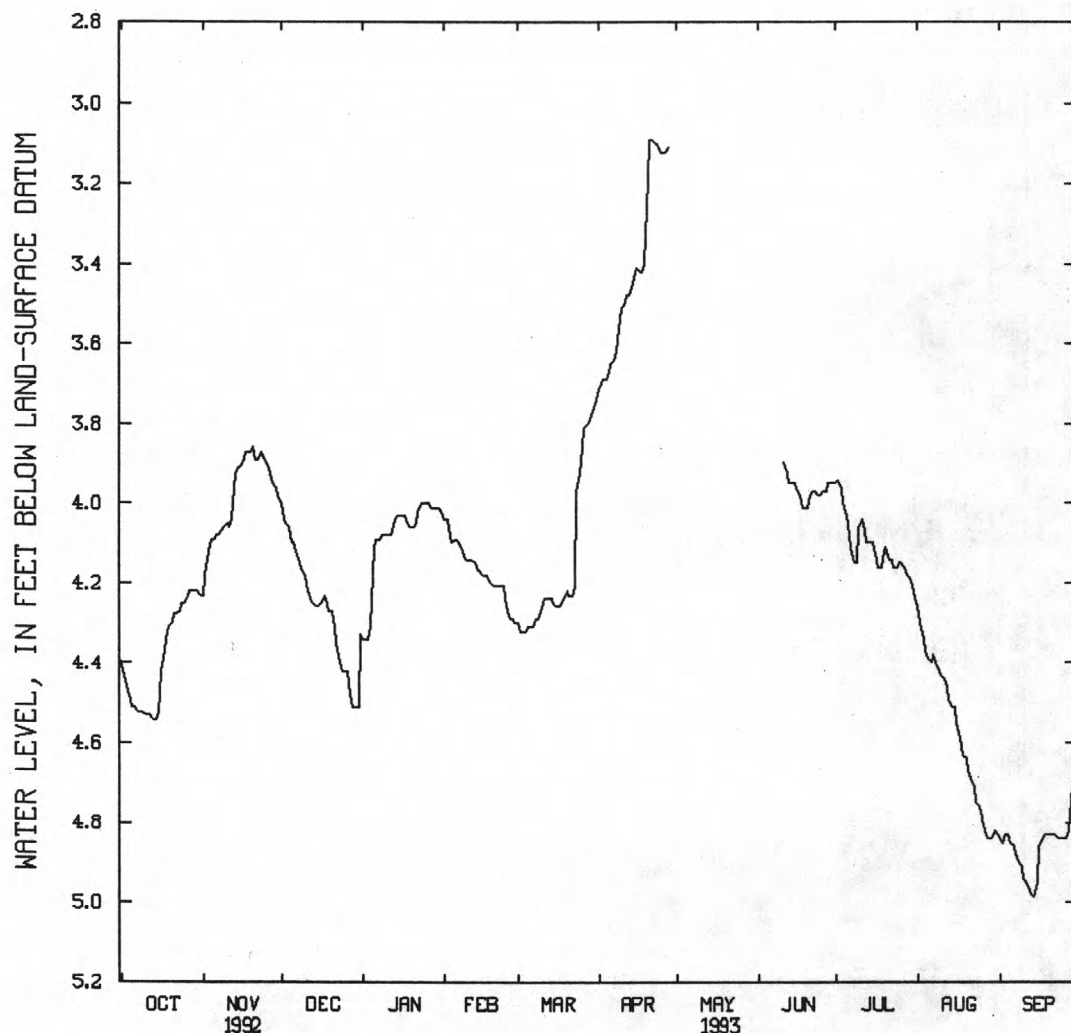
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--March 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 1.9 ft below land-surface datum, April 1974; lowest recorded, 6.67 ft below land-surface datum, Sept. 2, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	4.51	4.09	4.10	4.11	4.09	4.31	3.67	--	--	4.03	4.39	4.85
10	4.53	4.05	4.18	4.08	4.14	4.27	3.51	--	--	4.06	4.43	4.94
15	4.52	3.91	4.26	4.03	4.17	4.25	3.43	--	3.95	4.10	4.51	4.95
20	4.30	3.86	4.27	4.06	4.21	4.22	3.19	--	4.01	4.11	4.67	4.83
25	4.25	3.89	4.42	4.00	4.26	3.92	3.12	--	3.98	4.15	4.79	4.84
EOM	4.23	3.98	4.33	4.02	4.30	3.75	--	--	3.95	4.24	4.83	4.65
WTR YR 1993	HIGHEST		3.06	APR 20		LOWEST		4.99	SEP 14			



## 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.

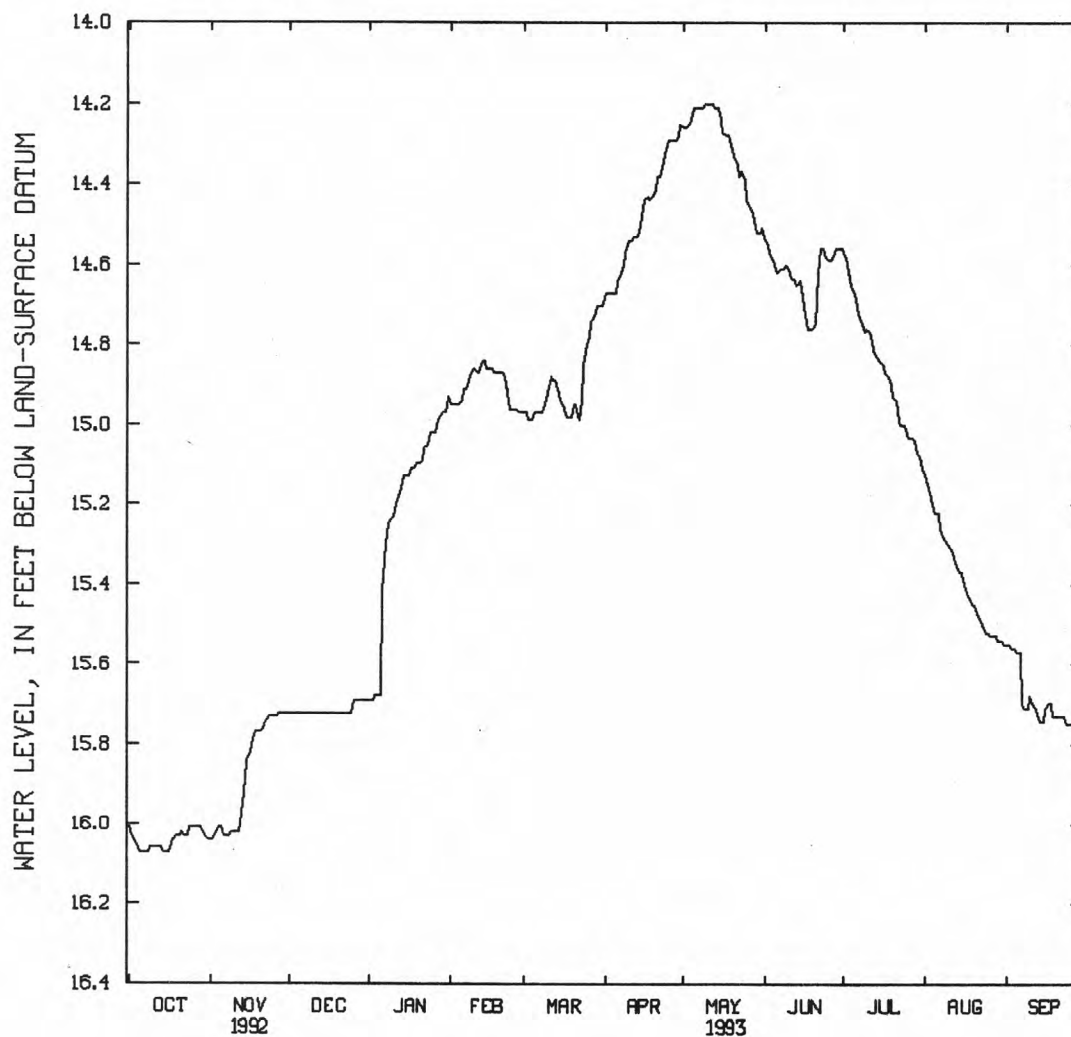
DATUM.--Elevation of land-surface datum is 930 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.07	16.01	15.72	15.68	14.94	14.97	14.67	14.21	14.61	14.67	15.22	15.57
10	16.06	16.02	15.72	15.23	14.86	14.92	14.54	14.20	14.61	14.76	15.30	15.68
15	16.07	15.84	15.72	15.13	14.86	14.94	14.48	14.24	14.68	14.84	15.37	15.74
20	16.03	15.77	15.72	15.10	14.87	14.95	14.41	14.33	14.75	14.93	15.45	15.73
25	16.01	15.73	15.72	15.02	14.96	14.80	14.29	14.44	14.59	15.02	15.52	15.75
EOM	16.04	15.72	15.69	14.93	14.97	14.70	14.25	14.51	14.56	15.11	15.55	15.75
WTR YR 1993	HIGHEST			14.20	MAY 8-13, 15			LOWEST	16.07	OCT 5-8, 14-16		



## GROUND-WATER LEVELS

## 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 sea level. Measuring point: Top of recorder base, 3.00 ft above land-surface datum.

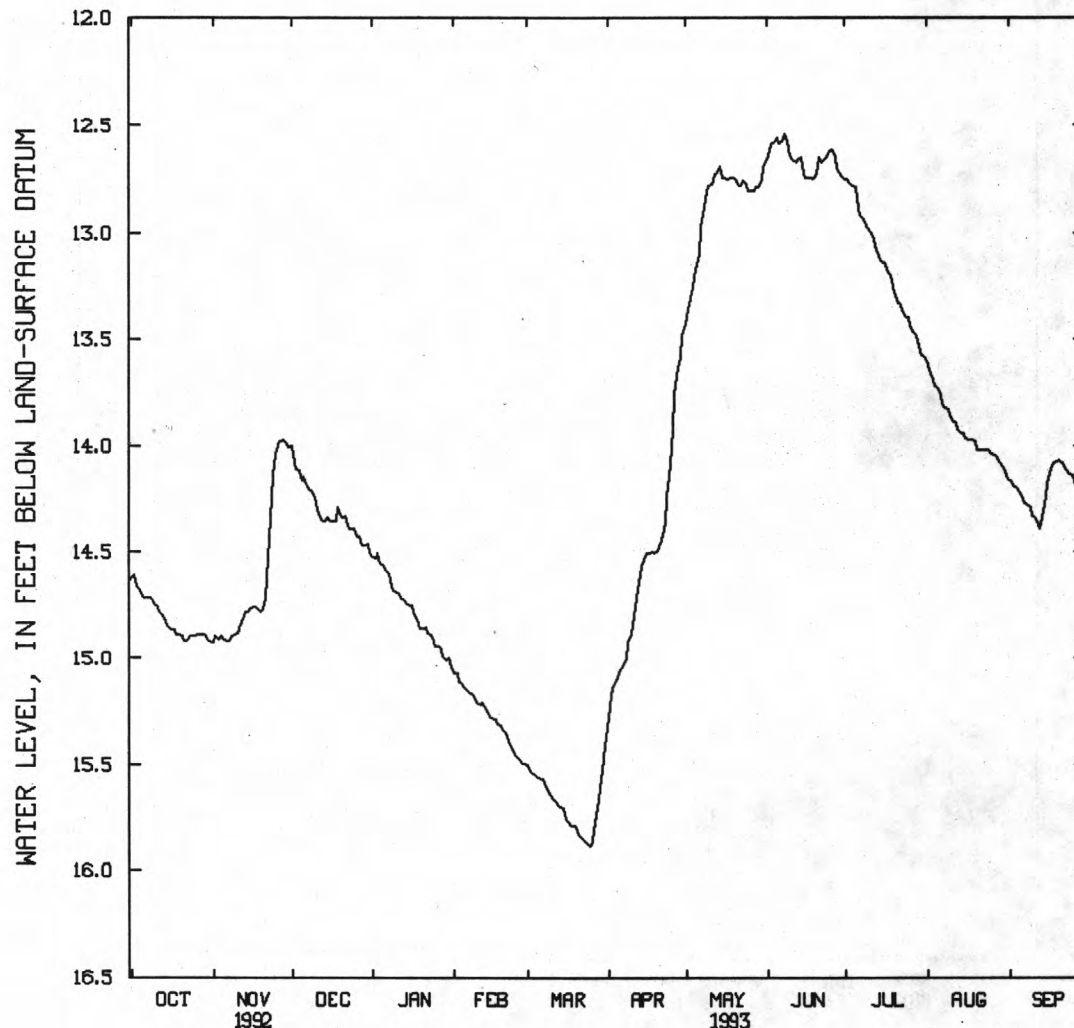
REMARKS.--Federal key well.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.69	14.91	14.16	14.57	15.14	15.56	15.07	13.17	12.56	12.79	13.73	14.22
10	14.75	14.88	14.24	14.69	15.21	15.65	14.88	12.78	12.64	12.98	13.86	14.33
15	14.85	14.77	14.34	14.75	15.27	15.71	14.54	12.74	12.73	13.13	13.94	14.24
20	14.90	14.77	14.34	14.86	15.34	15.81	14.49	12.75	12.73	13.28	14.02	14.07
25	14.90	14.04	14.39	14.94	15.46	15.88	14.09	12.80	12.62	13.40	14.04	14.14
EOM	14.93	14.01	14.50	15.04	15.49	15.41	13.48	12.69	12.74	13.58	14.14	14.28
WTR YR 1993	HIGHEST		12.50	JUNE 9		LOWEST		15.88	MAR 25			





## GROUND-WATER LEVELS

## OAKLAND COUNTY

423622083390701. Local number, 2N 7E 5BAAD.

LOCATION.--Lat 42°36'22", long 83°39'07", Hydrologic Unit 04090005, at Honeywell Lake Road, 3.5 mi northwest of Milford. Owner: American Aggregates Company.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Bored observation well, diameter 2 in., depth 44 ft, screened 41 to 44 ft.

INSTRUMENTATION.--Water-level recorder.

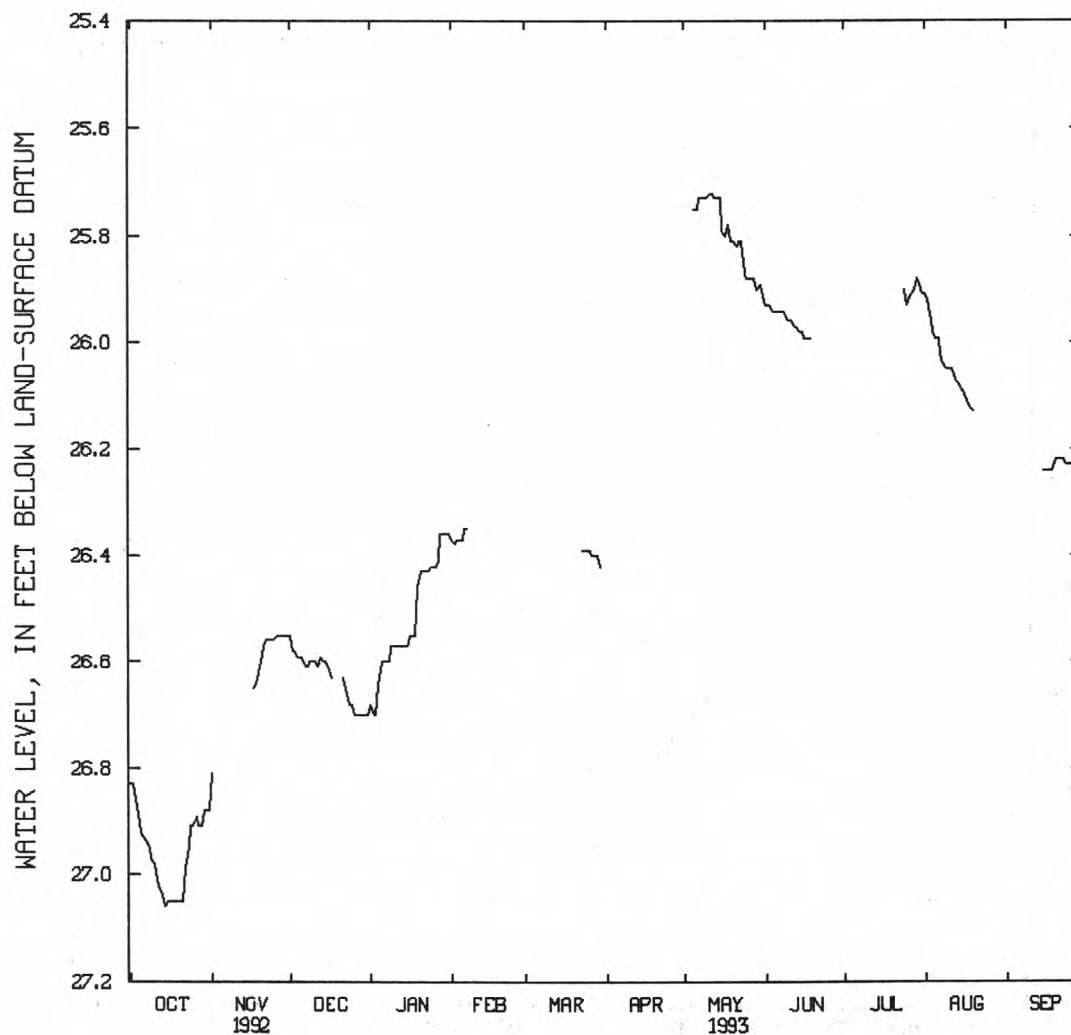
DATUM.--Elevation of land-surface datum is 1,020 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

PERIOD OF RECORD.--March 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 23.9 ft below land-surface datum, April 1976; lowest recorded, 28.89 ft below land-surface datum, Dec. 1, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	26.92	--	26.59	26.60	26.37	--	--	25.75	25.94	--	25.99	--
10	26.98	--	26.60	26.57	--	--	--	25.73	25.96	--	26.05	--
15	27.05	--	26.60	26.57	--	--	--	25.73	25.98	--	26.09	26.24
20	27.05	26.60	--	26.43	--	--	--	25.81	--	--	--	26.22
25	26.91	26.56	26.68	26.42	--	26.39	--	25.88	--	25.93	--	26.23
EOM	26.88	26.55	26.70	26.36	--	--	--	25.90	--	25.91	--	--
WTR YR 1993	HIGHEST		25.72	MAY 8-13		LOWEST		27.06	OCT 14			



## GROUND-WATER LEVELS

## OAKLAND COUNTY

424109083384301. Local number, 3N 7E 5BA.

LOCATION.--Lat 42°41'09", long 83°38'43", Hydrologic Unit 04080203, 150 ft west of Fish Lake Road, 1.2 mi east of Clyde. Owner: American Aggregates Company.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled observation well, diameter 2 in., depth 49 ft.

INSTRUMENTATION.--Water-level recorder.

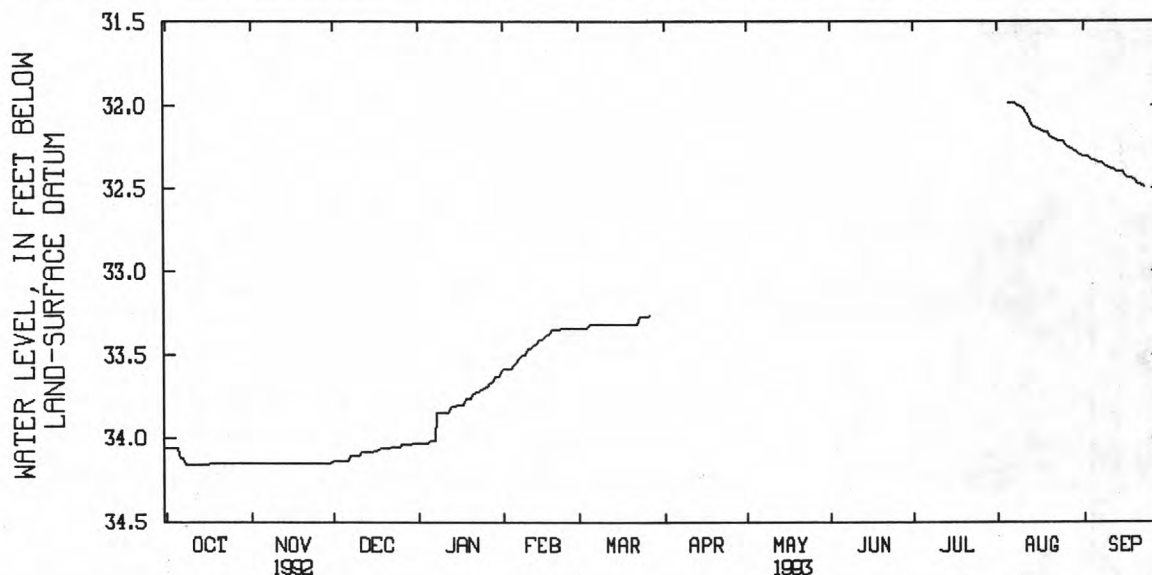
DATUM.--Elevation of land-surface datum is 1,055 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.0 ft above land-surface datum.

PERIOD OF RECORD.--Apr. 24, 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 29.5 ft below land-surface datum, June 1976; lowest recorded, 38.7 ft below land-surface datum, December 1972.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	34.06	34.15	34.13	34.01	33.56	33.32	--	--	--	--	31.99	32.33
10	34.16	34.15	34.11	33.84	33.47	33.32	--	--	--	--	32.02	32.38
15	34.16	34.15	34.08	33.80	33.41	33.32	--	--	--	--	32.14	32.40
20	34.15	34.15	34.06	33.76	33.35	33.32	--	--	--	--	32.19	32.46
25	34.15	34.15	34.05	33.70	33.34	33.27	--	--	--	--	32.23	--
EOM	34.15	34.14	34.03	33.60	33.34	--	--	--	--	--	32.30	--
WTR YR 1993	HIGHEST			31.99	AUG 4-8			LOWEST	34.16	OCT 8-16		



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.--Periodic measurement.

DATUM.--Elevation of land-surface datum is 930 ft above sea level, 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 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	25.65	JAN 21	24.99	MAR 31	24.58	JUN 1	24.99	AUG 20	25.84	SEP 28	25.43
DEC 8	25.35	FEB 26	25.18	APR 15	24.44	JUL 29	25.52				

## 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 sea level. Measuring point: Top of casing, 2.5 ft above land-surface datum.

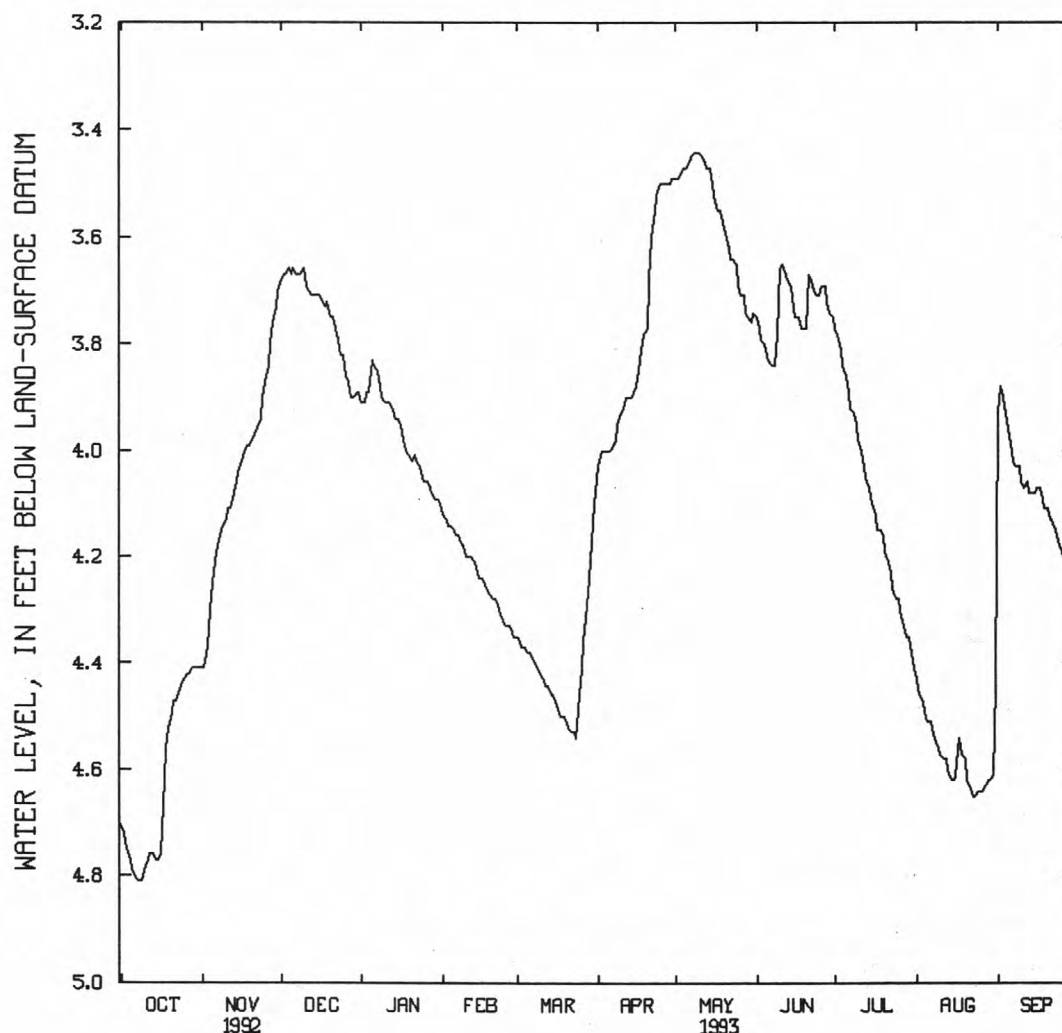
REMARKS.--Federal key well.

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 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	4.79	4.25	3.67	3.83	4.15	4.38	4.00	3.47	3.82	3.86	4.51	3.96
10	4.78	4.13	3.66	3.91	4.20	4.42	3.93	3.44	3.66	3.98	4.57	4.06
15	4.77	4.04	3.71	3.94	4.24	4.46	3.89	3.50	3.73	4.10	4.62	4.08
20	4.49	3.98	3.75	4.02	4.28	4.51	3.77	3.59	3.77	4.19	4.62	4.11
25	4.43	3.87	3.82	4.06	4.33	4.46	3.50	3.69	3.71	4.28	4.64	4.19
EOM	4.41	3.70	3.89	4.10	4.35	4.10	3.49	3.74	3.75	4.41	4.44	4.24
WTR YR 1993	HIGHEST		3.44	MAY 7-12		LOWEST		4.81	OCT 7, 8			



## GROUND-WATER LEVELS

## WASHTENAW COUNTY

421220083332501. Local number, 3S 7E 24CDBC.

LOCATION.--Lat 42°12'20", long 83°33'25", Hydrologic Unit 04090005, at Bridge Street, at Ypsilanti Township Waterworks. Owner: Ypsilanti Township.

AQUIFER.--Gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 75 ft, screened 70 to 75 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 657.83 ft above sea level. Measuring point: Plywood instrument shelf, 5.5 ft above land-surface datum.

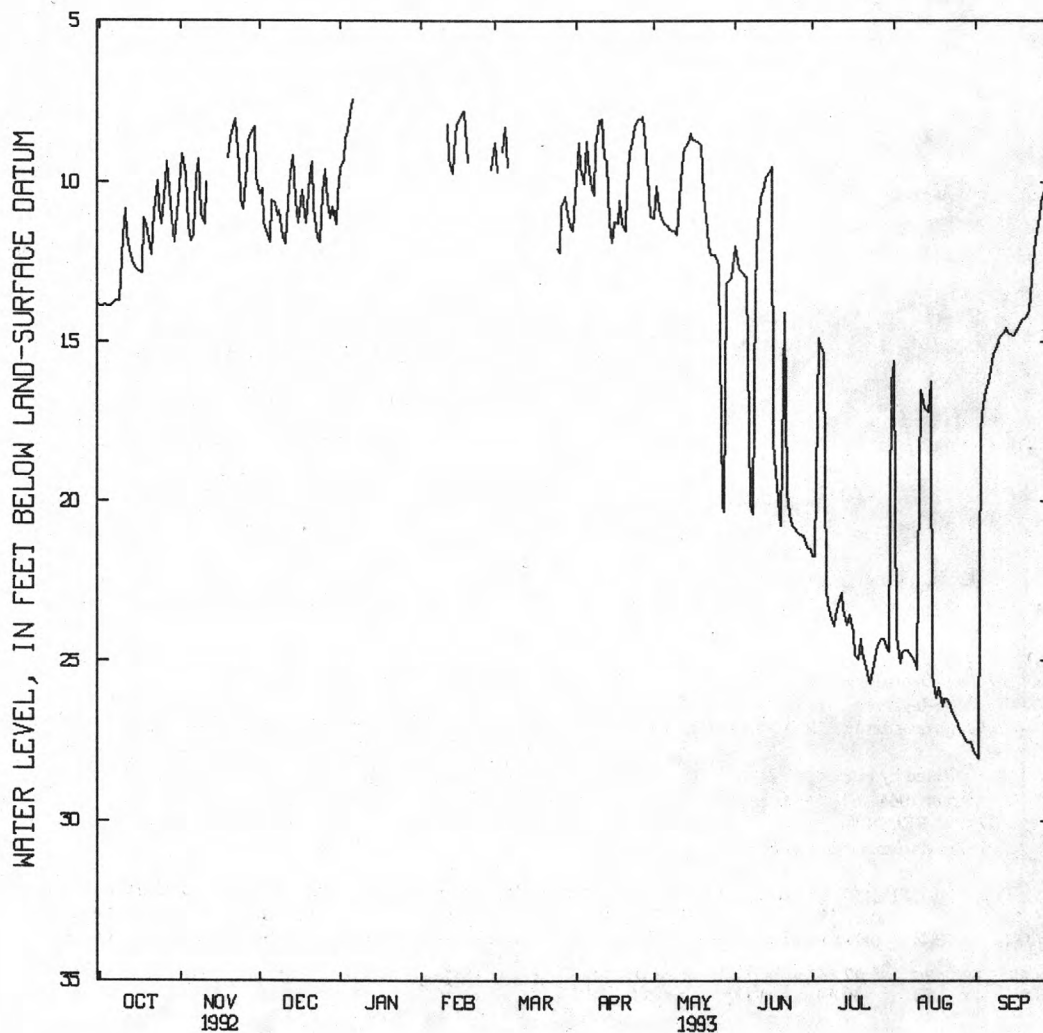
REMARKS.--Water levels affected by pumping.

PERIOD OF RECORD.--April 1944 to June 1945, December 1949 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.7 ft below land-surface datum, October 1981; lowest recorded, 63.2 ft below land-surface datum, February 1970.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	13.85	11.83	11.84	7.61	--	8.28	8.74	11.33	12.96	15.29	24.66	16.50
10	11.73	11.31	11.71	--	--	--	8.09	11.60	11.34	23.54	25.23	14.92
15	12.68	--	10.55	--	8.16	--	11.88	8.50	9.51	23.55	16.22	14.82
20	11.99	8.64	9.80	--	--	--	11.50	10.41	14.05	24.70	26.16	14.22
25	11.32	10.82	10.27	--	--	12.05	8.05	12.34	20.92	24.70	26.97	11.10
EOM	10.55	9.85	10.38	--	9.59	11.50	11.07	12.97	21.53	16.29	27.78	10.56
WTR YR 1993	HIGHEST			7.00	JAN 7			LOWEST	28.03	SEP 2		



## GROUND-WATER LEVELS

## WASHTENAW COUNTY

421322083441301. Local number, 3S 6E 16BCCD.

LOCATION.--Lat 42°13'22", long 83°44'13", Hydrologic Unit 04090005, at Ann Arbor Municipal Airport. Owner: City of Ann Arbor.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 10 in., depth 55 ft, screened 35 to 55 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 821.50 ft above sea level. Measuring point: Plywood instrument shelf, 2.5 ft above land-surface datum.

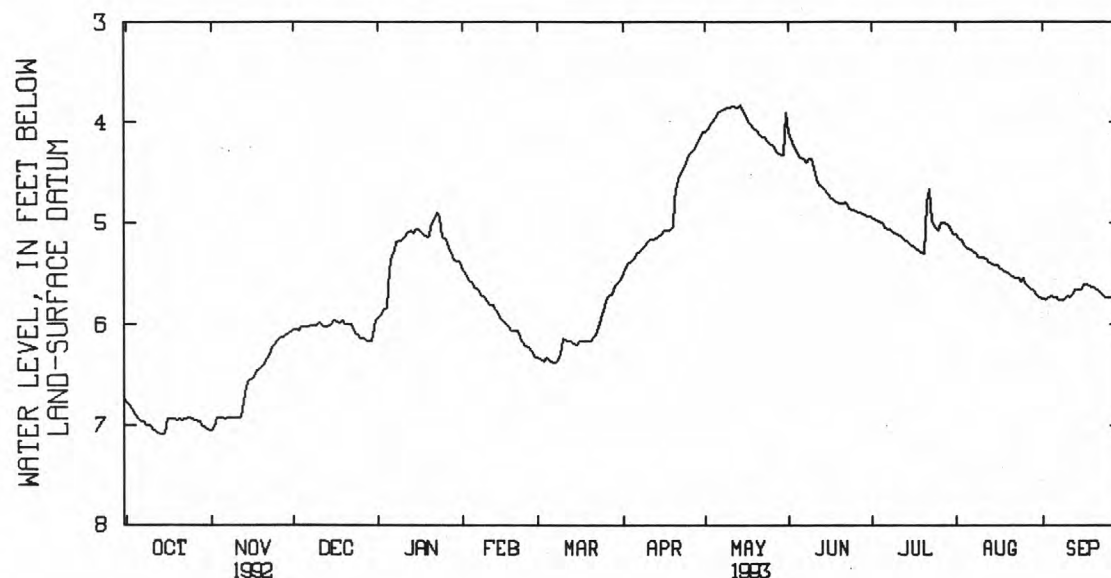
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.69 ft below land-surface datum, Mar. 10, 1974; lowest recorded, 15.86 ft below land-surface datum, Oct. 18, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	6.95	6.93	6.04	5.45	5.60	6.37	5.35	3.95	4.35	5.01	5.25	5.73
10	7.03	6.94	5.99	5.16	5.78	6.15	5.20	3.85	4.39	5.11	5.33	5.72
15	7.09	6.55	6.00	5.07	5.93	6.20	5.11	3.90	4.73	5.22	5.42	5.67
20	6.95	6.41	6.01	5.12	6.07	6.16	4.75	4.08	4.81	5.31	5.51	5.64
25	6.95	6.17	6.12	5.13	6.24	5.82	4.33	4.22	4.88	5.08	5.55	5.73
EOM	7.06	6.07	5.96	5.39	6.33	5.56	4.10	3.90	4.94	5.11	5.73	5.75
WTR YR 1993	HIGHEST			3.76	JUN 1			LOWEST	7.11	OCT 14		



421427083362301. Local number, 3S 7E 9ADBC1.

LOCATION.--Lat 42°14'27", long 83°36'23", Hydrologic Unit 04090005, at intersection of Park Street and Michigan Avenue, in Ypsilanti. Owner: City of Ypsilanti.

AQUIFER.--Medium to coarse gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 94 ft, screened 89 to 94 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 710 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 3.5 ft above land-surface datum.

REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 29.1 ft below land-surface datum, November 1945; lowest recorded, 78.8 ft below land-surface datum, October 1974.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	41.65	NOV 20	37.68	FEB 10	33.40	MAY 11	31.83	JUL 29	37.29	SEP 9	35.87
NOV 18	38.34	DEC 23	35.82	MAR 24	32.30	JUN 23	37.75				



## GROUND-WATER LEVELS

## WASHTENAW COUNTY

421532083382001. Local number, 3S 7E 5BBAC.

LOCATION.--Lat 42°15'32", long 83°38'20", Hydrologic Unit 04090005, at Superior Road, 1.5 mi northwest of Ypsilanti. Owner: City of Ypsilanti.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 8 in., depth 70 ft, screened 40 to 70 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 720 ft above sea level, from topographic map. Measuring point: Plywood instrument shelf, 6.0 ft above land-surface datum.

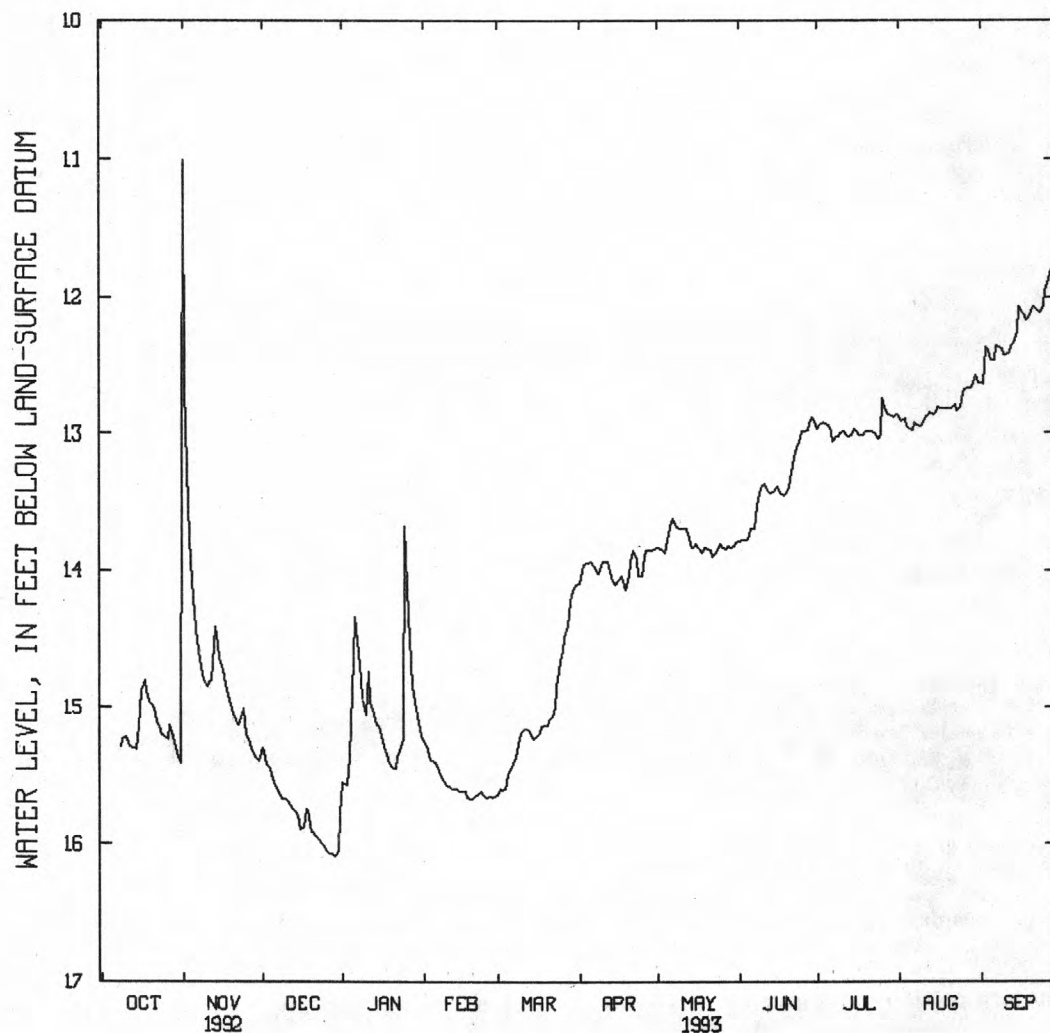
REMARKS.--Water levels affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 1.22 ft below land-surface datum, Jan. 30, 1992; lowest recorded, 21.4 ft below land-surface datum, Dec. 25, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993  
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	--	14.20	15.52	14.64	15.40	15.48	13.94	13.78	13.74	12.94	12.96	12.46
10	15.22	14.85	15.67	15.06	15.57	15.18	13.94	13.69	13.37	13.00	12.94	12.42
15	15.14	14.65	15.79	15.14	15.62	15.23	14.11	13.82	13.40	12.96	12.85	12.25
20	14.99	15.05	15.91	15.44	15.66	15.12	14.04	13.84	13.39	12.99	12.81	12.14
25	15.22	15.19	16.02	13.67	15.66	14.67	14.04	13.81	12.98	13.01	12.70	12.06
EOM	15.41	15.39	15.78	15.20	15.65	14.11	13.84	13.80	12.93	12.86	12.63	11.78
WTR YR 1993		HIGHEST	8.34	NOV 2		LOWEST	16.09	DEC 29				



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