PHYSICAL SETTING AND SURFACE WATER

PURPOSE AND SCOPE

This hydrologic atlas represents a part of a comprehensive study of the water resources of southeastern Michigan. Its purpose is to provide information on (1) the physical features of basins for minor streams draining into St. Clair River, Lake St. Clair, Detroit River, and Lake Erie, (2) the characteristics of streamflow, (3) the quality of surface water and ground water, and (4) the availability of ground water. The atlas is one in a series on the river basins in southeastern Michigan.

PHYSICAL DESCRIPTION

The minor streams in southeastern Michigan drain an area of 985 square miles (2,551 square kilometres), which includes parts of St. Clair, Macomb, Wayne, Washtenaw, Lenawee, and Monroe Counties. Almost all the land surface drained by the streams was formerly covered by glacial lakes. Thus, most of the land surface is underlain by lake sediments, which form a relatively smooth plain sloping from northwest to southeast. Only the Stony Creek basin, which lies between the Huron River and River Raisin basins, extends beyond the plain. Its land surface ranges from hilly to moderately undulating in the headwaters to smooth, gentle sloping lake plains in the lowest reaches.

Altitudes near the St. Clair River, Lake St. Clair, the Detroit River, and Lake Erie range from 572 to 579 feet (174 to 176 metres) above mean sea level. The maximum inland altitude is about 850 feet (259 metres) in the headwaters of Stony Creek basin. Elsewhere, maximum altitudes are less than 800 feet (244 metres); in the Bunce Creek area, the northernmost area, and in river basins adjacent to Detroit, altitudes do not exceed 675 feet (206 metres).

The minor streams have natural drainage networks that are not well developed. Most streams have eroded less than 10 feet (3 metres) below the adjacent land surface. In short reaches, generally near their mouths, the streams are incised more than 10 feet (3 metres). In all areas drained by the minor streams, natural drainage has been augmented by ditches and drains. In some places these manmade channels are closely spaced in an attempt to improve drainage and reclaim land for agricultural use. In the Detroit area much of the overland flow is captured by storm drains; thus, streamflow is significantly affected.

There are about 450 lakes and ponds within the areas drained by the minor streams (Humphrys and Green, 1962). Most lakes and ponds are relatively small; 52 percent are less than 1 acre (0.4 hectare) in size; only 11 percent exceed 10 acres (4.0 hectares). Most larger lakes and ponds are artificial, and many are inlets, estuaries, or canals adjacent to the shorelines of Lake St. Clair, the Detroit River, or Lake Erie.

POPULATION AND ECONOMY

Population of the areas drained by the minor streams ranges from rural to urban. Areas near Detroit are principally urban or suburban. Elsewhere, the population is suburban or rural in character, except near Port Huron, Mt. Clemens, Monroe, and Toledo, where it is urban. Most communities have grown rapidly; the population of some has increased several fold in the past 20 years. The population of Detroit, Highland Park, Hamtramck, and Royer, however, has decreased slightly.

Near Detroit, industry and manufacturing form the principal economic base. Elsewhere, agricultural as well as industrial and manufacturing activities are of economic importance. Monroe County, the southernmost area, is among the top 10 agricultural counties in Michigan. St. Clair, Macomb, and Lenawee Counties also rank among the top agricultural counties in the State.

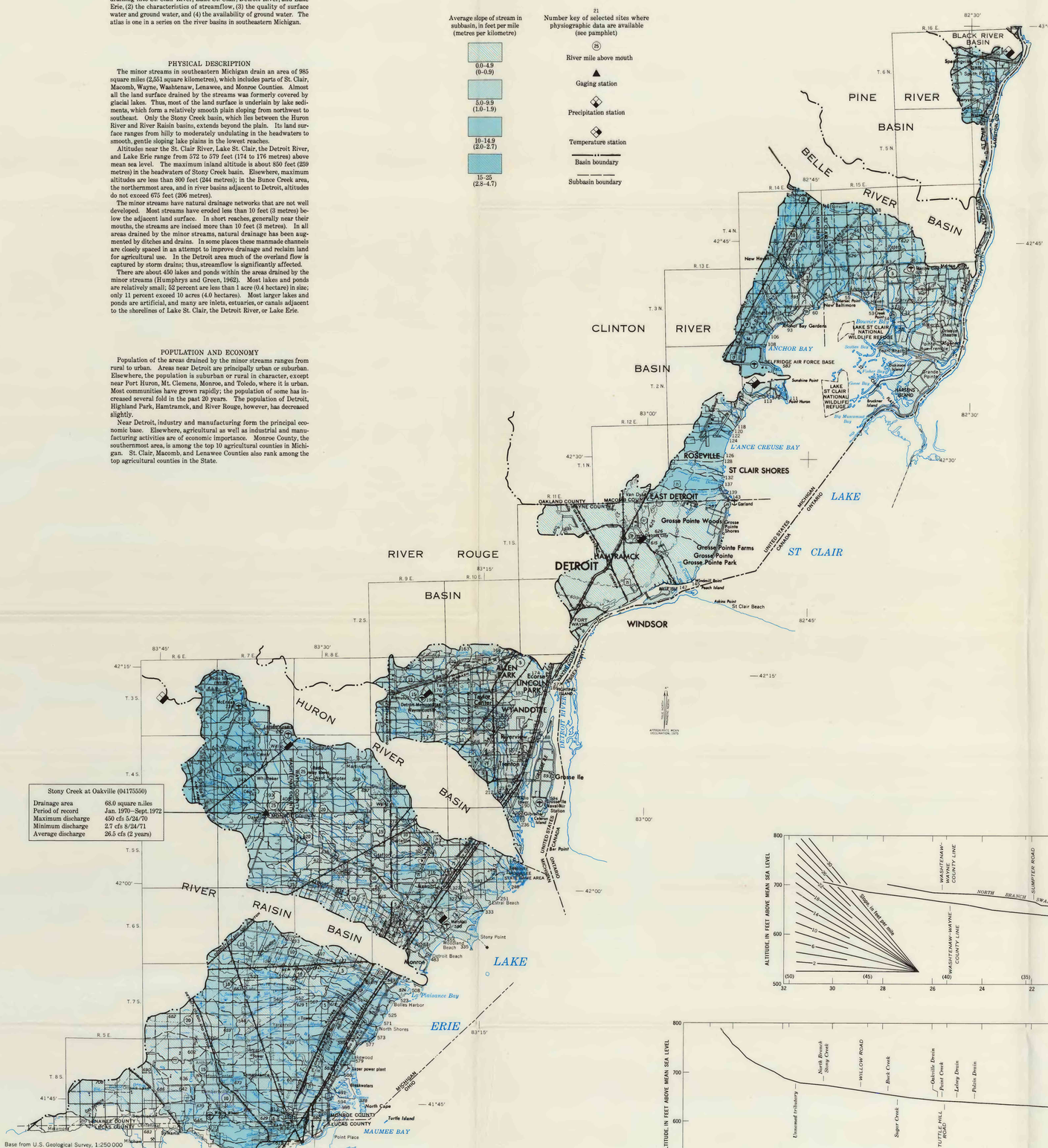
EXPLANATION

Average slope of stream in subbasin, in feet per mile (metres per kilometre)

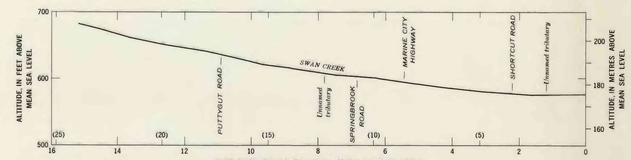
- 0.0–4.9 (0–0.9)
- 5.0–9.9 (1.0–1.9)
- 10–14.9 (2.0–2.7)
- 15–25 (2.8–4.7)

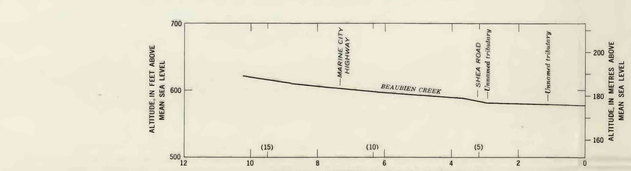
21 — Number key of selected sites where physiographic data are available (see pamphlet)

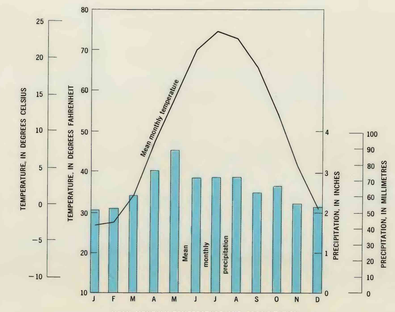
- River mile above mouth
- Gaging station
- Precipitation station
- Temperature station
- Basin boundary
- Subbasin boundary

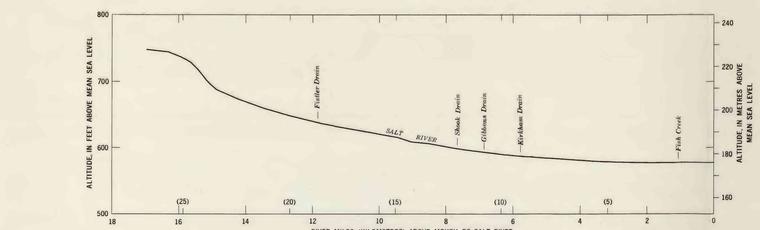


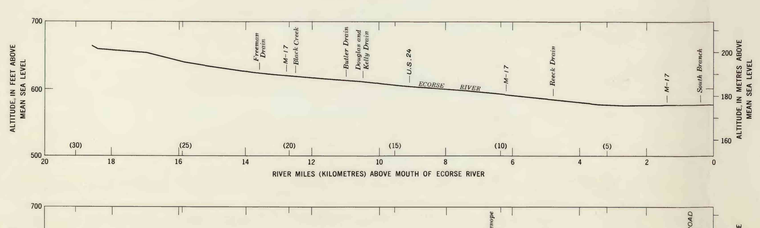
Stony Creek at Oakville (04175550)	
Drainage area	68.0 square miles
Period of record	Jan. 1970–Sept. 1972
Maximum discharge	450 cfs 5/24/70
Minimum discharge	2.7 cfs 8/24/71
Average discharge	26.5 cfs (2 years)

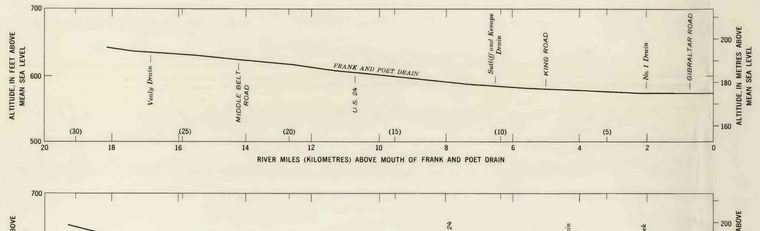


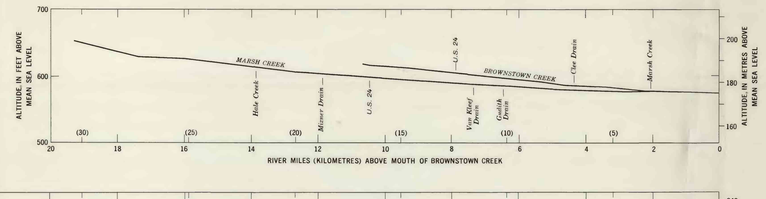


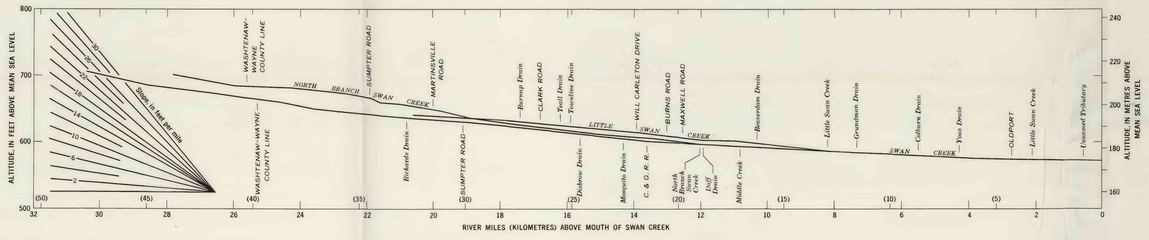


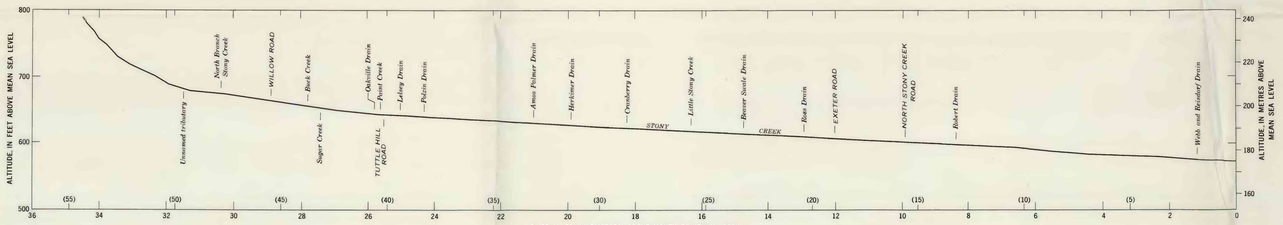


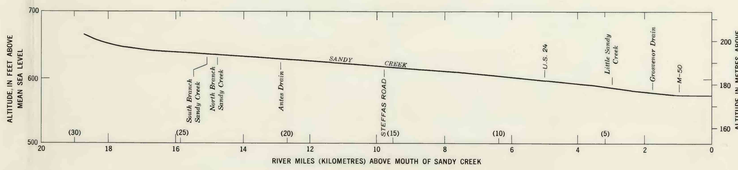


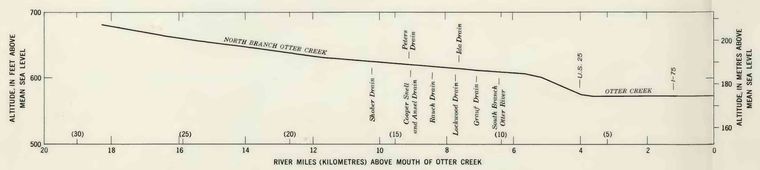


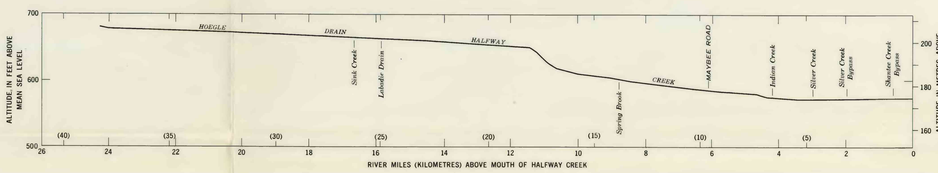


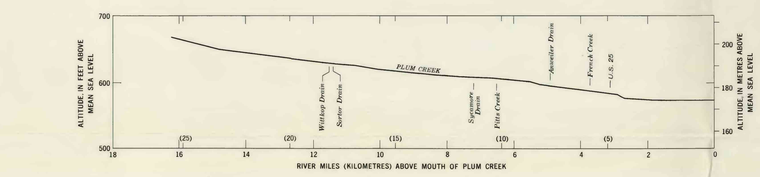












CLIMATE

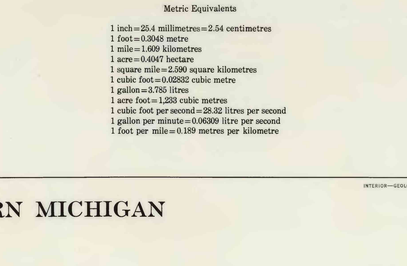
The climate of the areas drained by the minor streams is affected by the Great Lakes, which provide a source of moisture, lower temperatures during the summer, and warmer temperatures during the winter. Because prevailing westerly winds pass over appreciable distances of land surface before reaching southeastern Michigan, the influence of the lakes on the climate is moderated somewhat. Their influence is greatest when winds are from the northeast or southeast because lakes are closer in those directions.

Based on records at Detroit near the center of the minor stream basins, the mean annual temperature is about 10°C (50°F). Temperatures are slightly lower in the northern part and inland than in the southern part and along the lakes. Temperatures exceed 32°C (90°F) about 12 days per year. About 5 days per year experience sub-zero readings. The average frost-free period is about 175 days. The duration of the period changes slightly from north to south and from shoreline areas to inland areas; it is shorter in the north and inland from Lakes St. Clair and Erie.

Precipitation averages about 30 inches (760 millimetres) per year. The precipitation is fairly uniform throughout the year; however, it is slightly greater during the growing months, April to September. Snowfall totals about 30 inches (760 millimetres) during an average winter.

Summary of Climatic Data

Station / Summary	Port Huron	Mount Clemens	Detroit City Airport	Detroit Metropolitan Airport	Ann Arbor	Willis	Monroe
Mean annual temperature (°C)	9.2	9.1	10.0	9.5	9.8	9.0	10.0
Mean annual precipitation (inches)	33.55	28.07	30.95	30.89	30.10	32.19	31.29
Mean annual rainfall (inches)	35.4	30.0	31.7	34.9	29.5	33.9	30.7
Average frost-free season	May 3 to Oct. 16	May 1 to Oct. 14	Apr. 23 to Oct. 21	Apr. 23 to Oct. 21	May 2 to Oct. 17	May 7 to Oct. 7	May 6 to Oct. 16



STREAMFLOW

Runoff is normally highest in the late winter and spring and generally lowest in late summer and early fall. Day-to-day variations from the general pattern, as shown in the hydrograph for Stony Creek, are caused by rain and other climatic influences. Most areas drained by the minor streams are underlain by compact soils having low infiltration rates (see sheet 2). Consequently, streamflow increases rapidly after rain or snowmelt. Resultant peak discharges, however, are short-lived, and streamflow quickly diminishes.

The two sets of measurements in the table below were made during periods when surface runoff due to antecedent precipitation was minimal; therefore, they represent high and low base-flow conditions. Many streams become dry or have low base-flow discharge because aquifers have low permeability and do not transmit water readily to streams. The highest sustained dry-weather discharge per square mile in the minor basins is in the upper reaches of Paint Creek basin. During base-flow periods, Paint Creek loses water in its lower reaches; thus, discharge is less than that upstream.

Stream	Location ¼	Sec.	Township	Range	Drainage area (sq. mi.)	Date	Discharge (cfs)	Discharge ((cfsm)
Marsh Drain	Private claim 186		3N	16E	4.94	8/31/71	0	0
						5/ 4/72	1.0	.202
Beaubien Creek	NW	20	3N	16E	11.8	8/31/71	0	0
						5/ 4/72	5.15	.436
Swan Creek	SW	24	4N	15E	5.30	8/31/71	0	0
						5/ 4/72	5.75	1.08
Swan Creek	SE	3	3N	15E	15.8	8/31/71	0	0
						5/ 4/72	13.5	.854
Swan Creek tributary	SW	10	3N	15E	11.2	8/31/71	.08	.007
						5/ 4/72	4.91	.438
Marsac Creek	SW	8	3N	15E	5.68	8/31/71	.08	.014
						5/ 4/72	2.68	.472
Salt River	SE	22	4N	14E	8.08	9/ 1/71	1.80	.200
	SW	27	4N	14E	10.2	5/ 4/72	10.1	.990
Salt River	SE	11	3N	14E	24.4	9/ 1/71	.65	.002
	NE	11	3N	14E	25.3	5/ 4/72	26.3	1.12
Fish Creek	SE	15	3N	14E	7.10	9/ 1/71	.69	.013
						5/ 4/72	5.76	.811
Ecorse River	SE	36	2S	9E	7.32	8/31/71	.092	.0003
						5/ 5/72	1.67	.228
Ecorse River tributary	Private claim 51		3S	11E	16.5	8/31/71	.33	.020
						5/ 5/72	4.72	.286
South Branch Ecorse River	NE	24	3S	10E	11.7	8/31/72	1.10	.094
						5/ 5/72	5.13	.438
Frank and Poet Drain	NE	34	3S	10E	9.65	8/31/71	.06	.006
						5/ 5/72	19.3	2.00
Frank and Poet Drain	SW	24	4S	10E	17.4	8/31/71	.51	.029
						5/ 5/72	20.7	1.19
Blakely Drain	NE	2	4S	9E	11.6	8/31/71	.07	.006
						5/ 5/72	6.79	.584
Marsh Creek	SW	26	4S	10E	26.4	8/31/71	.73	.023
						5/ 5/72	17.1	.648
Brownstown Creek	NE	34	4S	10E	7.39	8/31/71	.08	.011
						5/ 5/72	4.42	.598
Swan Creek	SW	1	5S	8E	17.4	9/ 1/71	0	0
						5/23/72	4.38	.252
Dishrow Drain	SW	1	5S	8E	9.64	9/ 1/71	.08	.008
						5/23/72	1.97	.204
Swan Creek	NE	8	5S	9E	35.0	9/ 1/71	.08	.002
						5/24/72	7.38	.211
North Branch Swan Creek	SW	24	4S	8E	13.5	9/ 1/71	0	0
						5/24/72	3.18	.236
North Branch Swan Creek	SE	4	5S	9E	21.1	9/ 1/71	0	0
						5/24/72	3.62	.172
Little Swan Creek	SE	22	5S	9E	11.8	9/ 1/71	0	0
						5/24/72	1.22	.103
Swan Creek	NE	1	6S	9E	88.4	8/31/71	0	0
						5/23/72	18.5	.209
Little Swan Creek	SW	1	6S	9E	4.08	5/23/72	.22	.054
Stony Creek	SE	21	4S	7E	6.32	8/31/71	0	0
Sugar Creek	NE	33	4S	7E	13.5	8/31/71	0	0
						5/24/72	2.49	.184
Paint Creek	NE	33	3S	7E	17.5	8/31/71	2.74	.157
						5/24/72	5.92	.338
Paint Creek	NE	34	4S	7E	34.9	8/31/71	1.92	.055
						5/24/72	9.25	.265
Stony Creek	NE	3	5S	7E	68.0	8/31/71	2.53	.043
						5/24/72	18.3	.269
Polain Drain	SE	35	4S	7E	7.14	8/31/71	0	0
						5/24/72	1.84	.257
Stony Creek	SW	17	5S	8E	90.0	8/31/72	2.65	.029
						5/24/72	23.7	.263
Stony Creek	NE	25	5S	8E	105	9/ 1/71	2.96	.028
						5/23/72	28.1	.268
Robert Drain	NW	5	6S	9E	8.71	8/31/71	0	0
						5/23/72	1.10	.126
Stony Creek	NE	22	6S	9E	121	8/31/71	2.00	.017
						5/23/72	30.8	.304
Sandy Creek	Private claim 646		6S	9E	12.9	8/31/71	0	0
						5/23/72	2.01	.156
Little Sandy Creek	Private claim 353		6S	9E	10.8	8/31/71	.01	.0009
						5/23/72	1.87	.173
Sandy Creek	Private claim 476		6S	9E	29.6	8/31/71	.001	.027
						5/23/72	6.12	.207
Plum Creek	Private claim 521		6S	9E	10.9	8/31/71	0	0
						5/23/72	.95	.087
Pitts Creek	Private claim 517		7S	8E	11.4	8/31/71	0	0
						5/23/72	2.23	.196
Plum Creek	Private claim 550		7S	9E	32.1	8/31/71	1.20	.037
						5/23/72	5.54	.173
North Branch Otter Creek	NE	11	7S	7E	8.83	8/31/71	0	0
						5/23/72	1.16	.131
Peters Drain	SE	12	7S	7E	7.75	8/31/71	0	0
						5/23/72	1.82	.235
South Branch Otter Creek	NE	19	7S	8E	8.89	8/31/71	0	0
						5/23/72	1.94	.220
Otter Creek	Private claim 47		7S	8E	51.0	8/31/71	0	0
						5/23/72	17.1	.335
Muddy Creek	Private claim 384		7S	8E	5.48	8/31/71	0	0
						5/23/72	1.59	.290
Bay Creek	NE	16	8S	8E	11.7	8/31/71	.03	.003
						5/23/72	2.36	.202
Little Lake Creek	NE	29	8S	8E	11.9	8/31/71	0	0
						5/23/72	2.51	.218
Flat Creek	SW	20	8S	8E	5.39	8/31/71	0	0
						5/23/72	1.35	.250
Hogle Drain	NE	2	8S	6E	14.1	8/31/71	0	0
						5/23/72	.015	.001
Halfway Creek	SW	1	8S	6E	22.2	5/24/72	0	0
Halfway Creek	NW	13	8S	6E	23.0	5/23/72	.23	.010
Halfway Creek	SW	33	8S	7E	34.2	8/31/71	1.28	.037
						5/23/72	4.55	.133
Indian Creek	SW	26	8S	7E	8.26	8/31/71	.08	.010
						5/23/72	1.61	.195
Big Ravine Drain	SE	19	8S	6E	17.0	8/31/71	0	0
						5/23/72	1.78	.105
Ottawa Lake outlet	SE	27	8S	6E	24.7	8/31/71	0	0
						5/23/72	2.52	.102
North Branch Temmile Creek	SE	34	8S	6E	33.5	8/31/71	0	0
						5/23/72	2.70	.081
Bradshaw Drain	SW	32	4S	8E	10.5	9/ 1/71	1.02	.097
						5/24/72	3.89	.370

BASE-FLOW INVESTIGATIONS PROVIDE A BASIS FOR DETERMINING THE OCCURRENCE, DISTRIBUTION AND MAGNITUDE OF DRY-WEATHER STREAMFLOW

STREAM SLOPES

Stream slopes for each of the minor streams are relatively flat except in the headwaters of Stony Creek. Average slopes, in feet per mile, of some representative streams are shown in the following table.

As shown on the area map and the river profiles, stream slopes near the St. Clair River and the Detroit River are generally less than 5 feet per mile (0.9 metres per kilometre). Average slopes are slightly more for some streams tributary to Lake St. Clair and Lake Erie. Inland from the Great Lakes, stream slopes increase slightly but generally are less than 10 feet per mile (1.9 metres per kilometre).

Because of small drainage areas, variable discharge, low drought flows, and small stream slopes, dams have not been constructed on the minor streams to utilize streamflow. Dams in the minor stream basins were constructed to form small ponds for esthetic or recreational use.

Stream slopes may be approximated from the area map or from the river profiles. On the profiles, slopes for any reach may be compared with lines shown for various slopes at the left side of the Swan Creek profile. More accurate values of slope may be computed from mileage and altitude values given in the table of physiographic data (see pamphlet).

Stream	Average slope: Feet per mile	Metres per kilometre	Stream	Average slope: Feet per mile	Metres per kilometre
Marsh Drain	3.2	0.6	Swan Creek	4.4	0.8
Beaubien Creek	4.5	0.9	North Branch Swan Creek	6.5	1.2
Swan Creek	7.0	1.3	Sugar Creek	16.7	3.2
Salt River	10.2	1.9	Paint Creek	10.9	2.1
Fish Creek	10.9	2.1	Stony Creek	6.3	1.2
Milk River	1.6	0.3	Sandy Creek	4.9	0.9
Ecorse River	4.8	0.9	Plum Creek	5.9	1.1
South Branch Ecorse River	4.9	0.9	North Branch Otter Creek	6.0	1.1
Frank and Poet Drain	3.9	0.7	Otter Creek	5.8	1.1
Brownstown Creek	4.3	0.8	Muddy Creek	6.4	1.2
Marsh Creek	4.7	0.9	Bay Creek	7.7	1.5
Mouilles Creek	3.3	0.6	Halfway Creek	4.5	0.9

Metric Equivalents

1 inch = 25.4 millimetres = 2.54 centimetres
1 foot = 0.3048 metre
1 mile = 1.609 kilometres
1 acre = 0.4047 hectare
1 square mile = 2.590 square kilometres
1 cubic foot = 0.02832 cubic metre
1 gallon = 3.785 litres
1 acre-foot = 1,233 cubic metres
1 cubic foot per second = 28.32 litres per second
1 gallon per minute = 0.06309 litre per second
1 foot per mile = 0.189 metres per kilometre

WATER RESOURCES OF BASINS FOR MINOR STREAMS DRAINING INTO ST. CLAIR RIVER, LAKE ST. CLAIR, DETROIT RIVER, AND LAKE ERIE, SOUTHEASTERN MICHIGAN

By
F. R. Twenter, R. L. Knutilla, and T. R. Cummings

1975

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975

For sale by U.S. Geological Survey, Reston, Virginia 22092, price $2.50 per set