

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION



**A PROPOSED STREAMFLOW DATA PROGRAM
FOR MICHIGAN**

Open-file report

LANSING, MICHIGAN
1970

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BY

PAUL C. BENT

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CONTENTS

	Page
Abstract	1
Introduction	2
Hydrology	4
Concepts and procedures used in this study	7
Data for current use	9
Data for planning and design	10
Natural flow streams	11
Regulated flow streams	12
Accuracy goals	14
Data to define long-term trends	17
Data on stream environment	18
Goals of the Michigan streamflow data program	19
Data for current use	19
Data for planning and design	19
Data to define long-term trends	21
Data for stream environment	21
Evaluation of existing data in Michigan	22
Data for current use	22
Data for planning and design	22
Evaluation of the natural-flow system	23
Streamflow characteristics	24
Drainage basin characteristics	25
Regression analysis	27
Principal streams	30

CONTENTS--continued

Page

Evaluation of existing data in Michigan--continued

Data for planning and design--continued

Evaluation of the regulated-flow system	30
Data on stream environment	31
Data on stream environment	31
Discussion of the evaluation	32
The proposed program	33
Data collection	34
Data for current use	34
Data for planning and design	34
Natural-flow, minor streams	36
Natural-flow, principal streams	37
Regulated flow streams	38
Data to define long-term trends in streamflow	39
Summary	41
Data analysis	42
References	44

ILLUSTRATIONS

	Page
Figure 1. Average annual precipitation, in inches, 1931-60	5
2. Average annual runoff, in inches, 1951-60	5
3. Curve showing relation of standard error to length of record	16
4. Map of Michigan showing proposed network of gaging stations, coded as to purpose	In pocket
5. Map of Michigan showing existing stations and partial-record stations	In pocket

TABLES

Table 1. Framework for design of data collection program	8
2. Accuracy goals	20
3. Summary of regression analyses of mean annual flow ...	29

APPENDIX

TABLES

	Page
Table A-1. Current-purpose gaging stations	A-2
A-2. Streamflow characteristics at gaging stations	A-5
A-3. Basin characteristics at gaging stations	A-17
A-4. Summary of regression results	A-21
A-5. Gaging stations in operation and proposed for the network	A-22

A PROPOSED STREAMFLOW DATA PROGRAM FOR MICHIGAN

By P. C. Bent

ABSTRACT

An evaluation of the streamflow data available in Michigan was made to provide guidelines for planning future water resource programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives.

It was found that most goals could not be met by regionalization of the data for gaged basins by regression analysis. This fact indicates that few changes can be made in the present program on the basis of computing data by regression formulas. However, regression formulas that include factors not evaluated as a part of this study, may provide a basis for regional streamflow analysis. The evaluation indicated that some changes in the streamgaging network can be made on the basis of length of records already collected. A streamflow data program based on the guidelines developed in this study is proposed for the future.

Introduction

The streamflow program of the U. S. Geological Survey in Michigan has evolved through the years as the Federal and State interests in surface-water resources have increased and as funds for operating the stream-gaging station network have become available.

Systematic collection of streamflow records was begun in 1898 by city officials, waterpower companies and others interested in water. During the winter of 1900-1, a Survey employee made arrangements with several interested parties to do the field work required for 13 gaging stations. The first definite allotment of Survey funds was made soon thereafter to supervise the work and to compute the records.

State cooperation through the Michigan Stream Control Commission started in 1930 but ceased in 1931 because of lack of funds. Cooperation resumed in November 1932 with State employees performing field work and Survey employees computing records. Thirteen gaging stations were in operation in 1931. Coverage was gradually increased to 30 by 1939. Problems caused by stream pollution were the principal reasons for obtaining records at that time.

Expansion of the gaging program continued through the 1940's. Problems of fish propagation, bridge design, drainage, flood control, hydro-powerplant expansion, and pollution emphasized the need for more water data. By 1947 the gaging-station network had increased to 93 stations. The floods of 1947 and 1948 triggered the most rapid expansion in the gaging network. By 1950 the network had been expanded to 106 stations and by 1960 to 165. During the 1960's the number increased to 200 stations.

During the 1950's a supplemental network of low-flow partial-record stations was established to define the low-flow characteristics at sites other than those at which daily discharge was collected. By 1969, data had been collected at 220 sites throughout the state, and was currently being collected at 40 others.

A crest-stage partial-record network was also started during the 1950's. The purpose of the program is to obtain data on peak flows. During 1969, 21 stations were being operated.

The increasing cost of operation, the restraint on funds and manpower, and the need for a greater variety of hydrologic information, made it imperative that a systematic evaluation of the streamflow data program be made to determine how to apply the funds and manpower available in order to best serve State and Federal interests. The purpose of this study is to evaluate the streamflow data program and use this evaluation to design a program that will most efficiently produce the types of information needed.

The concepts and procedures used in this study are presented in detail by Carter and Benson (1969), and are summarized only briefly in this report. The basic steps are (1) definition of the long-term objectives of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which objectives have already been met, (3) consideration of alternate means of meeting the remaining objectives, and (4) preparation of a proposed program of data collection and analysis to meet the remaining objectives.

HYDROLOGY

Michigan enjoys an auspicious setting, largely bordered by the Great Lakes--lakes that represent a vast supply of water. In addition to the Great Lakes, abundant supplies of water are available from streams, underground reservoirs, and inland lakes. Indeed, water is one of Michigan's greatest resources.

The water-bearing rocks that underlie Michigan are of 2 major types--glacial deposits and sedimentary bedrock. The glacial deposits are those unconsolidated surficial beds of gravel, sand, silt, and clay that were deposited from glaciers and that now cover most of the state. Glacial deposits in most of the lower Peninsula range in thickness from a few feet to more than 800 feet, but generally are less than 200 feet thick in the upper Peninsula.

All but a 48 square mile area in the western part of Michigan's Upper Peninsula drains into the Great Lakes either directly or through tributary river systems. Because of the proximity of the Great Lakes most drainage basins are small. The largest river system is the Saginaw River, draining more than 6,000 square miles.

Precipitation statewide averages about 30 inches annually. Annual averages are slightly higher in the western part of the Upper Peninsula and in the southwestern part of the Lower Peninsula (fig. 1). Annual precipitation is slightly less than the statewide average in the northeast part of the Lower Peninsula. Stream runoff is about 50 percent of precipitation in the Upper Peninsula and the northern part of the Lower Peninsula (fig. 2). In the southern part of the Lower Peninsula runoff generally is only about 30 percent of precipitation.

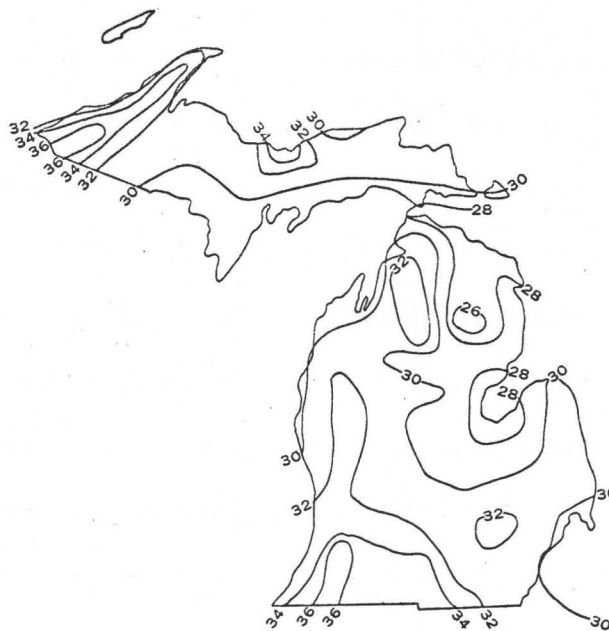


Figure 1.-- AVERAGE ANNUAL PRECIPITATION, IN INCHES, 1931-60
(Data from U.S. Weather Bureau-ESSA)



Figure 2.-- AVERAGE ANNUAL RUNOFF, IN INCHES, 1951-60

Streamflow generally varies widely from month to month, but usually most runoff occurs during the snowmelt months in the spring. Subsequently streams recede to yearly lows in late summer or early fall.

The magnitude of the base flow of streams throughout the state varies considerably and is believed to be directly related to basin geology. Manistee River and the Au Sable River in the northern part of the Lower Peninsula have high base flows. North Branch Clinton River and River Rouge in the southeastern part of the Lower Peninsula have low base flows. Sandy soils and glacial deposits characterize the Manistee and Au Sable basins. The maximum discharge in each of the basins is slightly less than 10 times the minimum daily value. Glacial clay lake beds characterize most of the North Branch Clinton and Rouge basins. In these basins the maximum discharges are several thousand times the minimum daily values.

CONCEPTS AND PROCEDURES USED IN THIS STUDY

The principal concept of this study is that streamflow information may be needed at any point on any stream in Michigan, and that the program must be designed to accommodate this need. This information can be provided by a combination of data collection and hydrologic studies that regionalize the information obtained at specific sites.

Another important concept is that the goals of the program, including accuracy goals, should be identified in quantitative form. This permits evaluation of existing data to determine which goals have been attained and how the program should be modified.

The procedures used in this study are presented with reference to the general framework shown by table 1. Streamflow data are classified into four types; (1) data for current use, (2) data for planning and design, (3) data to define long-term trends (4) data on the stream environment. For the second type of data, streams are classified as natural or regulated, and each of these classifications is further subdivided into principal or minor, with the separation of the two occurring at a drainage area of about 350 square miles.

In the initial phase of the study, program goals were established for each type of data. All available data were then examined and analyzed. This led to a comparison of the information now available with the goals that had been set and to consideration of the elements that should be included in the future program.

Criteria for each of the four types of data, and the methods employed in deriving information, are discussed in the subsequent section.

Table 1. -- Framework for design of data collection program

Type of data	Current use	Planning and Design				Long-term trends	Stream environment
		Natural Flow		Regulated Flow			
		Minor streams	Principal streams	Minor streams	Principal streams		
Goals	To provide current data on streamflow needed for day-by-day decisions on water management as required.	To provide information on statistical characteristics of flow at any site on any stream to the specified accuracy.				To provide a long-term data base of homogeneous records on natural-flow streams.	To describe the hydrologic environment of stream channels and drainage basins.
Drainage area limits	Full range	Less than 350* sq mi.	Greater than 350* sq mi.	Less than 350* sq mi.	Greater than 350* sq mi.	Full range	Full range
Accuracy goal	As required	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Highest obtainable	As required
Approach	Operate gaging stations as required to provide specific information needed.	Relate flow characteristics to drainage basin characteristics using data for gaged basins.	Operate gaging stations to obtain 25 years of record (or the equivalent by correlation) at a network of points on principal streams; interpolate between points.	Develop generalized relations that account for the effect of storage, diversion or regulation on natural flow characteristics.	Utilize analytical model of stream system with observed data as input to compute homogeneous records for both natural flow conditions and present conditions of development.	Operate a number of carefully selected gaging stations indefinitely.	Observe and publish information on stream environment.
Evaluate available data	Identify stations where data is used currently and code the specific use of data.	Develop relationship for each flow characteristic and compare standard error with accuracy goal. Evaluate sample.	Lay out network of points on principal streams and compare data available at these points with goal.	Appraise type of regulation, data available, and areas where relationships are needed.	Identify stream systems that should be studied using model approach and determine data requirements.	Select two stations in each WRC subregion to operate indefinitely for this purpose.	Evaluate information available in relation to goals.
Design future program	Identify goals that have not been attained. Consider alternate means of attaining goals. Identify elements of future program.						

* May be varied with terrain and hydrologic conditions.

Data for Current Use

Current information on streamflow is needed at many sites for day-to-day decisions on water management, for assessment of current water availability, for the management of water quality, for the forecast of water hazards, and for the surveillance necessary to comply with legal requirements. Sites at which the needed data are collected are termed "current purpose" streamflow stations.

Data for current use are obtained by operating gaging stations to obtain the data specifically required for water-management systems. Current-purpose-data stations are identified separately in this study because (1) justification can be related to specific needs; (2) the data may have little or no transfer value in a hydrologic sense; and (3) the locations of the stations, the accuracy requirements, and the period of operation are specified by the user of the data, who usually provides the financing.

This part of the program is not subject to design, and it changes in response to the needs for data in water management.

Data for Planning and Design

Streamflow records form the principal basis for the planning and design of water-related facilities. Past hydrologic experience, however, is never precisely duplicated in the future; the exact sequence of wet and dry years probably will not occur again. For this reason, designers and planners commonly utilize statistical characteristics of streamflow rather than the records of flow at specific times. It is assumed that the probability of occurrence of a flow of a given magnitude or other statistical parameter in the future can be approximated from the frequency of such occurrence in the past. Typical statistical characteristics are the mean flow, the flood of 50-year recurrence interval, and the standard deviation of annual mean flows.

A long record of streamflow at the specific site is desirable for defining statistical characteristics of streamflow at that site. Although it is not feasible to collect a long continuous streamflow record at every site where it may be needed, a number of such stations are required to provide information that can be transferred to ungaged sites or to sites where little streamflow information is available.

Natural-Flow Streams

The transfer of information on natural-flow streams is done by relating flow characteristics to basin characteristics, such as drainage area, topography, and climate; by relating a short record to a longer one; or by interpolating between gaged points on a stream channel.

To evaluate the statistical characteristics of streamflow, the streams in Michigan were identified as having either natural or regulated-flow conditions. For the purpose of this study, streams were also defined under each of the above categories as being minor streams (drainage area, less than 350 sq mi), or principal streams (drainage area, greater than 350 sq mi). The principal-stream network was further defined by first identifying sites with drainage areas of about 350 square miles on the upstream segment of all streams, and then identifying the next and following sites on each stream from the upstream station to the mouth at points where the drainage area has doubled, or more than doubled, due to large tributaries entering.

Regulated-Flow Streams

The natural flow regime of many streams is altered by the construction of storage reservoirs and the diversion of water. These alterations increase the scope of both the data collection and the analysis that is required to provide information on the flow characteristics.

To be useful in statistical prediction, streamflow data must be homogeneous in time. Frequently, however, it is not possible to obtain a long record under one condition of development before additional changes occur.

Definition of the flow characteristics at any point on any stream is also much more difficult under conditions of regulation. The procedures used for natural streams--regression, correlation, interpolation, etc.--cannot be applied.

For regulated streams, a systems approach seems to be the most efficient way of providing meaningful information on the statistical characteristics of flow. This approach requires some sort of analytical model of the stream system. Such models are simple in concept and generally consist of water-budget equations and flow-storage equations. However, in many instances the use of the digital computer is required for complex equations, or to handle large volumes of data. A computer program tailored to the individual system can be prepared.

Development of such a model requires information on stage-capacity curves of reservoirs, stage-discharge curves at the outlets, operating-rule curves for the release of water, losses due to evaporation and seepage, the geometry of the stream channel, and records of diversions and return flow. Information on streamflow at some point or points is also needed as input to the model and to verify the output. Frequently aquifer characteristics and ground-water pumpage should be considered.

The model and the associated data can be used to derive homogeneous data for both the natural and the regulated conditions. All historical streamflow records for both natural and regulated flows could be used as input to the model. Furthermore, data could also be derived for ungaged sites in the stream system.

Accuracy Goals

In using past hydrologic experience to appraise the probability of future occurrences, some error must be tolerated. Natural streamflow, like other events related to climate, is generally random in occurrence and varies greatly in time and space. Statistical techniques used in the analysis of random events, therefore, are considered applicable. Measures of the variability with time of annual mean flow and other streamflow characteristics are determined from the historical streamflow data, and the probable errors involved in defining streamflow characteristics can be appraised. The principal measure of the accuracy with which a particular streamflow characteristic can be determined is the statistical measure of error, "standard error of estimate," and is expressed in this report as a percentage of the average value of the characteristic. The standard error is the estimated limit above and below the average within which about 67 percent of future values of the characteristics are expected to fall. Conversely, there is only one chance in three that future values will differ from the average by more than one standard error.

In general, the longer the record, the more reliable are the estimates of probable future occurrences. However, even with a long record, say 50-100 years or more, it is not possible to determine with great precision the probability of certain flow characteristics such as floods of a given magnitude, for example. The standard error of various streamflow parameters decreases with the years of available record, but at a decreasing rate, as shown in figure 3. The incremental economic value of the additional years of record beyond a reasonable limit in the planning and design of projects is under continuing study, but no usable guidelines are available now.

Accuracy goals for streamflow characteristics are expressed as the accuracy equivalent of an arbitrary number of years of record. These goals are the same for natural and regulated flows; that is, accuracy equivalent to that which would be obtained from 10 years of record at the site for minor streams (drainage area, less than 350 sq mi), and accuracy equivalent to that which would be obtained from 25 years of record for principal streams (drainage area, more than 350 sq mi).

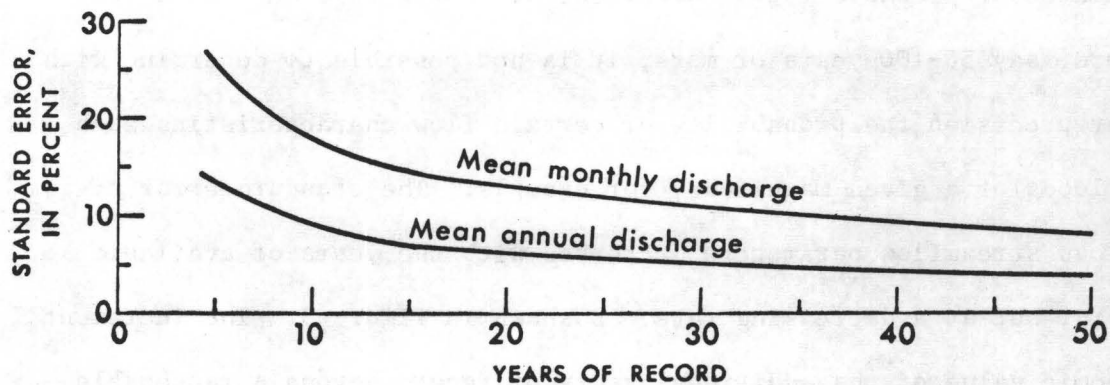


Figure 3.—Curve showing relation of standard error to length of record.

At sites on natural-flow streams where streamflow records are not available, the desired streamflow characteristics may be defined by means of the relation between the streamflow parameter and the characteristics of the drainage basin. This definition is accomplished by multiple regression analysis, a statistical method of handling sample data that can relate a streamflow characteristic to the topographic and climatic characteristics that affect streamflow. This analysis produces a regression equation that can be used to compute the flow characteristics at any point on natural streams in Michigan. The standard error of a regression equation provides a measure of the accuracy of an estimate made from it at an ungaged site. That error may be compared with the error associated with the same characteristic defined from a given number of years of record in order to determine whether the accuracy objective has been met.

Data to Define Long-Term Trends

Characteristics of streamflow defined from gaging-station records are used to estimate future-flow characteristics, on the assumption that the observed record is a representative sample of the long-term flows of the stream. To affirm this assumption, or to better define the ways in which the characteristics of flows change with time, selected gaging stations on natural streams should be operated indefinitely. The accuracy of gaging at these sites should be the highest that the state of the art permits.

Data on Stream Environment

Environmental data describe the physical environment in which the water exists, especially those features that relate to the use of water for recreation, waste disposal, conjunctive surface water-ground water supply, and the preservation of the esthetic character of water features.

The types of data required for this purpose are suggested by the following:

1. The geologic and hydraulic properties of the stream-aquifer systems.
2. Time of travel of solutes in stream channels.
3. Definition of flood profiles along stream channels.
4. Identification of flood plains of streams for floods of different frequencies.
5. Definition of stream and stream-channel properties, such as velocities, depths, bank vegetation, bed material, water temperature, water quality, and accessibility.
6. Data needed to define the effects of manmade changes in the environment on the quantity and quality of streamflow.
7. Character of the drainage basin, including area, vegetal cover, land and channel slopes, geology, and topography.
8. Climatic factors influencing the water supply.

GOALS OF THE MICHIGAN STREAMFLOW DATA PROGRAM

The objective of the Michigan streamflow data program is to provide information on flow at any point on any stream. Within this general objective, specific goals are set for each of the four types of data that represent the particular information that is needed.

Data for Current Use

The program goal for this type of data is to provide the particular information needed at specific sites for current use. Accuracy goals at a given site, as specified by the data user, can be met by intensive observation, or by more sophisticated instrumentation as needed.

Data for Planning and Design

The goal for this type of data is to define, within the given accuracy, the statistical flow characteristics listed in table 2. This definition applies not only to all streams with natural flow, but also to those streams that are affected by regulation and diversion. The accuracy goals shown for each flow characteristic are equivalent to 10 years of record for minor streams and 25 years of record for principal streams. The standard errors were calculated from a theoretical relation of standard error to index of variability for Michigan streams and number of years of record.

Table 2.--Accuracy goals

Streamflow characteristic	Standard error (percent)		
	10 years	25 years	From Regression
Mean annual discharge -----	9	6	23.4
Standard deviation of annual discharge -----	22	14	23.0
Mean monthly discharge (average) -----	18	12	37.1
Standard deviation of monthly discharges (average) -----	22	14	39.4
2-year flood -----	16	10	43.1
5-year flood -----	19	11	48.9
10-year flood -----	21	13	51.0
25-year flood -----	25	16	55.1
50-year flood -----	28	17	57.8
7-day 2-year low flow -----	10	7	74.7
7-day 10-year low flow -----	14	9	92.8
7-day 20-year low flow -----	16	10	100
7-day 50-year high flow -----	27	16	41.9

Data to Define Long-Term Trends

The goal for this type of data is to operate indefinitely a small network of gaging stations on streams that are expected to be relatively free from manmade changes. One or two stations should be located in each major drainage area in the State, and stations should be located on streams that differ in physical characteristics.

Data on Stream Environment

Environmental data describe the flow and the stream channel in terms that will be valuable in planning the use of the stream for any purpose such as recreation, waste disposal, conjunctive surface water-ground-water supply, and in guarding against water hazards. The long-range goals for this type of data in Michigan are given below:

1. Hydrologic surveys of stream-aquifer systems.
2. Surveys of time of travel of solutes in stream channels.
3. Definition of flood profiles along stream channels.
4. Identification of flood plains of streams for floods of different frequencies.
5. Reconnaissance surveys of streamflow and stream channel parameters that are related to the use of the stream for recreation, such as velocities, depths, bank vegetation, bed material, water temperature, water quality, and accessibility.
6. Research studies of the effect of manmade changes in the environment on streamflow.

EVALUATION OF EXISTING DATA IN MICHIGAN

In this evaluation all available data are considered and analyzed in relation to program objectives. A separate evaluation is made for each of the four types of data.

Data for Current Use

About half the gaging stations in Michigan are operated to provide data for current use. It is assumed that the need for this type of data is being met, and that this part of the program can be modified as requirements change. The 95 gaging stations operated in Michigan to satisfy the need for current data are identified in table A-1 in the appendix. The principal uses of the data for each station are also shown in this table.

Data for Planning and Design

The statistical characteristics of streamflow can be defined by sample gaging, analytical methods of regionalization, systems studies, or any combination of the three. The following discussion of the evaluation of data needed for planning and design follows the framework shown in table 1.

Evaluation of the Natural-Flow Systems

The purpose of the evaluation is to determine how accurately the statistical characteristics that are listed as goals can be defined by regionalization of data now available.

The most effective way now known for defining statistical streamflow characteristics on a broad scale is to relate the streamflow characteristics to basin characteristics in equations developed by use of multiple-regression techniques applied to past data.

Once the equation and its constants are defined, streamflow characteristics for a specific site in a given basin can be computed by substituting the appropriate values of the hydrologic variables in the formulas.

The 145 streamflow records used in the analysis are those having 10 or more years of mostly unregulated flow, or flow that can be adjusted to natural conditions. Both minor and principal streams are included. Records were not adjusted to a base period. Because of some regulation, not all flow characteristics were defined from each record. At some stations, regulation materially affected low flows but insignificantly affected peaks. At a few, low-flow characteristics were not defined because only 9 years of low-flow season records were available.

Streamflow characteristics.--The following streamflow characteristics defined at gaging stations include the full range of flow and represent those required for planning and design. They are listed in table A-2. Low and high-flow characteristics were determined by computer using methods described by the U. S. Water Resources Council (1967).

- a. Flood-peak characteristics are represented by discharges from the annual flood-frequency curve at recurrence intervals of 2, 5, 10, 25, and 50 years. In this report, these peak-flow rates are denoted as Q_2 , Q_5 , etc.
- b. Mean-flow characteristics are described by the mean of the annual means, Q_a , and by the means of record for each calendar month, q_n , where the subscript refers to the numerical order of the month beginning with January as 1.
- c. Flow-variability characteristics are represented by the standard deviations of the annual and monthly means. The symbols used are, respectively, SD_a and SD_n , where the subscript n refers to the numerical order of months with January as 1.
- d. Low-flow characteristics are the annual minimum 7-day mean flows at 2, 10, and 20-year recurrence intervals ($M_{7,2}$, $M_{7,10}$ and $M_{7,20}$).
- e. Flood-volume characteristics represent the annual highest average flow for 7-day periods at recurrence intervals of 2, 10, and 50 years. These characteristics are noted symbolically in this report as $V_{7,2}$, $V_{7,10}$, and $V_{7,50}$.

Drainage basin characteristics.--Drainage-basin characteristics

defined for this study are:

- a. Drainage area (A), in square miles, as shown in the latest Geological Survey streamflow reports.
- b. Main-channel slope (S), in feet per mile, determined from elevations at points 10 percent and 85 percent of the distance along the channel from the gaging station to the divide. This index was described and used by Benson (1962, 1964).
- c. Main-channel length, in miles, from the gaging station to the basin divide, as measured with a template graduated in 0.1-mile units, or as obtained from U. S. Army Corps of Engineer reports.
- d. Area of lakes and ponds (L), expressed as percentage of the drainage area plus 1 percent, determined from topographic maps.
- e. Mean-basin elevation (E), in feet above mean sea level, measured on U. S. Geological Survey topographic maps by laying a grid over the map, determining the elevation at each grid intersection, and averaging those elevations. The grid spacing was selected to give at least 25 intersections within the basin boundary.
- f. Forest cover (F), expressed as the proportional part of the drainage area covered by forests, plus 1 percent, as shown on topographic maps, determined by the grid method. For areas of inadequate map coverage, forest area was determined from data documented by counties, the U. S. Soil Conservation Service, and the Forestry Division, Michigan Department of Natural Resources.

- g. Mean annual precipitation (P), in inches, determined from an isohyetal map for the period 1931-60, prepared by the U. S. Weather Bureau.
- h. The maximum 24-hour rainfall having a recurrence interval of 2 years (24-hour 2-year rainfall) (I), expressed in inches. These values were determined from U. S. Weather Bureau publication (1960).
- i. Mean minimum January temperature (T), in degrees Fahrenheit, is from Strommen (1959).
- j. Average Annual Snowfall (B), in inches, from U. S. Weather Bureau (1964).
- k. Minimum infiltration rate (C), in inches per hour, as defined by Schneider and Erickson (no date).

Values of the above basin characteristics for each of the 145 gaging stations used in the analysis are listed in table A-3. Although main channel length was not used in the regression analysis, it has been included in the table for general reference.

Regression analysis.--The next step was to relate each of the streamflow characteristics to basin and climatic characteristics in equations developed by using multiple regression techniques. The equation has the form $Y = aA^{b_1}S^{b_2}L^{b_3}$ ----, where Y is a statistical streamflow characteristic; A, S, and L are topographic or climatic characteristics; a is the regression constant; and b_1 , b_2 , and b_3 are coefficients obtained by regression. This method was described by Benson (1962). In this study, all basin characteristics that a trial regression indicated to be significant were used. For each streamflow characteristic analyzed, all basin characteristics were used that appeared to have some effect. The computer calculated the regression equation, the standard error of estimate, and the significance of the selected basin parameters. Automatically, then, the computer repeated the calculations, omitting the least significant basin parameter in each calculation until only the most significant parameter remained. After relations for a given streamflow characteristic had all been computed, the entire computation process was repeated using another streamflow characteristic with another applicable set of basin characteristics.

Table 3 illustrates the output of the regression analyses of mean annual flow. On the basis of the regression analyses, the equation for determining mean annual discharge at ungaged sites in Michigan, which includes all statistically significant variables, is

$$Q_A = 0.0252A^{1.01}L^{-.07}F^{.24}I^{1.56}B^{.34}$$

where Q_A is mean annual discharge, in cubic feet per second; A is drainage area, in square miles; L is percent lake and swamp area in basin (plus 1); F is percent forest area in basin (plus 1); I is precipitation intensity; and B is average annual snowfall in basin.

Table A-4 shows, for each of 37 streamflow characteristics, the regression constant, the regression coefficient (exponent) for all statistically significant basin parameters, and the standard error.

The standard errors shown in table A-4 should be compared with the accuracy goals (table 2). Though standard deviation of the annual discharge is the only streamflow characteristic whose standard error approaches the accuracy goal, the accuracy obtained from many other characteristics may be within satisfactory limits for some uses.

Table 3.--Summary of regression analyses of mean annual flow

Dependent Variable	Regression coefficients for independent variables						Regression Constant	Standard error of estimate
	Area	Slope	Ponds	Forests	Precipitation intensity	Snowfall		
Mean annual flow	1.03	0.05	-0.05	0.21	1.58	0.36	0.0204	23.4
	1.01	-	- .07	.24	1.56	.34	.0252	23.4
	1.01	-	-	.18	1.30	.37	.0299	23.9
	1.02	-	-	.15	-	.30	.1165	24.9
	1.02	-	-	.26	-	-	.256	25.6
	1.05	-	-	-	-	-	.554	33.8

Principal streams.--The goal for this category can be met only by gaging station operation, because the accuracy objective, equivalent of 25 years of record, cannot be achieved by techniques of regionalization. The study for this category consisted of the identification of principal-streams network and evaluation of length of record available at these sites.

The principal-streams network for Michigan includes 47 sites on unregulated streams, with at least 25 years of record at 30 of these sites. Of these 30 sites, continued operation is required at 23 to meet needs of long-term or current purpose stations.

Evaluation of the Regulated-Flow Systems

The goals for regulated streams are more difficult to attain because the technique of regionalization does not apply, the characteristics are not necessarily stationary in time, and a meaningful correlation seldom exists between flows at two sites if at least one of the flows is regulated. A systems approach may be used to define the characteristics of regulated streamflow under different patterns of regulation, or under the condition of natural flow. Systems studies for all of the regulated-stream systems in Michigan will require a major effort. Therefore, the present evaluation is limited to (1) identifying the regulated streams, and (2) describing briefly the approach that would be used.

The stream systems in Michigan materially affected by regulation are:

Ontonagon
Menominee
Flint
Thunder Bay
Tittabawassee

Some additional records of reservoir contents will be necessary for systems studies on these basins. Streamflow is affected by regulation on a few smaller streams on which no records are being collected.

Though some other basins, notably the Muskegon and Manistee rivers, are regulated to some extent for hydro-power production, the distortion of natural flow is not believed to be enough to warrant further study at this time.

Data to Define Long-Term Trends

At the present time, only one gaging station, Washington Creek at Windigo, Isle Royale, is designated as a bench mark station, and is identified in the long-term trend category. This station is planned for continuous and indefinite operation to record natural flow patterns.

Data on Stream Environment

Table A-3 shows the environmental factors that have been determined for the 145 gaging stations used in the analysis. Included are drainage area, slope, main channel length, areas of lakes and ponds, elevation, areas of forest cover, and minimum infiltration rate. Climatic factors shown are mean annual precipitation, 2-year 24-hour rainfall intensity, mean minimum January temperature, and average annual snowfall.

Channel surveys have been made at several sites in connection with indirect measurements of discharge, and channel geometry has been determined at a few gaging stations. Width and depth of channel, bed and bank materials, and bank height and bank vegetation have been mapped on several cold-water rivers in the northern part of the Lower Peninsula. Stream fiores, drainage areas, and river mileage are being determined for streams in southeastern Michigan that have drainage areas of 2 square miles or more.

DISCUSSION OF THE EVALUATION

Of the four data categories used in this study, only one, data for planning and designing of water projects, is clearly subject to design. The requirements for other types of data are established in response to specific needs, or are defined by hydrologic judgment.

The evaluation of available streamflow data by regression analysis was based on data from 145 continuous-record gaging stations, with drainage areas ranging from 1.2 to 4,900 square miles, (drainage area for 13 stations was less than 30 square miles). Records from both minor and principal natural-flow streams were included. Most records represent natural flow. Flow characteristics of the few stations that are regulated were not significantly affected.

On the basis of standard errors obtained from the regression analysis and as shown in tables 2 and A-4, it must be concluded that, in general, no flow characteristics can be estimated by regression equations in their present form within the accuracy limits set by the goals. The standard deviation of annual mean discharges can be estimated close to the accuracy limits for ten years of record but not for 25 years. Almost meeting this one accuracy goal does not in itself give sufficient reason to alter the network.

Further regression analysis is in order. Of the eleven basin and climatic characteristics that were used in the analysis (table A-3), drainage area was the most significant. The next most important characteristic was the minimum infiltration rate. The infiltration rates used were obtained from Schneider and Erickson (no date). Values of infiltration varied from 2 to 12 inches per hour. Comparison of the infiltration map with a map of Michigan's surface geology shows a high degree of correlation. Further evaluation of the infiltration data and addition of a variable that evaluates surface and sub-surface geology characteristics could be the step necessary to produce more acceptable results from regression equations. It is proposed to continue the study in this direction as a separate future project.

THE PROPOSED PROGRAM

The information developed in different segments of this study has been merged and applied in planning a streamflow-information program that would eventually attain as many of the goals as possible within the limits of available funds. For the optimum program, a balance must be maintained between data collection and data analysis, as continuous interaction between the two is needed, not only to gain a better understanding of the hydrologic system, but also to guide future evaluation of the program in meeting ever-changing needs and in adapting to changing technology.

Data Collection

Data for Current Use

Operation of the 95 stations identified as presently required and meeting the needs for current-purpose data (table A-1) should be continued. The changing needs will be assessed continuously, and the data collection network will be modified by adding or discontinuing stations as needs change for current-purpose data. Also the needs for this type data will be examined for each site, and a determination made as to whether a continuous record of daily discharge is required or a measure of a specific flow characteristic, such as peak flow or instantaneous flow, will suffice.

Data for Planning and Design

None of the objectives have been obtained by equations developed by regression analysis; however, the equations may be a valuable tool for estimating flow characteristics within the limits shown by table A-4. The accuracy obtained may be adequate for some purposes. It is apparent, though, that with the wide spread between the accuracy goals for low and peak flows, and the accuracy obtained from the regression equations, that continued gaging for these characteristics will be required.

Low-flow characteristics can be defined at ungaged sites by correlating a few low-flow measurements at the site with concurrent flow data at a suitable continuous-record index station where similar hydrologic conditions prevail. Information on low-flow characteristics has been obtained at about 200 sites in the State. Most of the sites are concentrated by groups within relatively small areas. Data are currently being obtained at about 20 sites and an additional 20 sites are now being established. In order to determine the low-flow characteristics of small streams throughout the State, an additional 50 low-flow partial-record stations will be needed. After operating these stations for about 4 years, the stations can be discontinued and data collection commenced at other sites, as needs dictate. By maintaining a low-flow station network of 50 to 70 stations, adequate coverage of low-flow characteristics might be obtained rapidly enough to keep pace with critical needs.

Flood-peak characteristics at recurrence intervals of 100 years are often estimated for project design. Although the objective includes only the 50-year flood, it would be desirable to continue collecting flood-peak data at selected sites indefinitely. For each streamflow station subject to discontinuance, consideration will be given to the continued collection of peak-flow data. The needed data can thus be obtained at little cost by operating a partial-record station. At present, about 40 crest-stage gages are being operated in the State. Half of them are concentrated on small streams in Genesee County. Another 100 should be installed on small streams throughout the State.

Natural-flow, minor streams.--Regression equations will not give results within accuracy goals equivalent to 10 years of record. Many stations on minor streams have already operated for well over 10 years, but in order to improve the regression equations the stations should be operated for 20 years. Continuation beyond 20 years does not significantly improve regionalization; hence, the following 17 stations are not recommended for inclusion in the future program.

- 4-0320. Presque Isle River near Tula, 1945-
- 4-0350. East Branch Ontonagon River near Mass, 1942-
- 4-0425. Otter River near Elo, 1942-
- 4-1210. Muskegon River near Merritt, 1946-
- 4-1230. Big Sable near Freesoil, 1942-
- 4-1235. Manistee River near Grayling, 1942-
- 4-1295. Pigeon River at Afton, 1942-
- 4-1325. Thunder Bay River near Hillman, 1945-
- 4-1380. East Branch Au Gres River at McIvor, 1950-
- 4-1390. Houghton Creek near Lupton, 1950-
- 4-1395. Rifle River at "The Ranch" near Lupton, 1950-
- 4-1400. Prior Creek near Selkirk, 1950-
- 4-1510. Cass River at Vassar, 1948-
- 4-1535. Salt River near North Bradley, 1934-

4-1670. Middle River Rouge near Garden City, 1947-

4-1695. Huron River at Commerce, 1946-

4-1730. Huron River near Dexter, 1946-

About 60 gaging stations with less than 20 years of record are now being operated on minor streams. This part of the network will be watched closely, and if each station will have served its purpose at the end of 20 years, it will be recommended for discontinuance at that time.

Natural flow, principal streams.--The accuracy objective of 25 years of record, or equivalent, has been attained at 7 of the 47 stations identified solely in this category of data. These 7 stations are not recommended for inclusion in the future program. Twenty-three of the stations that already have 25 years of record are identified as current-purpose or specific need stations, and must be continued. The following stations are those not recommended for retention.

4-0495. Manistique River at Germfask, 1938-

4-0550. Manistique River near Blaney, 1938-

4-1055. Kalamazoo River near Battle Creek, 1937-

4-1060. Kalamazoo River at Comstock, 1932-

4-1180. Thornapple River near Caledonia, 1930-38, 1951-

4-1285. Indian River at Indian River, 1942-

4-1545. Chippewa River near Midland, 1947-

It is recommended that the following six stations be established to fill gaps in the principal streams network.

Munuscong River near Kelden

Pine River near Rudyard

Whitefish River near Rapid River

Escanaba River near Arnold

St. Joseph River near Mendon

Manistee River near Sharon

Regulated-flow streams.--Most of the gaging stations on regulated streams are of the principal streams category, but some are on minor streams. Nearly all are classified as current-purpose stations for operational uses. As such the stations are recommended for continuance at least until a systems analysis study can be made and the specific purpose of each station further evaluated. Some additional data on inflow, outflow, reservoir contents, diversions, operation schedules, and evaporation and transpiration will be needed for the study.

Data to Define Long-Term Trends in Streamflow

Washington Creek at Windigo on Isle Royale was established as a benchmark station in 1964 for the specific purpose of recording natural characteristics of streamflow unaffected by changes caused by civilization. As a result of this study, 16 other gaging stations have been designated long-term-trend stations and should be operated indefinitely to meet the needs for this type of data. The additional stations were selected to provide a long-term sample reflecting areal coverage of the State, a range of drainage-area size, and a variety of climatic and physiographic characteristics. The 17 stations identified in this category and their drainage area and period of record for each are listed below.

Station Number	Station Name	Drainage area (sq. mi.)	Period of record
4-0010	Washington Creek at Windigo (Isle Royale)	13.2	1965-
4-0405	Sturgeon River near Sidnaw	171	1912-15, 1943-
4-0455	Tahquamenon River near Tahquamenon Paradise	790	1953-
4-460	Black River near Garnet	28	1951-
4-0565	Manistique River near Manistique	1,100	1938-
4-0595	Ford River near Hyde	450	1954-
4-0610	Brule River near Florence, Wis.	389	1914-16, 1944-
4-1050	Battle Creek at Battle Creek	241	1930-31, 1932-33, 1934-
4-1175	Thornapple River near Hastings	385	1944-
4-1225	Pere Marquette River at Scottville	709	1939-
4-1240	Manistee River near Sherman	900	1903-16, 1930-31, 1933-
4-1280	Sturgeon River near Wolverine	170	1942-
4-1420	Rifle River near Sterling	320	1905-8, 1936-
4-1460	Farmers Creek near Lapeer	57	1932-
4-1540	Chippewa River near Mount Pleasant	416	1930-31, 1932-
4-1645	North Branch Clinton River near Mount Clemens	199	1947-
4-1765	River Raisin near Monroe	1,034	1937-

Summary

Table A-5 summarizes the data-collection phase of the proposed program. The table includes all streamflow stations now in operation and those to be established for the proposed program. Each station is identified as to type of data and, as a result of this study, recommendations are made as to whether the station should be included in the proposed network or whether it has met the objective for which it was operated and could be discontinued. Data collected at most current-purpose gaging stations may also be used for planning and design. The locations of gaging stations included in the proposed network and the types of data to be collected are shown in figure 4 (in pocket).

In summary the recommended changes in the streamgaging network resulting from the evaluation study are as follows:

1. 7 principal stream-gaging stations may be discontinued.
2. 17 minor stream-gaging stations may be discontinued.
3. 6 unclassified stream-gaging stations may be discontinued.
4. 6 principal streamgaging stations should be established.
5. A network of about 50 low-flow partial-record stations should be established--stations to be operated on a rotating basis with new stations added as sufficient data become available from stations in the initial network.
6. 100 crest-stage gages should be established, preferably on small streams.

The above items should not be undertaken independently. In order to get the maximum data at the least cost, establishment of new stations should be accomplished concurrently with discontinuance of the old.

Data Analysis

The streamflow-data network operated through the years supplies a base for analyses and reports thereon which should be started as soon as the proposed program can be implemented. Some aspects of data analyses are of a continuing nature, with the data collection effort continuing, reoriented as necessary to fill gaps or eliminate deficiencies, and provide data for continuing future analyses.

The proposed program of data analyses for Michigan streams may be classed in two phases--those based on data collected to date, and those for which additional data will be required.

Data analyses and appropriate reports should be scheduled for completion at the earliest possible time on the following:

1. "Statistical Summaries of Michigan Streams" a compilation and summary of streamflow data obtained through 1967 from computer programs run for the evaluation study. Report now in progress.
2. Magnitude and Frequency of peak flows--an update of the Michigan portion of Water-Supply Paper 1677, Magnitude and Frequency of Floods in the United States, Part 4, St. Lawrence River Basin. That report used peak data through 1962. Data are now available through 1967 using log-Pearson Type III frequency distribution.
3. Flood-volume frequency based on analysis of annual maximum average flows for selected periods of time.
4. Statistics of mean annual and mean monthly flows.
5. Low-flow characteristics of Michigan streams--low-flow frequency, flow-duration, and storage requirements.

6. Compilation of base-flow data at partial-record and miscellaneous sites.

Utilizing available data to the extent possible, but depending primarily on the collection of additional data specifically required, the following studies should be initiated as part of the streamflow data program:

1. Further evaluate infiltration rates and determine surface and sub-surface geological factors that affect streamflow. Continue regression analysis in an attempt to improve equations for determining streamflow characteristics.
2. Time of travel and dispersion of solutes in selected streams in Michigan, especially those flowing through industrialized areas.
3. Regulated stream system.
4. Definition of flood plains and flood profiles on principal streams.
5. Frequency of floods on small streams and in urban areas.
6. Evaluate effects of urbanization.
7. Effects of reservoir development on streamflow.
8. Define channel properties (physiographic).
9. Define channel properties (geologic and hydraulic).

These types of data analyses and hydrologic studies are the most needed at present. Others will no doubt emerge as changing needs for streamflow data develop. The needs must and will be continuously evaluated as time goes on and the data programs altered as necessary to meet the needs.

References

- Benson, M. A., 1962, Factors influencing the occurrence of floods in a humid region of diverse terrain: U. S. Geol. Survey Water-Supply Paper 1580-B, 64 p.
- Benson, M. A., 1964, Factors affecting the occurrence of floods in the southwest: U. S. Geol. Survey Water-Supply Paper 1580-D, 72 p.
- Carter, R. W., and Benson, M. A., 1969, Concepts for the design of streamflow data programs: U. S. Geol. Survey open-file report, 33 p.
- Eichmeier, A. H., 1964, Snow depths in Michigan, East Lansing, Michigan Weather Service, 14 p., 10 figs., 1 table.
- Schneider, I. F., and Erickson, A. E., (no date) Water holding capacity and infiltration rates of soils in Michigan: Data from Michigan agriculture experiment project 413, Soil Science Department, Michigan State University. Atlas Folio.
- Strommen, N. D., 1959, Climates of the States, Michigan: Inivronmental Science Services Administration, Climatography of the U. S., no. 60-20, 25 p.
- U. S. Water Resources Council, 1967, A uniform technique for determining flood flow frequencies: U. S. Water Resources Council Bull. 15, 15 p.
- U. S. Weather Bureau, 1960, Rainfall intensity-frequency regime, U. S. Weather Bureau Tech. Paper 29, 31 p.

APPENDIX A

Table A-1.--Current Purpose Gaging Stations

Station number	Station name	Purpose						
		Account- ing	Oper- ation	Fore- casting	Dis- posal	Water quality	Compact or legal	Research or special studies
4-0310.	Black River near Bessemer	-----	X	-----	-----	-----	-----	-----
0330.	Middle Branch Ontonagon River near Paulding	-----	-----	-----	-----	-----	X	-----
0335.	Bond Falls Canal near Paulding	-----	X	-----	-----	-----	-----	-----
0345.	Middle Branch Ontonagon River near Trout Creek	-----	X	-----	-----	-----	-----	-----
0355.	Middle Branch Ontonagon River near Rockland	-----	X	-----	-----	-----	-----	-----
0360.	West Branch Ontonagon River near Bergland	-----	X	-----	-----	-----	-----	-----
0375.	Cisco Branch Ontonagon River nr. Cisco L. Outlet	-----	X	-----	-----	-----	-----	-----
0395.	South Branch Ontonagon River at Ewen	-----	X	-----	-----	-----	-----	-----
0400.	Ontonagon River near Rockland	-----	X	-----	-----	-----	-----	-----
0405.	Sturgeon River near Sidnaw	X	-----	-----	-----	-----	-----	-----
0415.	Sturgeon River near Alston	-----	-----	-----	-----	-----	X	-----
0430.	Sturgeon River near Arnheim	X	-----	-----	-----	-----	-----	-----
0444.	Carp River near Negaunee	-----	X	-----	-----	-----	-----	-----
0455.	Tahquamenon River near Tahquamenon Paradise	X	-----	-----	-----	-----	-----	-----
0565.	Manistique River near Manistique	X	-----	-----	-----	-----	-----	-----
0578.	Middle Branch Escanaba River at Humboldt	-----	X	-----	-----	-----	-----	-----
0580.	Middle Branch Escanaba River near Ishpeming	-----	X	-----	-----	-----	-----	X
0581.	Middle Branch Escanaba River near Princeton	-----	X	-----	-----	-----	-----	-----
0582.	Schweitzer Creek near Palmer	-----	X	-----	-----	-----	-----	-----
0584.	Goose Lake Outlet near Sands Station	-----	X	-----	-----	-----	-----	-----
0585.	East Branch Escanaba River at Gwinn	-----	X	-----	-----	-----	-----	X
0590.	Escanaba River at Cornell	X	X	-----	-----	-----	-----	-----
0610.	Brule River near Florence, Wis.	-----	-----	-----	-----	-----	X	-----
0615.	Paint River at Crystal Falls	-----	-----	-----	-----	-----	X	-----
0620.	Paint River near Alpha	-----	X	-----	-----	-----	-----	-----
0622.	Peshekee River near Champion	-----	X	-----	-----	-----	-----	-----
0622.3.	Michigamme River near Michigamme	-----	X	-----	-----	-----	-----	-----
0623.	Michigamme River at Republic	-----	X	-----	-----	-----	-----	-----
0624.	Michigamme River near Witch Lake	-----	X	-----	-----	-----	-----	-----
0625.	Michigamme River near Crystal Falls	-----	X	-----	-----	-----	-----	-----
0630.	Menominee River near Florence	-----	X	-----	-----	-----	-----	-----
0653.	West Branch Sturgeon River near Randville	-----	X	-----	-----	-----	-----	-----
0971.7.	Portage River near Vicksburg	-----	-----	-----	-----	-----	-----	X
0971.95.	Gourdneck Canal near Schoolcraft	-----	X	-----	-----	-----	-----	-----
0972.	Gourdneck Creek near Schoolcraft	-----	X	-----	-----	-----	-----	-----

Table A-1.--Current Purpose Gaging Stations--Continued

Station number	Station name	Purpose						
		Account- ing	Oper- ation	Fore- casting	Dis- posal	Water quality	Compact or legal	Research or special studies
4-0990.	St. Joseph River at Mottville	-----	X	-----	-----	-----	X	-----
1015.	St. Joseph River at Niles	X	-----	-----	-----	-----	-----	-----
1057.	Augusta Creek near Augusta	-----	-----	-----	-----	-----	-----	X
1058.	Gull Creek near Galesburg	-----	-----	-----	-----	-----	-----	X
1063.	Portage Creek near Kalamazoo	-----	X	-----	-----	-----	-----	-----
1064.	West Fork Portage Creek at Kalamazoo	-----	X	-----	-----	-----	-----	X
1085.	Kalamazoo River near Fennville	X	-----	-----	-----	-----	X	-----
1090.	Grand River at Jackson	-----	-----	-----	X	-----	-----	-----
1115.	Deer Creek near Dansville	-----	-----	-----	-----	X	-----	X
1120.	Sloan Creek near Williamston	-----	-----	-----	-----	X	-----	X
1125.	Red Cedar River at East Lansing	X	-----	-----	-----	-----	-----	-----
1130.	Grand River at Lansing	-----	-----	X	X	-----	-----	-----
1145.	Lookingglass River near Eagle	-----	X	-----	-----	-----	-----	-----
1160.	Grand River at Ionia	-----	-----	X	-----	-----	-----	-----
1170.	Quaker Brook near Nashville	-----	-----	-----	-----	-----	-----	X
1185.	Rogue River near Rockford	-----	-----	-----	X	-----	-----	-----
1190.	Grand River at Grand Rapids	-----	-----	X	-----	-----	-----	-----
1215.	Muskegon River at Ewart	X	-----	-----	-----	-----	-----	-----
1220.	Muskegon River at Newaygo	X	-----	-----	-----	-----	-----	-----
1221.	Bear Creek near Muskegon	-----	-----	-----	X	-----	-----	-----
1260.	Manistee River near Manistee	X	-----	-----	-----	-----	X	-----
1270.	Boardman River near Mayfield	-----	-----	-----	-----	-----	X	-----
1300.	Cheboygan River near Cheboygan	X	X	-----	-----	-----	-----	-----
1305.	Black River near Tower	-----	-----	-----	-----	-----	X	-----
1320.	Black River near Cheboygan	X	-----	-----	-----	-----	X	-----
1356.	East Branch Au Sable River at Grayling	-----	X	-----	-----	-----	-----	-----
1365.	Au Sable River at Mio	X	-----	-----	-----	-----	X	-----
1420.	Rifle River near Sterling	-----	-----	-----	-----	X	-----	-----
1439.	Shiawassee River at Linden	-----	-----	-----	X	-----	-----	-----
1445.	Shiawassee River at Owosso	-----	-----	X	X	X	-----	-----
1450.	Shiawassee River near Fergus	X	-----	-----	-----	-----	-----	-----
1460.	Farmers Creek near Lapeer	-----	-----	-----	X	-----	-----	-----
1475.	Flint River near Otisville	-----	-----	-----	X	-----	-----	-----
1485.	Flint River near Flint	-----	-----	-----	X	-----	-----	-----
1490.	Flint River near Fosters	X	-----	-----	-----	-----	-----	-----
1500.	South Branch Cass River near Cass City	-----	-----	-----	-----	-----	-----	X

Table A-1.--Current Purpose Gaging Stations--Continued

Station number	Station name	Purpose						
		Account- ing	Oper- ation	Fore- casting	Dis- posal	Water quality	Compact or legal	Research or special studies
4-1508.	Cass River at Wahjamega	-----	-----	-----	X	-----	-----	-----
1515.	Cass River at Frankenmuth	X	-----	-----	-----	-----	-----	-----
1550.	Pine River at Alma	-----	-----	-----	X	-----	-----	-----
1560.	Tittabawassee River at Midland	X	-----	-----	X	-----	-----	-----
1595.	Black River near Fargo	-----	-----	-----	-----	X	-----	-----
1605.7.	North Branch Belle River at Imlay City	-----	-----	-----	X	-----	-----	-----
1610.	Clinton River at Auburn Heights	-----	-----	-----	X	-----	-----	-----
1615.8.	Stony Creek near Romeo	-----	X	-----	-----	-----	-----	-----
1618.	Stony Creek near Washington	-----	X	-----	-----	-----	-----	-----
1629.	Big Beaver Creek near Warren	-----	-----	-----	X	-----	-----	X
1640.	Clinton River near Fraser	-----	-----	-----	X	X	-----	-----
1641.	East Pond Creek at Romeo	-----	-----	-----	-----	-----	-----	X
1641.5.	North Branch Clinton River near Meade	-----	-----	-----	-----	-----	-----	X
1642.	Coon Creek near Armada	-----	-----	-----	-----	-----	-----	X
1643.	East Branch Coon Creek at Armada	-----	-----	-----	-----	-----	-----	X
1643.5.	Highbank Creek near Armada	-----	-----	-----	-----	-----	-----	X
1643.6.	East Branch Coon Creek near New Haven	-----	-----	-----	-----	-----	-----	X
1655.	Clinton River at Mount Clemens	X	-----	-----	-----	-----	-----	-----
1665.	River Rouge at Detroit	-----	-----	-----	-----	-----	-----	X
1700.	Huron River at Milford	-----	X	-----	-----	-----	-----	-----
1705.	Huron River near New Hudson	-----	X	-----	-----	-----	-----	-----
1745.	Huron River at Ann Arbor	X	-----	-----	X	-----	-----	-----
1764.	Saline River near Saline	-----	-----	-----	X	-----	-----	-----
1765.	River Raisin near Monroe	X	-----	-----	-----	X	-----	-----

Table A-2.--Streamflow characteristics at gaging stations

CharacteristicQ₂, Q₅ ...; Annual flood peaks of 2, 5, ..., year recurrence interval.Q_a, q₁₀ ...; Mean annual flow, mean monthly flow for month indicated by subscript beginning with subscript 1 for January.SD_a, SD₁₀ ...; Standard deviation of annual flows, standard deviation of flows for month indicated by subscript beginning with subscript 1 for January.M_{7,2}; M_{7,10}; M_{7,20}; Average 7-day low-flows of 2-, 10-, or 20-year recurrence interval.V_{7,2}; V_{7,10}; V_{7,50}; Average 7-day flood volumes of 2-, 10-, or 50-year recurrence interval.

NUMBER	STATION NAME	Q ₂	Q ₅	Q ₁₀	Q ₂₅	Q ₅₀	Q _a	q ₁₀
04031000	Black River near Bessemer	3283.	5573.	7837.	11866.	15971.	226.00	152.00
04031500	Presque Isle River at Marenisco	1199.	1842.	2331.	3021.	3588.	172.00	116.00
04032000	Presque Isle River near Tula	2453.	3356.	3901.	4536.	4974.	268.00	171.00
04033000	M. Br. Ontonagon River near Paulding	936.	1338.	1600.	1923.	2158.	170.00	146.00
04035000	East Branch Ontonagon River near Mass	2880.	3808.	4305.	4826.	5151.	254.00	194.00
04040500	Sturgeon River near Sidnaw	2376.	3191.	3641.	4126.	4437.	203.00	129.00
04041500	Sturgeon River near Alston	3459.	4539.	5184.	5937.	6448.	410.00	294.00
04042500	Otter River near Elo	2808.	3830.	4428.	5105.	5559.	212.00	129.00
04043000	Sturgeon River near Arnheim	5758.	8565.	10789.	14054.	16842.	747.00	534.00
04045500	Tahquamenon R nr Tahquamenon Paradise	4216.	5291.	5935.	6689.	7216.	865.00	748.00
04046000	Black River near Garnet	219.	347.	481.	731.	997.	26.30	23.10
04049500	Manistique River at Germfask	1181.	1487.	1714.	2029.	2286.	440.00	412.00
04054500	Duck Creek near Blaney	891.	1211.	1417.	1673.	1860.	93.80	49.90
04055000	Manistique River near Blaney	3463.	4880.	6018.	7709.	9169.	820.00	671.00
04056000	W. Br. Manistique R. nr. Manistique	2582.	3544.	4196.	5038.	5678.	411.00	265.00
04056500	Manistique River near Manistique	6421.	9164.	11359.	14610.	17411.	1355.00	1031.00
04058000	M. Br. Escanaba River nr. Ishpeming	1045.	1504.	1868.	2404.	2861.	133.00	102.00
04058500	East Branch Escanaba River at Gwinn	784.	1074.	1312.	1671.	1986.	98.80	72.80
04059000	Escanaba River at Cornell	6080.	8062.	9317.	10847.	11953.	829.00	582.00
04059500	Ford River near Hyde	2497.	3492.	4470.	6166.	7850.	341.00	246.00
04061000	Brule River near Florence, Wis.	1478.	2226.	2814.	3671.	4396.	348.00	296.00
04061500	Paint River at Crystal Falls	4086.	6079.	7663.	9992.	11985.	568.00	418.00
04065300	W. Br. Sturgeon R. nr. Randville	280.	366.	438.	551.	651.	39.60	32.00
04065500	Sturgeon River near Foster City	1077.	1491.	1838.	2368.	2839.	171.00	140.00
04097500	St. Joseph River at Three Rivers	3150.	4416.	5363.	6688.	7773.	919.00	543.00
04098500	Fawn River near White Pigeon	352.	448.	498.	550.	581.	138.00	94.00
04099000	St. Joseph River at Mottville	6465.	6175.	7210.	8566.	9562.	1472.00	937.00
04101500	St. Joseph River at Niles	9842.	12970.	14657.	16442.	17565.	3044.00	2020.30
04102500	Paw Paw River at Riverside	1141.	1406.	1577.	1790.	1946.	384.00	316.00
04103500	Kalamazoo River at Marshall	909.	1287.	1578.	1997.	2347.	280.00	208.00
04105000	Battle Creek at Battle Creek	1249.	1898.	2318.	2830.	3196.	189.00	98.40
04105500	Kalamazoo River near Battle Creek	2342.	3498.	4415.	5759.	6907.	613.00	410.00
04106000	Kalamazoo River at Comstock	2657.	3787.	4592.	5672.	6522.	794.00	578.00
04106500	Portage Creek at Kalamazoo	221.	330.	403.	497.	566.	56.50	53.60
04108500	Kalamazoo River near Fennville	3954.	5461.	6577.	8130.	9393.	1301.00	958.00
04109000	Grand River at Jackson	614.	769.	869.	993.	1085.	110.00	58.90
04109500	Portage R below L Portage L nr Munith	276.	427.	544.	709.	846.	41.40	21.50
04110000	Orchard Creek at Munith	468.	779.	1008.	1317.	1560.	37.20	14.10
04111000	Grand River near Eaton Rapids	1999.	2883.	3414.	4024.	4437.	394.00	222.00
04111500	Deer Creek near Dansville	254.	412.	489.	558.	599.	8.67	4.40
04112000	Sloan Creek near Williamston	197.	366.	471.	588.	662.	4.52	2.01
04112500	Red Cedar River at East Lansing	2181.	3283.	3851.	4404.	4719.	185.00	74.00
04113000	Grand River at Lansing	5186.	8358.	10808.	14301.	17191.	787.00	374.00
04114000	Grand River at Portland	4589.	6463.	7572.	8833.	9681.	744.00	387.00
04114500	Lookingglass River near Eagle	1127.	1748.	2117.	2528.	2796.	158.00	62.60
04115000	Maple River at Maple Rapids	1961.	3625.	4927.	6763.	8250.	232.00	69.20
04116000	Grand River at Ionia	9914.	15283.	18788.	23082.	26162.	1597.00	712.00
04116500	Fiat River at Smyrna	1491.	2030.	2412.	2926.	3331.	399.00	295.00
04117000	Quaker Brook near Nashville	94.	172.	235.	330.	411.	5.17	4.12
04117500	Thornapple River near Hastings	2017.	3301.	4216.	5421.	6344.	279.00	147.00
04118000	Thornapple River near Caledonia	2653.	4128.	5097.	6288.	7144.	508.00	317.00
04118500	Rogue River near Rockford	1316.	1780.	2059.	2381.	2603.	211.00	156.00
04119000	Grand River at Grand Rapids	17809.	27206.	33424.	41153.	46781.	3372.00	1864.00
04121000	Muskegon River near Merritt	801.	1009.	1116.	1227.	1295.	221.00	145.00
04121500	Muskegon River at Evart	4077.	5585.	6504.	7583.	8333.	964.00	666.00
04122000	Muskegon River at Newaygo	6009.	7957.	9174.	10641.	11689.	1908.00	1431.00
04122200	White River near Whitehall	1271.	2025.	2638.	3552.	4344.	390.00	319.00
04122500	Pere Marquette River at Scottville	1671.	2189.	2489.	2828.	3056.	621.00	513.00
04123000	Big Sable River near Freesoil	355.	443.	487.	532.	559.	139.00	116.00
04123500	Manistee River near Grayling	294.	328.	346.	366.	378.	182.00	179.00
04124000	Manistee River near Sherman	2353.	2781.	3036.	3334.	3542.	1034.00	936.00
04124500	East Branch Pine River near Tustin	321.	594.	861.	1334.	1811.	25.90	18.40
04125000	Pine River near LeRoy	562.	815.	1042.	1412.	1761.	88.00	77.00
04125500	Pine River near Hoxeyville	948.	1325.	1630.	2085.	2480.	276.00	254.00
04126000	Manistee River near Manistee	4990.	6122.	6744.	7422.	7865.	1958.00	1782.00
04126200	Little Manistee R. nr. Freesoil	384.	487.	540.	593.	626.	197.00	169.00
04127000	Boardman River near Mayfield	627.	833.	979.	1173.	1326.	190.00	174.00
04128000	Sturgeon River near Wolverine	662.	848.	959.	1087.	1176.	200.00	188.00
04128500	Indian River at Indian River	849.	976.	1046.	1122.	1172.	544.00	462.00
04129000	Pigeon River near Vanderbilt	429.	716.	965.	1358.	1716.	74.80	70.30
04129500	Pigeon River at Afton	659.	864.	983.	1117.	1206.	133.00	115.00
04130000	Cheboygan River near Cheboygan	1346.	1503.	1586.	1675.	1732.	775.00	616.00
04130500	Black River near Tower	1153.	1509.	1722.	1969.	2140.	251.00	208.00
04131000	Rainy River near Onaway	328.	498.	595.	698.	763.	24.90	10.20
04131500	Rainy River near Ocqueoc	399.	619.	757.	918.	1029.	36.30	16.80
04132000	Black River near Cheboygan	1442.	1858.	2108.	2400.	2604.	418.00	307.00
04132500	Thunder Bay River near Hillman	874.	1164.	1315.	1471.	1565.	208.00	177.00
04134000	N. Br. Thunder Bay R. nr. Bolton	1332.	1947.	2314.	2732.	3013.	105.00	49.70

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	Q2	Q5	Q10	Q25	Q50	Qa	q10
04135500	Au Sable River at Grayling	165.	203.	224.	247.	263.	73.20	67.40
04135600	E. Br. Au Sable River at Grayling	99.	126.	139.	153.	160.	40.70	38.70
04136500	Au Sable River at Mio	2814.	3095.	3262.	3458.	3596.	926.00	850.00
04138000	E. Br. Au Gres River at McIvor	543.	795.	925.	1052.	1126.	62.80	45.00
04138500	Au Gres River near National City	1331.	1753.	1850.	1892.	1903.	93.60	51.80
04139000	Houghton Creek near Lupton	347.	529.	649.	796.	902.	50.80	45.00
04139500	Rifle River at "The Ranch" nr. Lupton	497.	736.	905.	1129.	1303.	90.50	76.50
04140000	Prior Creek near Selkirk	196.	298.	366.	453.	518.	16.30	11.00
04140500	Rifle River at Selkirk	930.	1439.	1787.	2232.	2565.	140.00	108.00
04141000	S. Br. Shepards Creek near Selkirk	72.	130.	154.	171.	178.	0.52	0.20
04141500	W. Br. Rifle River near Selkirk	691.	940.	1101.	1302.	1449.	60.20	50.00
04142000	Rifle River near Sterling	2374.	3306.	3791.	4282.	4574.	302.00	212.00
04143500	N. Br. Kawkawlin R. nr. Kawkawlin	832.	1254.	1455.	1636.	1731.	53.70	8.74
04144000	Shiawassee River at Byron	1483.	2246.	2706.	3231.	3581.	238.00	124.00
04144500	Shiawassee River at Owosso	2504.	3836.	4551.	5275.	5703.	302.00	133.00
04145000	Shiawassee River near Fergus	3697.	5369.	6292.	7268.	7875.	401.00	175.00
04145500	Bad River near Brant	1211.	1914.	2377.	2946.	3355.	62.90	22.90
04146000	Farmers Creek near Lapeer	310.	555.	743.	1005.	1215.	27.80	10.70
04147500	Flint River near Otisville	1895.	3529.	4786.	6524.	7905.	248.00	102.00
04148000	Flint River at Genesee	3112.	4794.	5584.	6276.	6628.	358.00	142.00
04148200	Swartz Creek near Holly	46.	64.	76.	90.	100.	5.80	2.60
04148500	Flint River near Flint	4691.	7176.	8927.	11237.	13017.	531.00	203.00
04150000	S. Br. Cass River near Cass City	2770.	4119.	4576.	4864.	4966.	117.00	14.60
04150500	Cass River at Cass City	3801.	5931.	6794.	7440.	7715.	190.00	23.70
04151000	Cass River at Vassar	5976.	9967.	12015.	13933.	14969.	371.00	75.60
04151500	Cass River at Frankenthuth	7553.	12103.	14424.	16615.	17813.	454.00	121.00
04152500	Tobacco River at Beaverton	3691.	5366.	6501.	7954.	9048.	358.00	255.00
04153500	Salt River near North Bradley	2123.	3992.	5371.	7194.	8578.	76.50	26.00
04154000	Chippewa River near Mount Pleasant	1772.	2809.	3557.	4559.	5342.	292.00	197.00
04154500	Chippewa River near Midland	3661.	5112.	6186.	7509.	8466.	419.00	234.00
04155000	Pine River at Alma	1385.	2357.	3113.	4190.	5077.	198.00	121.00
04155500	Pine River near Midland	2333.	3701.	4637.	5833.	6722.	271.00	151.00
04156000	Tittabawassee River at Midland	13029.	21546.	27501.	35184.	40947.	1548.00	832.00
04157500	Sebewaing River near Sebewaing	1810.	2355.	2580.	2763.	2850.	34.70	10.90
04158000	E. Fk. Sebewaing R. nr. Sebewaing	881.	1234.	1360.	1445.	1479.	18.20	5.64
04158500	Pigeon River near Owendale	936.	1740.	2139.	2685.	2654.	27.20	8.10
04159500	Black River near Fargo	6164.	9377.	10650.	11589.	11985.	271.00	65.80
04160000	Mill Creek near Abbottsford	1657.	2643.	3013.	3264.	3361.	97.00	26.70
04160500	Black River near Port Huron	5706.	9052.	11587.	15142.	18043.	289.00	30.60
04161000	Clinton River at Auburn Heights	476.	576.	620.	658.	679.	74.80	40.80
04161500	Paint Creek near Lake Orion	132.	232.	313.	433.	535.	19.90	13.10
04161800	Stony Creek near Washington	208.	314.	390.	491.	571.	29.10	12.90
04162900	Big Beaver Creek near Warren	501.	742.	906.	1114.	1270.	11.20	2.70
04163500	Plum Brook near Utica	384.	644.	824.	1052.	1219.	11.40	4.70
04164000	Clinton River near Fraser	3380.	5233.	6613.	8523.	10064.	318.00	171.00
04164100	East Pond Creek at Romeo	104.	192.	269.	393.	506.	10.60	5.02
04164300	East Branch Coon Creek at Armada	250.	490.	672.	915.	1101.	4.72	0.68
04164500	N. Br. Clinton R. nr. Mount Clemens	2362.	3895.	4962.	6336.	7363.	108.00	30.30
04165500	Clinton River at Mount Clemens	6130.	10428.	13862.	18878.	23115.	470.00	197.00
04166000	River Rouge at Birmingham	275.	454.	588.	774.	924.	13.70	6.41
04166100	River Rouge at Southfield	918.	1363.	1677.	2093.	2417.	39.50	16.20
04166200	Evans Ditch at Southfield	275.	383.	463.	574.	664.	5.78	2.24
04166300	Upper River Rouge at Farmington	200.	370.	520.	760.	960.	8.11	3.19
04166500	River Rouge at Detroit	2002.	3701.	4957.	6627.	7904.	104.00	40.80
04167000	Middle River Rouge near Garden City	1073.	1541.	1843.	2214.	2482.	62.50	27.60
04168000	Lower River Rouge at Inkster	1429.	2193.	2731.	3439.	3985.	46.50	14.20
04169500	Huron River at Commerce	106.	153.	189.	241.	283.	35.20	20.50
04170000	Huron River at Milford	313.	425.	495.	579.	640.	89.20	61.80
04170500	Huron River near New Hudson	323.	485.	620.	830.	1018.	102.00	76.20
04171500	Ore Creek near Brighton	78.	107.	127.	155.	176.	21.30	14.80
04172000	Huron River near Hamburg	578.	837.	1025.	1282.	1487.	184.00	126.00
04173000	Huron River near Dexter	1043.	1600.	2038.	2675.	3214.	341.00	198.00
04173500	Mill Creek near Dexter	727.	1001.	1158.	1331.	1445.	62.60	35.00
04174500	Huron River at Ann Arbor	1964.	3031.	3793.	4807.	5597.	407.00	221.00
04175700	River Raisin near Tecumseh	1034.	1296.	1397.	1475.	1511.	140.00	75.70
04176000	River Raisin near Adrian	2532.	3685.	4335.	5035.	5479.	261.00	138.00
04176500	River Raisin near Monroe	5693.	8567.	10368.	12497.	13977.	648.00	225.00

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	q11	q12	q1	q2	q3	q4	q5
04031000	Black River near Bessemer	199.00	112.00	63.00	49.40	156.00	1131.00	417.00
04031500	Presque Isle River at Marenisco	136.00	104.00	80.90	73.20	119.00	493.00	371.00
04032000	Presque Isle River near Tula	207.00	142.00	98.60	88.50	158.00	956.00	585.00
04033000	M. Br. Ontonagon R. nr. Paulding	149.00	118.00	105.00	100.00	134.00	355.00	300.00
04035000	E. Br. Ontonagon River near Mass	224.00	172.00	143.00	134.00	241.00	712.00	394.00
04040500	Sturgeon River near Sidnaw	158.00	104.00	65.30	53.60	132.00	757.00	490.00
04041500	Sturgeon River near Alston	348.00	259.00	209.00	187.00	329.00	1177.00	895.00
04042500	Otter River near Elo	162.00	132.00	111.00	105.00	195.00	793.00	382.00
04043000	Sturgeon River near Arnheim	624.00	498.00	402.00	366.00	642.00	2575.00	1636.00
04045500	Tahquamenon R nr Tahquemenon Paradise	962.00	786.00	455.00	438.00	548.00	2633.00	1858.00
04046000	Black River near Garnet	29.50	23.20	14.70	13.00	18.10	83.70	44.80
04049500	Manistique River at Germfask	478.00	433.00	380.00	353.00	414.00	808.00	651.00
04054500	Duck Creek near Blaney	89.10	68.50	53.50	41.20	104.00	389.00	163.00
04055000	Manistique River near Blaney	872.00	766.00	621.00	558.00	778.00	2125.00	1319.00
04056000	W. Br. Manistique R. nr. Manistique	399.00	331.00	254.00	217.00	354.00	1243.00	787.00
04056500	Manistique River near Manistique	1397.00	1203.00	946.00	818.00	1206.00	3810.00	2396.00
04058000	M. Br. Escanaba R. nr. Ishpeming	116.00	80.80	54.90	44.00	63.50	456.00	307.00
04058500	E. Br. Escanaba R. at Gwinn	85.20	63.80	45.60	38.70	57.70	347.00	202.00
04059000	Escanaba River at Cornell	700.00	497.00	344.00	302.00	482.00	2691.00	1662.00
04059500	Ford River near Hyde	302.00	176.00	111.00	79.00	166.00	1219.00	930.00
04061000	Brule River near Florence, Wis.	318.00	260.00	235.00	225.00	287.00	650.00	525.00
04061500	Paint River at Crystal Falls	452.00	345.00	294.00	274.00	409.00	1547.00	1077.00
04065300	W. Br. Sturgeon R. nr. Randville	37.20	25.40	20.10	16.90	29.60	104.00	87.00
04065500	Sturgeon River near Foster City	152.00	99.20	72.70	59.50	104.00	506.00	393.00
04097500	St. Joseph River at Three Rivers	668.00	806.00	879.00	1024.00	1666.00	1762.00	1382.00
04098500	Fawn River near White Pigeon	114.00	133.00	133.00	152.00	213.00	229.00	194.00
04099000	St. Joseph River at Mottville	1118.00	1297.00	1524.00	1689.00	2355.00	2545.00	2035.00
04101500	St. Joseph River at Niles	2278.00	2527.00	3111.00	3506.00	4765.00	5106.00	4235.00
04102500	Paw Paw River at Riverside	361.00	407.00	425.00	456.00	616.00	561.00	459.00
04103500	Kalamazoo River at Marshall	231.00	258.00	286.00	314.00	428.00	454.00	344.00
04105000	Battle Creek at Battle Creek	130.00	150.00	184.00	217.00	404.00	359.00	268.00
04105500	Kalamazoo River near Battle Creek	480.00	532.00	586.00	682.00	1053.00	1015.00	815.00
04106000	Kalamazoo River at Comstock	669.00	711.00	795.00	872.00	1262.00	1247.00	1014.00
04106500	Portage Creek at Kalamazoo	54.70	55.90	56.80	57.30	63.90	66.30	62.30
04108500	Kalamazoo River near Fennville	1144.00	1233.00	1390.00	1473.00	2019.00	1949.00	1632.00
04109000	Grand River at Jackson	80.20	87.00	106.00	128.00	201.00	215.00	160.00
04109500	Portage R below L Portage L nr Munith	27.40	30.40	39.40	43.60	92.80	105.00	66.30
04110000	Orchard Creek at Munith	17.40	25.40	39.80	44.90	83.70	89.20	61.60
04111000	Grand River near Eaton Rapids	298.00	357.00	411.00	480.00	827.00	806.00	573.00
04111500	Deer Creek near Dansville	5.14	7.50	6.37	10.50	26.50	18.40	12.10
04112000	Sloan Creek near Williamston	1.95	3.27	2.58	5.23	15.60	10.10	6.99
04112500	Red Cedar River at East Lansing	97.40	134.00	168.00	248.00	465.00	424.00	296.00
04113000	Grand River at Lansing	458.00	546.00	687.00	905.00	1879.00	1668.00	1121.00
04114000	Grand River at Portland	495.00	600.00	581.00	814.00	1804.00	1565.00	1176.00
04114500	Lookingglass River near Eagle	84.20	109.00	147.00	183.00	404.00	376.00	253.00
04115000	Maple River at Maple Rapids	104.00	162.00	215.00	237.00	680.00	604.00	371.00
04116000	Grand River at Ionia	1049.00	1242.00	1429.00	1760.00	3894.00	3639.00	2519.00
04116500	Flat River at Smyrna	365.00	383.00	367.00	403.00	621.00	745.00	536.00
04117000	Quaker Brook near Nashville	4.84	5.27	4.61	6.10	10.70	8.22	6.25
04117500	Thornapple River near Hastings	177.00	229.00	292.00	315.00	651.00	575.00	419.00
04118000	Thornapple River near Caledonia	394.00	443.00	493.00	552.00	1051.00	963.00	754.00
04118500	Rogue River near Rockford	194.00	208.00	181.00	215.00	356.00	387.00	284.00
04119000	Grand River at Grand Rapids	2248.00	2585.00	3188.00	3901.00	7391.00	6636.00	4560.00
04121000	Muskegon River near Merritt	184.00	197.00	188.00	183.00	255.00	520.00	371.00
04121500	Muskegon River at Evert	852.00	847.00	796.00	815.00	1437.00	2165.00	1340.00
04122000	Muskegon River at Newaygo	1762.00	1765.00	1791.00	1933.00	2886.00	3315.00	2429.00
04122200	White River near Whitehall	395.00	418.00	372.00	372.00	527.00	651.00	461.00
04122500	Pere Marquette R. at Scottville	607.00	626.00	616.00	608.00	829.00	947.00	734.00
04123000	Big Sable River near Freesoil	136.00	138.00	135.00	137.00	178.00	204.00	160.00
04123500	Manistee River near Grayling	185.00	178.00	172.00	171.00	182.00	218.00	193.00
04124000	Manistee River near Sherman	1017.00	1007.00	983.00	979.00	1155.00	1490.00	1156.00
04124500	E. Br. Pine River near Tustin	24.60	17.80	14.40	17.90	46.80	79.90	34.90
04125000	Pine River near LeRoy	89.50	74.00	64.90	71.00	125.00	184.00	108.00
04125500	Pine River near Hoxeyville	277.00	267.00	240.00	250.00	328.00	420.00	306.00
04126000	Manistee River near Manistee	1933.00	1946.00	1836.00	1841.00	2191.00	2953.00	2197.00
04126200	Little Manistee R. nr. Freesoil	181.00	221.00	188.00	198.00	214.00	282.00	224.00
04127000	Boardman River near Mayfield	186.00	185.00	167.00	166.00	197.00	286.00	223.00
04128000	Sturgeon River near Wolverine	206.00	191.00	181.00	178.00	228.00	299.00	222.00
04128500	Indian River at Indian River	503.00	549.00	556.00	561.00	570.00	711.00	737.00
04129000	Pigeon River near Vanderbilt	79.70	72.50	67.10	66.00	80.50	122.00	85.30
04129500	Pigeon River at Afton	132.00	116.00	110.00	107.00	168.00	259.00	166.00
04130000	Cheboygan River near Cheboygan	718.00	770.00	812.00	800.00	860.00	1072.00	1047.00
04130500	Black River near Tower	224.00	224.00	200.00	196.00	301.00	529.00	340.00
04131000	Rainy River near Onaway	18.20	11.50	11.40	8.36	50.80	117.00	40.80
04131500	Rainy River near Ocqueoc	24.50	28.70	14.80	15.90	44.20	153.00	78.50
04132000	Black River near Cheboygan	382.00	423.00	385.00	377.00	476.00	949.00	636.00
04132500	Thunder Bay River near Hillman	202.00	196.00	185.00	178.00	241.00	372.00	260.00
04134000	N. Br. Thunder Bay R. nr. Bolton	72.20	73.60	59.40	51.40	167.00	456.00	172.00

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	Q11	Q12	Q1	Q2	Q3	Q4	Q5
04135500	Au Sable River at Grayling	73.20	70.20	66.80	64.20	76.80	106.00	84.70
04135600	E. Br. Au Sable River at Grayling	40.40	39.70	34.40	32.40	37.70	65.70	53.10
04136500	Au Sable River at Mio	904.00	887.00	819.00	806.00	957.00	1410.00	1129.00
04138000	E. Br. Au Gres River at McIvor	51.20	52.80	44.80	49.40	92.00	135.00	92.90
04138500	Au Gres River near National City	68.20	80.50	58.10	72.80	205.00	280.00	145.00
04139000	Houghton Creek near Lupton	48.70	49.50	44.00	47.30	69.00	80.40	58.00
04139500	Rifle R. at "The Ranch" nr. Lupton	87.30	89.50	79.30	84.30	119.00	152.00	108.00
04140000	Prior Creek near Selkirk	14.30	15.90	11.10	13.20	31.30	38.80	22.20
04140500	Rifle River at Selkirk	128.00	135.00	115.00	126.00	207.00	274.00	182.00
04141000	S. Br. Shepards Creek near Selkirk	0.34	0.36	0.19	0.49	2.13	1.50	0.60
04141500	W. Br. Rifle River near Selkirk	58.30	53.10	45.90	51.10	109.00	121.00	76.70
04142000	Rifle River near Sterling	259.00	265.00	244.00	280.00	550.00	627.00	387.00
04143500	N. Br. Kawkawlin R. nr. Kawkawlin	32.40	29.20	29.70	34.60	168.00	189.00	101.00
04144000	Shiawassee River at Byron	161.00	210.00	234.00	316.00	540.00	485.00	346.00
04144500	Shiawassee River at Owosso	184.00	238.00	296.00	413.00	697.00	645.00	461.00
04145000	Shiawassee River near Fergus	238.00	310.00	388.00	519.00	985.00	843.00	624.00
04145500	Bad River near Brant	43.50	47.00	69.90	76.40	197.00	154.00	64.90
04146000	Farmers Creek near Lapeer	16.10	20.80	24.80	37.10	71.00	64.10	42.30
04147500	Flint River near Otisville	184.00	169.00	170.00	267.00	727.00	579.00	417.00
04148000	Flint River at Genesee	208.00	270.00	412.00	550.00	910.00	753.00	450.00
04148200	Swartz Creek near Holly	3.93	5.09	4.37	5.42	13.20	15.90	9.28
04148500	Flint River near Flint	302.00	386.00	472.00	687.00	1404.00	1235.00	760.00
04150000	S. Br. Cass River near Cass City	37.40	84.60	100.00	162.00	438.00	308.00	131.00
04150500	Cass River at Cass City	69.90	132.00	174.00	255.00	720.00	500.00	218.00
04151000	Cass River at Vassar	173.00	277.00	333.00	494.00	1199.00	967.00	469.00
04151500	Cass River at Frankenmuth	216.00	306.00	393.00	549.00	1515.00	1071.00	630.00
04152500	Tobacco River at Beaverton	300.00	316.00	290.00	344.00	672.00	746.00	423.00
04153500	Salt River near North Bradley	40.20	49.20	53.20	98.90	274.00	178.00	86.90
04154000	Chippewa River near Mount Pleasant	248.00	257.00	260.00	321.00	565.00	564.00	354.00
04154500	Chippewa River near Midland	326.00	361.00	325.00	412.00	877.00	997.00	557.00
04155000	Pine River at Alma	166.00	172.00	176.00	221.00	437.00	403.00	257.00
04155500	Pine River near Midland	200.00	234.00	234.00	334.00	589.00	620.00	333.00
04156000	Tittabawassee River at Midland	1165.00	1207.00	1222.00	1611.00	3689.00	3526.00	2034.00
04157500	Sebewaing River near Sebewaing	15.60	20.30	37.90	61.60	129.00	68.40	26.70
04158000	E. Fk. Sebewaing R. nr. Sebewaing	6.68	9.27	18.40	34.00	73.40	37.20	13.00
04158500	Pigeon River near Owendale	13.20	23.20	15.70	29.90	103.00	63.20	35.40
04159500	Black River near Fargo	82.40	181.00	244.00	395.00	993.00	646.00	325.00
04160000	Mill Creek near Abbottsford	39.50	78.10	102.00	142.00	338.00	228.00	122.00
04160500	Black River near Port Huron	92.10	203.00	185.00	556.00	956.00	804.00	367.00
04161000	Clinton River at Auburn Heights	56.10	69.10	72.50	91.70	118.00	143.00	107.00
04161500	Paint Creek near Lake Orion	11.80	15.90	14.60	17.40	34.00	46.90	34.20
04161800	Stony Creek near Washington	19.50	25.00	24.10	29.50	72.60	74.80	38.10
04162900	Big Beaver Creek near Warren	5.71	12.50	7.72	13.40	35.70	29.80	11.30
04163500	Plum Brook near Utica	7.68	11.00	7.51	13.90	31.80	28.80	18.10
04164000	Clinton River near Fraser	212.00	294.00	323.00	405.00	631.00	618.00	438.00
04164100	East Pond Creek at Romeo	6.45	7.77	7.55	12.20	26.90	28.50	14.00
04164300	E. Br. Coon Creek at Armada	1.84	3.60	2.21	5.18	17.80	15.40	3.35
04164500	N. Br. Clinton R. nr. Mount Clemens	54.50	106.00	111.00	180.00	322.00	260.00	140.00
04165500	Clinton River at Mount Clemens	252.00	385.00	458.00	686.00	1050.00	1000.00	689.00
04166000	River Rouge at Birmingham	8.91	12.60	11.80	17.20	33.30	29.80	19.90
04166100	River Rouge at Southfield	24.80	35.90	29.20	44.70	109.00	96.20	45.50
04166200	Evans Ditch at Southfield	3.57	5.78	3.87	6.37	13.00	12.20	5.94
04166300	Upper River Rouge at Farmington	4.87	6.23	5.74	9.69	24.00	20.30	10.80
04166500	River Rouge at Detroit	56.80	87.80	105.00	159.00	224.00	228.00	168.00
04167000	Middle River Rouge nr. Garden City	37.40	58.40	69.60	92.40	137.00	128.00	88.80
04168000	Lower River Rouge at Inkster	23.30	46.00	56.20	86.60	126.00	108.00	49.10
04169500	Huron River at Commerce	26.60	33.00	35.60	39.50	59.90	71.20	52.70
04170000	Huron River at Milford	75.00	88.20	92.40	103.00	147.00	161.00	115.00
04170500	Huron River near New Hudson	122.00	115.00	109.00	120.00	157.00	141.00	122.00
04171500	Ore Creek near Brighton	17.80	20.50	20.20	21.90	39.30	41.40	29.60
04172000	Huron River near Hamburg	187.00	180.00	181.00	193.00	315.00	296.00	257.00
04173000	Huron River near Dexter	282.00	323.00	341.00	376.00	606.00	688.00	502.00
04173500	Mill Creek near Dexter	45.90	62.60	52.40	73.30	155.00	135.00	79.00
04174500	Huron River at Ann Arbor	301.00	352.00	394.00	499.00	813.00	842.00	583.00
04175700	River Raisin near Tecumseh	110.00	146.00	135.00	176.00	304.00	289.00	169.00
04176000	River Raisin near Adrian	192.00	253.00	235.00	348.00	612.00	550.00	324.00
04176500	River Raisin near Monroe	376.00	504.00	730.00	963.00	1599.00	1391.00	960.00

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	Q6	Q7	Q8	Q9	SD ₆	SD ₁₀	SD ₁₁
04031000	Black River near Bessemer	145.00	80.70	97.70	120.00	37.20	116.00	61.20
04031500	Presque Isle River at Marenisco	218.00	151.00	100.00	106.00	51.00	98.20	70.00
04032000	Presque Isle River near Tula	308.00	210.00	142.00	154.00	78.40	158.00	118.00
04033000	M. Br. Ontonagon River near Paulding	222.00	161.00	124.00	132.00	35.90	76.00	43.70
04035000	E. Br. Ontonagon R. nr. Mass	292.00	207.00	167.00	173.00	45.70	91.80	64.60
04040500	Sturgeon River near Sidnaw	232.00	130.00	76.70	110.00	47.60	120.00	74.80
04041500	Sturgeon River near Alston	480.00	306.00	216.00	250.00	73.20	178.00	131.00
04042500	Otter River near Elo	195.00	126.00	110.00	111.00	36.50	57.00	60.40
04043000	Sturgeon River near Arnheim	858.00	582.00	419.00	427.00	150.00	314.00	237.00
04045500	Tahquamenon R. nr. Tahquamenon Paradise	614.00	466.00	318.00	554.00	162.00	483.00	359.00
04046000	Black River near Garnet	21.00	16.40	12.00	16.00	7.85	18.20	15.20
04049500	Manistique River at Germfask	446.00	330.00	258.00	322.00	70.70	125.00	106.00
04054500	Duck Creek near Blaney	86.70	40.40	21.20	21.70	23.30	66.70	63.20
04055000	Manistique River near Blaney	774.00	524.00	375.00	463.00	170.00	335.00	312.00
04056000	W. Br. Manistique R. nr. Manistique	464.00	270.00	176.00	177.00	75.60	147.00	170.00
04056500	Manistique River near Manistique	1302.00	852.00	597.00	709.00	296.00	565.00	541.00
04058000	M. Br. Escanaba River near Ishpeming	139.00	88.00	64.50	77.70	41.20	76.40	54.20
04058500	E. Br. Escanaba River at Gwinn	103.00	69.00	47.50	54.40	35.20	59.60	42.90
04059000	Escanaba River at Cornell	891.00	677.00	548.00	576.00	222.00	398.00	308.00
04059500	Ford River near Hyde	347.00	182.00	125.00	208.00	121.00	218.00	179.00
04061000	Brule River near Florence, Wis.	406.00	369.00	289.00	304.00	70.90	97.30	89.90
04061500	Paint River at Crystal Falls	709.00	528.00	358.00	403.00	132.00	243.00	128.00
04065300	W. Br. Sturgeon River nr. Randville	42.10	23.00	24.90	33.90	9.59	12.50	15.10
04065500	Sturgeon River near Foster City	190.00	118.00	93.80	128.00	48.40	94.20	65.00
04097500	St. Joseph River at Three Rivers	826.00	575.00	460.00	443.00	275.00	268.00	297.00
04098500	Fawn River near White Pigeon	125.00	98.30	91.70	87.20	36.40	29.70	33.90
04099000	St. Joseph River at Mottville	1492.00	1045.00	836.00	817.00	466.00	344.00	415.00
04101500	St. Joseph River at Niles	3052.00	2283.00	1901.00	1792.00	914.00	890.00	822.00
04102500	Paw Paw River at Riverside	322.00	248.00	223.00	225.00	85.50	162.00	148.00
04103500	Kalamazoo River at Marshall	263.00	226.00	183.00	176.00	97.50	95.30	89.30
04105000	Battle Creek at Battle Creek	204.00	99.60	74.20	82.20	69.50	60.20	77.70
04105500	Kalamazoo River near Battle Creek	645.00	433.00	353.00	360.00	200.00	170.00	197.00
04106000	Kalamazoo River at Comstock	810.00	592.00	495.00	495.00	223.00	219.00	240.00
04106500	Portage Creek at Kalamazoo	57.10	53.30	48.10	48.50	9.40	10.00	10.80
04108500	Kalamazoo River near Fennville	1272.00	908.00	815.00	838.00	299.00	325.00	362.00
04109000	Grand River at Jackson	122.00	71.20	50.00	47.70	36.90	34.10	36.40
04109500	Portage R below L Portage L nr Munith	38.70	15.10	6.58	10.20	11.30	24.60	16.50
04110000	Orchard Creek at Munith	42.70	12.70	7.50	7.81	11.50	15.40	11.00
04111000	Grand River near Eaton Rapids	310.00	197.00	136.00	124.00	136.00	192.00	168.00
04111500	Deer Creek near Dansville	4.69	4.97	2.13	1.52	3.73	8.99	6.05
04112000	Sloan Creek near Williamston	1.86	2.79	1.27	0.64	2.27	5.69	3.61
04112500	Red Cedar River at East Lansing	158.00	69.60	44.90	49.80	81.80	91.40	80.10
04113000	Grand River at Lansing	819.00	435.00	288.00	283.00	290.00	292.00	256.00
04114000	Grand River at Portland	600.00	400.00	272.00	244.00	237.00	333.00	310.00
04114500	Lookingglass River near Eagle	115.00	65.00	42.00	51.90	68.30	63.80	64.90
04115000	Maple River at Maple Rapids	150.00	82.40	47.40	62.00	96.10	106.00	124.00
04116000	Grand River at Ionia	1130.00	805.00	537.00	465.00	560.00	532.00	748.00
04116500	Flat River at Smyrna	329.00	254.00	240.00	251.00	87.90	94.10	109.00
04117000	Quaker Brook near Nashville	4.15	2.75	2.52	2.56	1.45	3.29	1.90
04117500	Thornapple River near Hastings	223.00	123.00	94.90	104.00	101.00	116.00	95.60
04118000	Thornapple River near Caledonia	405.00	278.00	227.00	217.00	152.00	210.00	200.00
04118500	Rogue River near Rockford	182.00	126.00	119.00	124.00	39.60	65.70	61.90
04119000	Grand River at Grand Rapids	3145.00	1868.00	1437.00	1600.00	1086.00	998.00	1081.00
04121000	Muskegon River near Merritt	225.00	161.00	112.00	114.00	55.00	88.30	87.10
04121500	Muskegon River at Evert	972.00	664.00	499.00	527.00	194.00	286.00	335.00
04122000	Muskegon River at Newaygo	1870.00	1357.00	1150.00	1214.00	394.00	504.00	601.00
04122200	White River near Whitehall	333.00	262.00	266.00	305.00	77.00	85.80	94.80
04122500	Pere Marquette River at Scottville	610.00	475.00	433.00	461.00	81.00	138.00	138.00
04123000	Big Sable River near Freesoil	135.00	112.00	103.00	110.00	14.20	20.10	24.00
04123500	Manistee River near Grayling	185.00	176.00	170.00	175.00	9.15	16.80	15.00
04124000	Manistee River near Sherman	1033.00	916.00	856.00	883.00	79.60	144.00	148.00
04124500	E. Br. Pine River near Tustin	19.80	11.80	13.60	11.00	6.54	12.30	9.87
04125000	Pine River near LeRoy	78.70	62.30	62.90	59.10	12.50	27.50	22.30
04125500	Pine River near Hoxeyville	264.00	231.00	236.00	235.00	26.60	47.80	37.30
04126000	Manistee River near Manistee	1897.00	1694.00	1591.00	1641.00	185.00	356.00	274.00
04126200	Little Manistee River near Freesoil	202.00	168.00	161.00	160.00	20.00	33.50	29.40
04127000	Boardman River near Mayfield	193.00	174.00	159.00	168.00	18.50	33.00	26.60
04128000	Sturgeon River near Wolverine	196.00	168.00	161.00	183.00	16.20	26.50	30.20
04128500	Indian River at Indian River	598.00	476.00	400.00	410.00	61.90	89.60	82.70
04129000	Pigeon River near Vanderbilt	68.30	60.80	57.50	67.60	5.73	12.80	11.60
04129500	Pigeon River at Afton	126.00	98.70	85.60	109.00	17.20	32.00	31.80
04130000	Cheboygan River near Cheboygan	815.00	649.00	551.00	597.00	102.00	172.00	192.00
04130500	Black River near Tower	240.00	184.00	151.00	190.00	38.80	71.80	73.70
04131000	Rainy River near Onaway	16.10	8.98	2.04	3.40	12.70	17.80	25.10
04131500	Rainy River near Ocqueoc	28.30	17.70	4.22	9.53	13.80	23.60	18.40
04132000	Black River near Cheboygan	347.00	264.00	208.00	266.00	83.10	161.00	185.00
04132500	Thunder Bay River near Hillman	201.00	170.00	152.00	165.00	23.00	37.30	33.60
04134000	N. Br. Thunder Bay R. nr. Bolton	77.50	38.90	17.70	24.80	36.80	72.40	69.70

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	96	97	98	99	SD _a	SD ₁₀	SD ₁₁
04135500	Au Sable River at Grayling	77.30	66.80	60.70	64.10	8.97	14.30	13.50
04135600	E. Br. Au Sable River at Grayling	41.20	34.60	34.50	36.40	7.06	13.20	10.30
04136500	Au Sable River at Mio	950.00	827.00	772.00	800.00	117.00	172.00	131.00
04138000	East Branch Au Gres R. at McIvor	64.30	46.30	39.80	39.60	12.90	14.10	12.60
04138500	Au Gres River near National City	69.80	35.20	27.20	30.70	25.50	46.20	37.90
04139000	Houghton Creek near Lupton	46.00	40.90	39.80	41.10	3.88	6.46	5.78
04139500	Rifle R. at "The Ranch" nr. Lupton	80.20	70.60	68.70	71.50	7.88	14.20	12.40
04140000	Prior Creek near Selkirk	12.80	8.82	7.90	8.49	2.91	5.65	4.74
04140500	Rifle River at Selkirk	122.00	97.70	92.30	96.70	17.00	25.00	21.70
04141000	S. Br. Shepards Creek near Selkirk	0.17	0.06	0.10	0.08	0.19	0.28	0.24
04141500	W. Br. Rifle River near Selkirk	45.80	36.90	36.80	37.10	7.46	20.70	14.30
04142000	Rifle River near Sterling	281.00	183.00	165.00	176.00	48.00	77.40	71.90
04143500	N. Br. Kawawlin R. nr. Kawawlin	36.00	9.83	3.77	1.55	22.80	16.40	53.80
04144000	Shiawassee River at Byron	173.00	115.00	81.50	78.30	97.60	109.00	101.00
04144500	Shiawassee River at Owosso	244.00	127.00	93.10	102.00	127.00	141.00	123.00
04145000	Shiawassee River near Fergus	323.00	178.00	116.00	126.00	158.00	186.00	165.00
04145500	Bad River near Brant	31.80	34.30	5.98	7.98	24.40	39.30	57.40
04146000	Farmers Creek near Lapeer	22.70	8.74	7.53	8.72	11.50	9.98	10.30
04147500	Flint River near Ottsville	166.00	75.40	96.20	74.30	87.20	67.10	168.00
04148000	Flint River at Genesee	298.00	120.00	92.40	109.00	142.00	148.00	158.00
04148200	Swartz Creek near Holly	3.99	2.87	1.46	1.53	2.00	7.34	2.67
04148500	Flint River near Flint	411.00	181.00	164.00	177.00	210.00	217.00	221.00
04150000	S. Br. Cass River near Cass City	57.30	44.30	21.40	10.20	60.60	24.20	47.90
04150500	Cass River at Cass City	82.30	60.80	30.30	15.30	92.10	35.80	84.40
04151000	Cass River at Vassar	194.00	139.00	84.80	58.70	164.00	72.10	174.00
04151500	Cass River at Frankenmuth	334.00	153.00	92.50	79.80	188.00	174.00	203.00
04152500	Tobacco River at Beaverton	284.00	260.00	198.00	212.00	62.00	100.00	96.60
04153500	Salt River near North Bradley	52.20	31.00	13.00	17.00	32.80	39.80	44.80
04154000	Chippewa River near Mount Pleasant	250.00	175.00	147.00	166.00	60.70	92.20	86.10
04154500	Chippewa River near Midland	318.00	258.00	185.00	188.00	94.20	113.00	174.00
04155000	Pine River at Alma	158.00	94.30	80.50	96.20	54.50	70.80	78.30
04155500	Pine River near Midland	193.00	137.00	113.00	127.00	75.70	103.00	103.00
04156000	Tittabawassee River at Midland	1267.00	733.00	631.00	543.00	409.00	492.00	635.00
04157500	Sebewaing River near Sebewaing	27.90	8.66	5.18	5.70	16.40	29.30	20.20
04158000	E. Fk. Sebewaing R. nr. Sebewaing	15.00	3.10	1.83	2.10	6.71	16.30	6.96
04158500	Pigeon River near Owendale	17.40	8.24	4.98	3.68	13.10	10.60	13.70
04159500	Black River near Fargo	170.00	69.80	60.90	26.90	134.00	133.00	124.00
04160000	Mill Creek near Abbottsford	44.00	15.90	18.60	11.20	47.50	38.90	43.40
04160500	Black River near Port Huron	178.00	50.40	48.70	24.70	170.00	16.70	137.00
04161000	Clinton River at Auburn Heights	69.40	57.80	43.40	40.10	18.20	20.50	25.00
04161500	Paint Creek near Lake Orion	17.00	11.50	8.67	13.50	7.84	5.95	10.20
04161800	Stony Creek near Washington	21.10	12.30	9.94	8.80	11.10	9.46	11.30
04162900	Big Beaver Creek near Warren	8.47	2.29	2.57	1.92	5.69	4.64	8.25
04163500	Plum Brook near Utica	6.54	4.09	1.53	1.69	5.40	5.51	8.63
04164000	Clinton River near Fraser	264.00	188.00	138.00	136.00	95.00	92.70	99.90
04164100	East Pond Creek at Romeo	7.28	4.74	3.33	3.23	4.20	4.14	4.04
04164300	East Branch Coon Creek at Armada	3.28	2.50	0.66	0.21	3.97	1.50	3.33
04164500	N. Br. Clinton R. nr. Mount Clemens	45.50	21.20	13.40	15.50	54.90	39.90	67.90
04165500	Clinton River at Mount Clemens	404.00	218.00	161.00	157.00	172.00	130.00	159.00
04166000	River Rouge at Birmingham	10.40	6.36	4.07	3.42	6.29	4.52	5.84
04166100	River Rouge at Southfield	34.80	12.30	14.80	11.60	17.30	12.70	21.00
04166200	Evans Ditch at Southfield	7.63	2.93	3.60	2.34	2.31	2.25	3.37
04166300	Upper River Rouge at Farmington	5.79	2.28	2.36	2.21	2.66	1.95	3.07
04166500	River Rouge at Detroit	80.30	40.60	32.40	25.90	46.10	42.40	38.40
04167000	Middle R. Rouge nr. Garden City	42.10	28.20	21.90	20.50	24.50	23.90	25.00
04168000	Lower River Rouge at Inkster	22.50	12.00	8.66	7.81	20.20	16.80	26.20
04169500	Huron River at Commerce	31.30	20.20	14.90	17.60	13.80	13.50	15.40
04170000	Huron River at Milford	75.20	56.50	45.60	51.60	30.60	27.90	30.80
04170500	Huron River near New Hudson	85.90	60.70	53.90	61.30	33.50	36.30	28.40
04171500	Ore Creek near Brighton	18.60	13.10	9.60	8.86	6.19	13.40	10.10
04172000	Huron River near Hamburg	162.00	119.00	99.40	95.40	55.30	74.10	58.00
04173000	Huron River near Dexter	297.00	180.00	137.00	163.00	124.00	126.00	117.00
04173500	Mill Creek near Dexter	46.80	26.40	20.60	19.80	15.90	44.30	27.20
04174500	Huron River at Ann Arbor	364.00	200.00	146.00	178.00	145.00	142.00	144.00
04175700	River Raisin near Tecumseh	95.30	67.40	54.50	59.30	40.40	30.80	55.10
04176000	River Raisin near Adrian	174.00	130.00	98.90	87.60	84.40	97.50	115.00
04176500	River Raisin near Monroe	482.00	276.00	150.00	143.00	310.00	179.00	322.00

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	SD ₁₂	SD ₁	SD ₂	SD ₃	SD ₄	SD ₅	SD ₆
04031000	Black River near Bessemer	43.40	19.30	14.40	164.00	279.00	236.00	96.70
04031500	Presque Isle River at Marenisco	36.20	22.40	17.20	83.80	181.00	187.00	129.00
04032000	Presque Isle River near Tula	60.60	26.10	20.10	134.00	270.00	296.00	202.00
04033000	M. Br. Ontonagon R. nr. Paulding	23.40	18.60	16.40	54.90	120.00	132.00	103.00
04035000	E. Br. Ontonagon River near Mass	32.60	21.20	20.10	137.00	208.00	161.00	128.00
04040500	Sturgeon River near Sidnaw	38.00	22.60	18.00	149.00	229.00	276.00	135.00
04041500	Sturgeon River near Alston	58.50	53.00	36.90	213.00	331.00	398.00	206.00
04042500	Otter River near Elo	23.70	15.60	11.80	158.00	211.00	221.00	92.40
04043000	Sturgeon River near Arnheim	107.00	71.80	57.50	461.00	632.00	789.00	354.00
04045500	Tahquamenon R nr Tahquamenon Paradise	359.00	121.00	156.00	226.00	527.00	1024.00	221.00
04046000	Black River near Garnet	12.10	5.97	5.20	14.20	26.60	29.50	8.12
04049500	Manistique River at Germfask	92.50	79.60	66.10	125.00	121.00	226.00	179.00
04054500	Duck Creek near Blaney	30.80	33.20	15.70	113.00	114.00	103.00	89.40
04055000	Manistique River near Blaney	252.00	180.00	130.00	434.00	487.00	639.00	398.00
04056000	W. Br. Manistique R. nr. Manistique	95.00	82.40	45.60	259.00	318.00	410.00	311.00
04056500	Manistique River near Manistique	413.00	302.00	220.00	748.00	941.00	1277.00	737.00
04058000	M. Br. Escanaba R. nr. Ishpeming	29.80	21.70	17.80	45.20	138.00	175.00	60.10
04058500	E. Br. Escanaba River at Gwinn	25.60	17.60	13.20	45.70	108.00	131.00	48.90
04059000	Escanaba River at Cornell	187.00	102.00	78.80	296.00	793.00	766.00	402.00
04059500	Ford River near Hyde	136.00	90.40	48.00	180.00	494.00	594.00	220.00
04061000	Brule River near Florence, Wis.	44.50	38.80	34.10	87.60	258.00	212.00	129.00
04061500	Paint River at Crystall Falls	73.80	58.60	48.60	245.00	599.00	562.00	321.00
04065300	W. Br. Sturgeon R. nr. Randville	11.20	8.43	4.49	22.30	44.70	36.70	17.00
04065500	Sturgeon River near Foster City	54.30	37.40	23.10	92.40	213.00	227.00	83.50
04097500	St. Joseph River at Three Rivers	417.00	571.00	484.00	590.00	606.00	578.00	404.00
04098500	Fawn River near White Pigeon	64.50	59.60	63.90	56.00	63.10	68.80	48.70
04099000	St. Joseph River at Mottville	616.00	844.00	755.00	861.00	1217.00	964.00	799.00
04101500	St. Joseph River at Niles	989.00	1694.00	1510.00	1708.00	2192.00	1964.00	1419.00
04102500	Paw Paw River at Riverside	150.00	206.00	137.00	134.00	120.00	144.00	103.00
04103500	Kalamazoo River at Marshall	96.00	158.00	145.00	156.00	206.00	143.00	110.00
04105000	Battle Creek at Battle Creek	82.00	133.00	134.00	199.00	218.00	185.00	152.00
04105500	Kalamazoo River near Battle Creek	203.00	317.00	315.00	425.00	522.00	438.00	330.00
04106000	Kalamazoo River at Comstock	227.00	356.00	345.00	458.00	535.00	474.00	384.00
04106500	Portage Creek at Kalamazoo	10.10	12.00	9.90	12.30	14.60	14.40	12.10
04108500	Kalamazoo River near Fennville	337.00	581.00	500.00	621.00	775.00	645.00	488.00
04109000	Grand River at Jackson	39.50	64.90	68.30	76.40	105.00	106.00	86.70
04109500	Portage R below L Portage L nr Munith	18.00	30.70	27.60	33.90	69.20	42.50	24.90
04110000	Orchard Creek at Portage	17.70	34.60	31.00	43.30	67.70	43.60	33.30
04111000	Grand River near Eaton Rapids	190.00	351.00	283.00	304.00	293.00	369.00	176.00
04111500	Deer Creek near Dansville	6.98	6.06	7.73	13.60	9.30	14.60	3.45
04112000	Sloan Creek near Williamston	4.05	3.00	4.86	8.96	6.12	10.10	1.70
04112500	Red Cedar River at East Lansing	117.00	163.00	226.00	275.00	289.00	288.00	119.00
04113000	Grand River at Lansing	339.00	553.00	617.00	1194.00	950.00	840.00	637.00
04114000	Grand River at Portland	372.00	445.00	486.00	765.00	649.00	1043.00	328.00
04114500	Lookingglass River near Eagle	80.60	135.00	142.00	237.00	271.00	212.00	87.20
04115000	Maple River at Maple Rapids	146.00	225.00	206.00	394.00	438.00	352.00	133.00
04116000	Grand River at Ionia	789.00	1412.00	1035.00	1685.00	1932.00	2105.00	485.00
04116500	Flat River at Smyrna	131.00	155.00	143.00	152.00	328.00	172.00	124.00
04117000	Quaker Brook near Nashville	2.50	2.25	2.82	4.16	2.87	2.84	2.27
04117500	Thornapple River near Hastings	128.00	233.00	193.00	358.00	418.00	323.00	136.00
04118000	Thornapple River near Caledonia	205.00	358.00	262.00	415.00	441.00	561.00	166.00
04118500	Rogue River near Rockford	83.10	66.90	73.00	75.60	186.00	112.00	61.40
04119000	Grand River at Grand Rapids	1209.00	2111.00	2750.00	4192.00	3669.00	2761.00	2577.00
04121000	Muskegon River near Merritt	87.00	76.80	73.90	91.70	148.00	126.00	122.00
04121500	Muskegon River at Evert	331.00	283.00	362.00	606.00	808.00	433.00	570.00
04122000	Muskegon River at Newaygo	620.00	591.00	699.00	1077.00	1211.00	812.00	826.00
04122200	White River near Whitehall	149.00	86.70	102.00	91.70	273.00	130.00	115.00
04122500	Pere Marquette River at Scottville	164.00	136.00	123.00	167.00	266.00	147.00	157.00
04123000	Big Sable River near Freesoil	23.00	23.50	22.40	33.30	53.80	32.30	23.70
04123500	Manistee River near Grayling	12.90	11.70	11.80	17.60	21.50	17.60	17.50
04124000	Manistee River near Sherman	134.00	112.00	139.00	226.00	282.00	158.00	197.00
04124500	East Br. Pine River near Tustin	3.86	4.24	9.21	21.90	54.80	18.00	14.00
04125000	Pine River near LeRoy	8.65	9.20	18.70	39.20	88.80	36.80	30.90
04125500	Pine River near Hoxeyville	58.10	30.00	40.20	61.60	123.00	51.30	54.60
04126000	Manistee River near Manistee	321.00	233.00	266.00	338.00	651.00	340.00	438.00
04126200	Little Manistee R. nr. Freesoil	55.10	40.60	42.10	39.40	43.30	26.70	49.60
04127000	Boardman River near Mayfield	33.60	22.60	26.20	40.70	52.20	38.70	43.50
04128000	Sturgeon River near Wolverline	22.30	21.90	21.60	44.30	57.10	39.30	26.20
04128500	Indian River at Indian River	90.90	76.80	79.50	84.80	123.00	136.00	122.00
04129000	Pigeon River near Vanderbilt	6.59	6.56	7.74	12.40	21.70	17.20	10.30
04129500	Pigeon River at Afton	14.50	21.20	17.60	51.90	83.20	45.70	32.40
04130000	Cheboygan River near Cheboygan	167.00	160.00	144.00	142.00	228.00	239.00	208.00
04130500	Black River near Tower	54.70	44.20	41.00	95.00	174.00	108.00	61.70
04131000	Rainy River near Onaway	11.20	12.60	9.18	37.40	81.40	23.80	13.80
04131500	Rainy River near Ocqueoc	25.30	9.88	13.60	33.00	80.00	48.70	20.80
04132000	Black River near Cheboygan	142.00	91.00	101.00	161.00	390.00	344.00	162.00
04132500	Thunder Bay River near Hallman	29.40	30.70	33.00	62.20	105.00	69.90	49.20
04134000	N. Br. Thunder Bay R. nr. Bolton	61.00	46.00	28.20	130.00	250.00	98.40	74.40

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	SD12	SD1	SD2	SD3	SD4	SD5	SD6
04135500	Au Sable River at Grayling	10.70	11.40	10.50	17.40	21.40	15.40	18.90
04135600	E. Br. Au Sable River at Grayling	11.20	8.56	8.32	9.28	16.60	11.00	10.20
04136500	Au Sable River at Mio	175.00	123.00	132.00	210.00	314.00	191.00	207.00
04138000	E. Br. Au Gres River at McIvor	18.20	13.30	15.70	34.50	57.50	31.90	28.10
04138500	Au Gres River near National City	55.10	31.00	35.90	99.10	144.00	67.20	52.00
04139000	Houghton Creek near Lupton	9.57	5.35	6.33	15.30	23.80	13.60	9.22
04139500	Rifle River at "The Ranch nr. Lupton	20.10	11.00	11.10	23.70	45.80	26.30	18.40
04140000	Prior Creek near Selkirk	7.95	3.82	4.52	11.70	17.00	8.64	7.18
04140500	Rifle River at Selkirk	37.30	22.90	27.30	59.60	104.00	61.00	46.00
04141000	S. Br. Shepards Creek nr. Selkirk	0.35	0.17	0.53	1.24	1.24	0.49	0.22
04141500	W. Br. Rifle River nr. Selkirk	17.60	16.20	15.70	37.80	57.60	24.30	15.40
04142000	Rifle River near Sterling	102.00	77.20	121.00	217.00	260.00	130.00	154.00
04143500	N. Br. Kawkawlin R. nr. Kawkawlin	46.20	62.20	48.20	102.00	137.00	69.20	71.80
04144000	Shiawassee River at Byron	136.00	198.00	214.00	267.00	234.00	300.00	110.00
04144500	Shiawassee River at Owosso	175.00	250.00	351.00	384.00	390.00	396.00	187.00
04145000	Shiawassee River near Fergus	238.00	352.00	398.00	467.00	540.00	553.00	260.00
04145500	Bad River near Brant	41.10	94.90	82.40	82.60	92.30	96.60	40.30
04146000	Farmers Creek near Lapeer	18.40	22.30	35.70	35.40	42.40	37.10	23.40
04147500	Flint River near Otisville	125.00	148.00	221.00	361.00	383.00	430.00	108.00
04148000	Flint River at Genesee	218.00	324.00	493.00	570.00	514.00	327.00	277.00
04148200	Swartz Creek near Holly	3.41	2.82	2.74	4.55	8.54	4.04	2.55
04148500	Flint River near Flint	322.00	419.00	612.00	769.00	821.00	698.00	370.00
04150000	S. Br. Cass River near Cass City	113.00	134.00	205.00	250.00	322.00	180.00	85.20
04150500	Cass River at Cass City	157.00	231.00	297.00	392.00	360.00	242.00	103.00
04151000	Cass River at Vassar	296.00	357.00	499.00	581.00	616.00	423.00	197.00
04151500	Cass River at Frankenmuth	298.00	409.00	557.00	885.00	780.00	571.00	339.00
04152500	Tobacco River at Beaverton	124.00	114.00	135.00	220.00	331.00	158.00	117.00
04153500	Salt River near North Bradley	51.50	57.90	128.00	175.00	150.00	77.50	74.30
04154000	Chippewa River near Mount Pleasant	84.80	101.00	220.00	271.00	267.00	145.00	149.00
04154500	Chippewa River near Midland	158.00	163.00	186.00	355.00	516.00	244.00	158.00
04155000	Pine River at Alma	78.10	90.80	165.00	220.00	227.00	119.00	85.00
04155500	Pine River near Midland	126.00	136.00	274.00	237.00	373.00	175.00	105.00
04156000	Tittabawassee River at Midland	671.00	718.00	1219.00	1864.00	2002.00	1120.00	1039.00
04157500	Sebewaing River near Sebewaing	21.70	50.60	62.10	71.70	70.30	24.60	49.20
04158000	E. Fk. Sebewaing R. nr. Sebewaing	8.07	20.30	29.40	37.90	40.70	13.40	24.10
04158500	Pigeon River near Owendale	24.50	15.70	38.40	54.30	52.30	35.50	18.20
04159500	Black River near Fargo	276.00	342.00	488.00	612.00	562.00	396.00	240.00
04160000	Mill Creek near Abbottsford	98.50	116.00	149.00	206.00	185.00	163.00	40.10
04160500	Black River near Port Huron	268.00	210.00	750.00	701.00	521.00	607.00	224.00
04161000	Clinton River at Auburn Heights	36.80	34.20	41.40	38.00	46.10	30.80	30.60
04161500	Paint Creek near Lake Orion	11.50	9.77	8.63	15.40	28.30	30.70	10.90
04161800	Stony Creek near Washington	16.10	13.90	16.00	40.20	37.80	10.30	15.10
04162900	Big Beaver Creek near Warren	17.20	8.92	15.50	20.80	14.80	5.88	9.46
04163500	Plum Brook near Utica	13.30	8.30	10.50	16.20	16.20	21.40	6.67
04164000	Clinton River near Fraser	181.00	253.00	228.00	253.00	237.00	295.00	122.00
04164100	East Pond Creek at Romeo	5.50	5.27	11.80	14.10	17.70	3.68	5.37
04164300	East Branch Coon Creek at Armada	6.08	3.21	8.65	12.70	15.60	1.91	5.75
04164500	N. Br. Clinton R. nr. Mount Clemens	120.00	141.00	165.00	164.00	152.00	176.00	39.70
04165500	Clinton River at Mount Clemens	320.00	407.00	551.00	449.00	572.00	646.00	268.00
04166000	River Rouge at Birmingham	11.30	11.80	14.30	17.80	14.60	21.60	7.85
04166100	River Rouge at Southfield	33.50	26.70	33.80	60.70	50.10	13.10	28.90
04166200	Evans Ditch at Southfield	6.26	3.86	6.16	5.92	5.98	2.48	7.59
04166300	Upper River Rouge at Farmington	4.84	4.83	8.11	12.80	8.62	3.42	4.41
04166500	River Rouge at Detroit	78.90	102.00	138.00	113.00	161.00	171.00	60.20
04167000	Middle R. Rouge nr. Garden City	47.00	70.60	65.80	70.00	64.10	72.20	24.90
04168000	Lower River Rouge at Inkster	45.80	81.20	76.00	69.00	64.20	45.50	27.60
04169500	Huron River at Commerce	19.20	21.80	23.30	25.20	31.60	34.10	20.70
04170000	Huron River at Milford	44.00	53.30	58.10	60.00	74.60	65.00	31.30
04170500	Huron River near New Hudson	48.60	59.70	62.10	60.60	77.30	73.70	39.70
04171500	Ore Creek near Brighton	9.09	12.10	9.86	13.70	13.20	20.80	8.75
04172000	Huron River near Hamburg	64.00	107.00	91.40	124.00	124.00	182.00	71.10
04173000	Huron River near Dexter	152.00	219.00	222.00	258.00	388.00	322.00	152.00
04173500	Mill Creek near Dexter	49.60	37.80	40.50	64.40	54.50	54.80	28.00
04174500	Huron River at Ann Arbor	187.00	267.00	326.00	378.00	464.00	386.00	223.00
04175700	River Raisin near Tecumseh	87.10	76.40	96.80	128.00	111.00	60.50	73.00
04176000	River Raisin near Adrian	178.00	176.00	183.00	258.00	235.00	207.00	133.00
04176500	River Raisin near Monroe	460.00	770.00	725.00	771.00	913.00	993.00	458.00

Table A-2.--Streamflow characteristics at gaging stations--Continued

NAME	STATION NAME	SD7	SD8	SD9	M7.2	M7.10	M7.20	V7.2
04031000	Black River near Bessemer	76.10	91.80	66.90	24.10	15.70	13.70	2189.
04031500	Presque Isle River at Marenisco	114.00	72.30	67.10	41.70	23.70	20.00	899.
04032000	Presque Isle River near Tula	182.00	107.00	111.00	50.10	31.00	27.00	1824.
04033000	M. Br. Ontonagon R. nr. Paulding	82.40	37.60	52.30	84.30	69.60	66.00	704.
04035000	E. Br. Ontonagon R. nr. Mass	111.00	70.50	64.70	107.00	84.30	78.80	1361.
04040500	Sturgeon River near Sidnaw	106.00	58.00	98.60	17.60	8.30	6.60	1669.
04041500	Sturgeon River near Alston	158.00	87.40	135.00	0.0 B	0.0 B	0.0 B	2462.
04042500	Otter River near Elo	62.50	42.40	30.00	79.80	73.80	72.50	1574.
04043000	Sturgeon River near Arnheim	302.00	167.00	178.00	273.00	206.00	187.00	4524.
04045500	Tahquamenon R nr Tahquamenon Paradise	282.00	55.30	230.00	212.00	187.00	181.00	4078.
04046000	Black River near Garnet	8.63	6.63	8.92	8.10	6.24	5.84	142.
04049500	Manistique River at Germfask	120.00	65.60	91.20	200.00	159.00	150.00	1081.
04054500	Duck Creek near Blaney	26.00	14.40	17.10	9.74	5.94	5.16	734.
04055000	Manistique River near Blaney	215.00	112.00	151.00	287.00	216.00	201.00	3191.
04056000	W. Br. Manistique R. nr. Manistique	107.00	48.50	53.80	124.00	93.30	86.80	2181.
04056500	Manistique River near Manistique	334.00	166.00	252.00	457.00	343.00	315.00	5784.
04058000	M. Br. Escanaba River near Ishpeming	66.90	41.40	57.70	21.80	16.20	15.10	835.
04058500	E. Br. Escanaba River at Gwinn	45.10	17.10	24.20	27.30	22.30	21.30	611.
04059000	Escanaba River at Cornell	512.00	409.00	329.00	210.00	163.00	153.00	4487.
04059500	Ford River near Hyde	164.00	97.90	176.00	38.10	29.10	27.10	2105.
04061000	Brule River near Florence, Wis.	184.00	73.50	93.30	194.00	159.00	152.00	1105.
04061500	Paint River at Crystal Falls	345.00	128.00	245.00	213.00	167.00	157.00	2952.
04065300	W. Br. Sturgeon R. nr. Randville	8.02	7.39	17.50	0.0 B	0.0 B	0.0 B	0.0 B
04065500	Sturgeon River near Foster City	80.60	50.50	92.60	0.0 B	0.0 B	0.0 B	0.0 B
04097500	St. Joseph River at Three Rivers	257.00	135.00	154.00	285.00	166.00	137.00	2870.
04098500	Fawn River near White Pigeon	43.30	34.40	32.80	0.0 B	0.0 B	0.0 B	319.
04099000	St. Joseph River at Mottville	543.00	356.00	324.00	534.00	345.00	303.00	3949.
04101500	St. Joseph River at Niles	992.00	704.00	654.00	1292.00	888.00	792.00	7950.
04102500	Paw Paw River at Riverside	64.90	43.10	65.80	176.00	145.00	138.00	1005.
04103500	Kalamazoo River at Marshall	89.60	59.70	58.70	130.00	80.00	69.00	698.
04105000	Battle Creek at Battle Creek	58.40	35.30	54.10	46.90	30.70	27.30	936.
04105500	Kalamazoo River near Battle Creek	182.00	118.00	166.00	254.00	163.00	143.00	1929.
04106000	Kalamazoo River at Comstock	250.00	167.00	200.00	345.00	246.00	226.00	2285.
04106500	Portage Creek at Kalamazoo	12.10	9.53	9.64	39.20	29.30	27.10	98.
04108500	Kalamazoo River near Fennville	313.00	281.00	246.00	550.00	334.00	286.00	3185.
04109000	Grand River at Jackson	43.20	18.20	20.10	31.60	20.80	18.10	386.
04109500	Portage R below L Portage L nr Munith	9.69	3.86	12.70	2.88	1.32	1.03	215.
04110000	Orchard Creek at Munith	6.09	2.66	4.85	4.06	2.34	1.94	242.
04111000	Grand River near Eaton Rapids	99.90	44.60	44.00	85.20	61.30	55.90	1483.
04111500	Deer Creek near Dansville	8.17	2.51	1.58	0.48	0.17	0.12	77.
04112000	Sloan Creek near Williamston	7.16	1.84	1.07	0.0 B	0.0 B	0.0 B	51.
04112500	Red Cedar River at East Lansing	84.40	27.50	44.20	18.80	8.30	6.38	1390.
04113000	Grand River at Lansing	380.00	175.00	226.00	138.00	71.70	58.50	3979.
04114000	Grand River at Portland	249.00	83.30	85.00	159.00	105.00	91.50	3525.
04114500	Lookingglass River near Eagle	111.00	19.00	55.20	24.80	14.50	12.30	849.
04115000	Maple River at Maple Rapids	71.60	47.80	116.00	16.40	8.10	6.60	1597.
04116000	Grand River at Ionia	712.00	182.00	137.00	273.00	181.00	160.00	7593.
04116500	Flat River at Smyrna	100.00	78.60	69.90	157.00	121.00	112.00	1205.
04117000	Quaker Brook near Nashville	1.20	0.85	0.56	1.60	0.97	0.81	24.
04117500	Thornapple River near Hastings	57.80	27.10	50.50	66.90	45.60	40.30	1625.
04118000	Thornapple River near Caledonia	138.00	58.10	42.00	169.00	116.00	101.00	2240.
04118500	Rogue River near Rockford	33.30	28.00	45.60	83.10	67.00	62.70	788.
04119000	Grand River at Grand Rapids	1133.00	516.00	744.00	981.00	681.00	603.00	14901.
04121000	Muskegon River near Merritt	110.00	52.60	53.10	64.60	35.60	30.50	709.
04121500	Muskegon River at Evert	445.00	144.00	160.00	380.00	300.00	282.00	3697.
04122000	Muskegon River at Newaygo	595.00	310.00	427.00	829.00	649.00	608.00	5369.
04122200	White River near Whitehall	69.40	62.60	124.00	0.0 B	0.0 B	0.0 B	1011.
04122500	Pere Marquette R. at Scottville	80.80	68.50	107.00	376.00	344.00	335.00	1440.
04123000	Big Sable River near Freesoil	12.80	12.60	19.60	91.80	85.20	83.80	300.
04123500	Manistee River near Grayling	13.30	10.80	13.80	156.00	146.00	143.00	257.
04124000	Manistee River near Sherman	132.00	75.40	95.40	804.00	699.00	660.00	2081.
04124500	E. Br. Pine River nr. Tustin	6.00	18.30	3.86	6.31	5.51	5.32	164.
04125000	Pine River near LeRoy	13.40	32.00	10.40	46.90	43.70	42.90	340.
04125500	Pine River near Hoxeyville	22.50	53.30	40.30	196.00	183.00	179.00	677.
04126000	Manistee River near Manistee	272.00	224.00	240.00	1329.00	1193.00	1160.00	3972.
04126200	Little Manistee R. nr. Freesoil	24.30	16.20	35.20	0.0 B	0.0 B	0.0 B	0.0 B
04127000	Boardman River near Mayfield	34.50	18.60	29.40	130.00	96.10	85.00	409.
04128000	Sturgeon River near Wolverine	17.60	17.30	27.40	141.00	126.00	121.00	445.
04128500	Indian River at Indian River	108.00	72.00	57.80	351.00	274.00	252.00	830.
04129000	Pigeon River near Vanderbilt	10.40	7.37	16.00	45.90	40.20	38.90	190.
04129500	Pigeon River at Afton	18.20	13.50	27.70	72.10	60.90	57.90	436.
04130000	Cheboygan River near Cheboygan	187.00	92.30	141.00	330.00	212.00	183.00	1304.
04130500	Black River near Tower	57.50	33.20	51.30	119.00	84.20	72.30	819.
04131000	Rainy River near Onaway	9.27	2.84	3.38	0.0 B	0.0 B	0.0 B	216.
04131500	Rainy River near Ocqueoc	30.30	3.11	14.00	1.19	0.56	0.48	275.
04132000	Black River near Cheboygan	151.00	80.90	137.00	73.30	38.70	32.00	1346.
04132500	Thunder Bay River near Hillman	35.40	19.50	25.00	127.00	114.00	111.00	579.
04134000	N. Br. Thunder Bay R. nr. Bolton	44.00	11.00	16.90	7.14	2.06	1.31	964.

B Insufficient natural record to define characteristic.

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	SD7	SD8	SD9	M7.2	M7.10	M7.20	V7.2
04135500	Au Sable River at Grayling	13.40	9.17	10.90	50.40	42.50	40.50	142.
04135600	E. Br. Au Sable R. at Grayling	5.92	7.06	9.10	0.0 R	0.0 R	0.0 R	0. R
04136500	Au Sable River at Mio	141.00	91.60	99.90	642.00	567.00	544.00	1867.
04138000	E. Br. Au Gres River at McIvor	12.40	7.16	5.97	30.90	26.10	24.60	267.
04138500	Au Gres River near National City	21.40	16.40	18.60	12.90	9.20	8.59	667.
04139000	Houghton Creek near Lupton	4.54	2.78	3.41	35.50	33.10	32.50	153.
04139500	Rifle R. at "The Ranch" nr. Lupton	9.39	6.54	8.08	60.30	55.20	53.70	265.
04140000	Prior Creek near Selkirk	3.01	3.49	2.91	5.57	4.97	4.84	91.
04140500	Rifle River at Selkirk	21.50	17.80	16.20	74.40	68.10	66.30	528.
04141000	S. Br. Shepards Creek nr. Selkirk	0.06	0.16	0.10	0.0 R	0.0 R	0.0 R	7.
04141500	W. Br. Rifle River near Selkirk	7.09	8.51	7.38	28.00	25.00	24.20	294.
04142000	Rifle River near Sterling	46.20	36.40	30.90	132.00	117.00	112.00	1487.
04143500	N. Br. Kawawlin R. nr. Kawawlin	21.40	8.41	4.67	0.0 R	0.0 R	0.0 R	380.
04144000	Shiawassee River at Byron	115.00	45.90	54.40	45.20	26.60	22.60	1162.
04144500	Shiawassee River at Owosso	134.00	65.40	85.20	49.80	18.60	12.90	1710.
04145000	Shiawassee River near Fergus	199.00	77.70	111.00	63.60	39.00	33.70	2486.
04145500	Bad River near Brant	67.30	9.26	19.50	0.0 R	0.0 R	0.0 R	600.
04146000	Farmers Creek near Lapeer	8.55	9.99	12.80	2.32	1.12	0.90	183.
04147500	Flint River near Otisville	51.90	86.80	40.40	44.70	28.80	24.80	1634.
04148000	Flint River at Genesee	71.40	74.50	101.00	48.10	24.30	19.20	2488.
04148200	Swartz Creek near Holly	4.82	0.94	0.98	0.41	0.12	0.08	34.
04148500	Flint River near Flint	174.00	141.00	190.00	73.00	40.30	33.10	3385.
04150000	S. Br. Cass R. nr. Cass City	73.90	34.00	20.90	2.03	0.80	0.58	1426.
04150500	Cass River at Cass City	93.20	47.00	24.00	3.60	1.40	1.00	2137.
04151000	Cass River at Vassar	166.00	99.00	49.40	28.00	16.30	13.80	3263.
04151500	Cass River at Frankenmuth	161.00	97.70	73.00	35.80	18.50	14.70	4399.
04152500	Tobacco River at Beaverton	200.00	42.50	51.70	124.00	76.20	64.00	1776.
04153500	Salt River near North Bradley	86.50	11.10	21.60	5.45	3.00	2.48	862.
04154000	Chippewa River near Mount Pleasant	109.00	49.70	50.40	98.10	67.80	60.30	1238.
04154500	Chippewa River near Midland	240.00	75.20	49.60	116.00	90.00	84.00	2172.
04155000	Pine River at Alma	50.70	36.60	49.60	49.00	27.40	22.50	905.
04155500	Pine River near Midland	105.00	53.80	66.20	60.30	32.90	26.30	1446.
04156000	Tittabawassee River at Midland	750.00	230.00	201.00	254.00	169.00	148.00	9052.
04157500	Sebewaing River near Sebewaing	16.30	9.93	12.50	0.0 R	0.0 R	0.0 R	429.
04158000	E. Ik. Sebewaing R. nr. Sebewaing	4.75	3.29	5.08	0.0 R	0.0 R	0.0 R	274.
04158500	Pigeon River near Owendale	8.46	3.81	2.08	1.47	0.63	0.46	288.
04159500	Black River near Fargo	83.80	115.00	26.50	10.40	5.07	3.90	3580.
04160000	Mill Creek near Abbottsford	10.50	28.20	6.83	6.11	4.11	3.63	965.
04160500	Black River near Port Huron	38.70	58.50	15.20	12.00	6.18	4.86	3429.
04161000	Clinton River at Auburn Heights	41.50	17.90	16.00	22.50	10.40	7.55	199.
04161500	Paint Creek near Lake Orion	11.10	4.94	9.36	2.54	1.52	1.36	88.
04161800	Stony Creek near Washington	12.00	4.72	4.19	0.0 R	0.0 R	0.0 R	0. R
04162900	Big Beaver Creek near Warren	3.72	2.28	1.90	0.0 R	0.0 R	0.0 R	0. R
04163500	Plum Brook near Utica	8.52	1.38	1.50	0.0 R	0.0 R	0.0 R	95.
04164000	Clinton River near Fraser	143.00	53.80	41.60	81.10	64.50	60.60	1392.
04164100	East Pond Creek at Romeo	6.11	1.63	1.23	0.0 R	0.0 R	0.0 R	0. R
04164300	E. Br. Coon Creek at Armada	6.50	1.46	0.28	0.0 R	0.0 R	0.0 R	0. R
04164500	N. Br. Clinton R. nr. Mount Clemens	28.20	16.30	23.10	2.30	0.73	0.52	979.
04165500	Clinton River at Mount Clemens	160.00	67.80	79.00	89.40	54.70	46.10	2803.
04166000	River Rouge at Birmingham	9.38	2.02	1.91	1.30	0.48	0.35	80.
04166100	River Rouge at Southfield	8.47	7.76	6.55	0.0 R	0.0 R	0.0 R	0. R
04166200	Evans Ditch at Southfield	2.38	2.60	1.64	0.0 R	0.0 R	0.0 R	0. R
04166300	Upper River Rouge at Farmington	1.30	1.16	0.98	0.0 R	0.0 R	0.0 R	0. R
04166500	River Rouge at Detroit	61.90	26.40	27.70	9.43	4.52	3.58	712.
04167000	Middle River Rouge near Garden City	33.80	15.20	13.70	7.95	4.09	3.35	430.
04168000	Lower River Rouge at Inkster	16.60	8.56	12.30	1.52	0.77	0.62	442.
04169500	Huron River at Commerce	17.20	9.38	12.00	9.10	5.60	4.90	97.
04170000	Huron River at Milford	40.00	17.80	20.20	30.10	19.10	16.80	235.
04170500	Huron River near New Hudson	44.10	21.70	27.20	27.20	16.60	14.50	241.
04171500	Ore Creek near Brighton	13.70	6.49	4.66	3.48	1.82	1.55	72.
04172000	Huron River near Hamburg	104.00	55.90	35.10	59.60	42.60	39.30	521.
04173000	Huron River near Dexter	104.00	69.00	112.00	87.70	51.90	44.20	988.
04173500	Mill Creek near Dexter	10.20	5.14	8.86	14.10	11.30	10.60	373.
04174500	Huron River at Ann Arbor	113.00	82.40	126.00	93.20	40.50	29.90	1411.
04175700	River Raisin near Tecumseh	41.40	18.40	26.70	34.20	14.80	10.80	619.
04176000	River Raisin near Adrian	90.70	41.30	41.20	54.50	34.30	29.40	1539.
04176500	River Raisin near Monroe	310.00	87.90	92.00	80.40	26.70	16.50	4081.

B Insufficient natural record to define characteristic.

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	V7,10	V7,50
04031000	Black River near Bessemer	3537.	4756.
04031500	Presque Isle River at Marenisco	1585.	2281.
04032000	Presque Isle River near Tula	2844.	3658.
04033000	M. Br. Ontonagon River near Paulding	1132.	1473.
04035000	E. Br. Ontonagon River near Mass	1924.	2338.
04040500	Sturgeon River near Sidnaw	2443.	3081.
04041500	Sturgeon River near Alston	3505.	4248.
04042500	Otter River near Elo	2441.	3142.
04043000	Sturgeon River near Arnheim	6888.	9041.
04045500	Tahquamenon R nr Tahquamenon Paradise	5666.	6768.
04046000	Black River near Garnet	241.	368.
04049500	Manistique River at Germfask	1479.	1892.
04054500	Duck Creek near Blaney	1126.	1488.
04055000	Manistique River near Blaney	4861.	6460.
04056000	W. Br. Manistique R. nr. Manistique	3473.	4722.
04056500	Manistique River near Manistique	9327.	13284.
04058000	M. Br. Escanaba River near Ishpeming	1308.	1786.
04058500	East Branch Escanaba River at Gwinn	909.	1165.
04059000	Escanaba River at Cornell	6622.	8294.
04059500	Ford River near Hyde	3444.	5346.
04061000	Brule River near Florence, Wis.	1917.	2678.
04061500	Paint River at Crystal Falls	4930.	6787.
04065300	W. Br. Sturgeon River nr. Randville	0.R	0.R
04065500	Sturgeon River near Foster City	0.R	0.R
04097500	St. Joseph River at Three Rivers	3817.	4131.
04098500	Fawn River near White Pigeon	433.	490.
04099000	St. Joseph River at Mottville	6305.	8007.
04101500	St. Joseph River at Niles	12154.	14897.
04102500	Paw Paw River at Riverside	1351.	1640.
04103500	Kalamazoo River at Marshall	1152.	1560.
04105000	Battle Creek at Battle Creek	1642.	2184.
04105500	Kalamazoo River near Battle Creek	3469.	4972.
04106000	Kalamazoo River at Comstock	3741.	5059.
04106500	Portage Creek at Kalamazoo	141.	175.
04108500	Kalamazoo River near Fennville	5236.	7560.
04109000	Grand River at Jackson	664.	920.
04109500	Portage R below L Portage L nr Munith	390.	580.
04110000	Orchard Creek at Munith	475.	667.
04111000	Grand River near Eaton Rapids	2369.	2979.
04111500	Deer Creek near Dansville	134.	160.
04112000	Sloan Creek near Williamston	90.	105.
04112500	Red Cedar River at East Lansing	2363.	2738.
04113000	Grand River at Lansing	7760.	11496.
04114000	Grand River at Portland	6186.	8141.
04114500	Lookingglass River near Eagle	1540.	1918.
04115000	Maple River at Maple Rapids	3539.	5430.
04116000	Grand River at Ionia	14300.	20083.
04116500	Flat River at Smyrna	2014.	2799.
04117000	Quaker Brook near Nashville	42.	60.
04117500	Thornapple River near Hastings	3049.	4153.
04118000	Thornapple River near Caledonia	4031.	5394.
04118500	Rogue River near Rockford	1321.	1837.
04119000	Grand River at Grand Rapids	29025.	41416.
04121000	Muskegon River near Merritt	959.	1090.
04121500	Muskegon River at Evart	5619.	6991.
04122000	Muskegon River at Nawaygo	8532.	10994.
04122200	White River near Whitehall	1651.	2174.
04122500	Pere Marquette River at Scottville	2073.	2500.
04123000	Big Sable River near Freesoil	422.	498.
04123500	Manistee River near Grayling	296.	319.
04124000	Manistee River near Sherman	2586.	2899.
04124500	East Branch Pine River near Tustin	357.	605.
04125000	Pine River near LeRoy	583.	825.
04125500	Pine River near Hoxeyville	1021.	1289.
04126000	Manistee River near Manistee	5219.	6013.
04126200	Little Manistee River near Freesoil	0.R	0.R
04127000	Boardman River near Mayfield	515.	568.
04128000	Sturgeon River near Wolverine	595.	710.
04128500	Indian River at Indian River	1031.	1166.
04129000	Pigeon River near Vanderbilt	266.	327.
04129500	Pigeon River at Afton	670.	860.
04130000	Cheboygan River near Cheboygan	1563.	1726.
04130500	Black River near Tower	1218.	1515.
04131000	Rainy River near Onaway	422.	592.
04131500	Rainy River near Ocqueoc	513.	722.
04132000	Black River near Cheboygan	1992.	2449.
04132500	Thunder Bay River near Hillman	791.	908.
04134000	N. Br. Thunder Bay R. nr. Bolton	1632.	2125.

B Insufficient natural record to define characteristic.

Table A-2.--Streamflow characteristics at gaging stations--Continued

NUMBER	STATION NAME	V7.10	V7.50
04135500	Au Sable River at Grayling	172.	197.
04135600	E. Br. Au Sable River at Grayling	0.R	0.R
04136500	Au Sable River at Mio	2498.	2880.
04138000	East Branch Au Gres River at McIvor	394.	436.
04138500	Au Gres River near National City	1024.	1104.
04139000	Houghton Creek near Lupton	230.	277.
04139500	Rifle River at "The Ranch" nr. Lupton	394.	488.
04140000	Prior Creek near Selkirk	148.	185.
04140500	Rifle River at Selkirk	856.	1075.
04141000	S. Br. Shepards Creek nr. Selkirk	15.	18.
04141500	W. Br. Rifle River nr. Selkirk	510.	703.
04142000	Rifle River near Sterling	2170.	2467.
04143500	N. Br. Kawkawlin R. nr. Kawkawlin	960.	1270.
04144000	Shiawassee River at Byron	2094.	2767.
04144500	Shiawassee River at Owosso	3075.	3891.
04145000	Shiawassee River near Fergus	4087.	4884.
04145500	Bad River near Brant	940.	1150.
04146000	Farmers Creek near Lapeer	353.	505.
04147500	Flint River near Otisville	3646.	5437.
04148000	Flint River at Genesee	4152.	4799.
04148200	Swartz Creek near Holly	55.	74.
04148500	Flint River near Flint	6368.	8683.
04150000	S. Br. Cass River near Cass City	2718.	3145.
04150500	Cass River at Cass City	4207.	5085.
04151000	Cass River at Vassar	6280.	7810.
04151500	Cass River at Frankenmuth	8149.	9967.
04152500	Tobacco River at Beaverton	3040.	4081.
04153500	Salt River near North Bradley	1772.	2456.
04154000	Chippewa River near Mount Pleasant	2556.	3220.
04154500	Chippewa River near Midland	4016.	5804.
04155000	Pine River at Alma	1864.	2928.
04155500	Pine River near Midland	2689.	3858.
04156000	Tittabawassee River at Midland	16906.	23690.
04157500	Sebewaing River near Sebewaing	733.	925.
04158000	E. Fk. Sebewaing R. nr. Sebewaing	402.	440.
04158500	Pigeon River near Owendale	567.	680.
04159500	Black River near Fargo	6506.	7388.
04160000	Mill Creek near Abbottsford	1751.	1968.
04160500	Black River near Port Huron	5753.	7466.
04161000	Clinton River at Auburn Heights	280.	341.
04161500	Paint Creek near Lake Orion	194.	319.
04161800	Stony Creek near Washington	0.R	0.B
04162900	Big Beaver Creek near Warren	0.R	0.B
04163500	Plum Brook near Utica	172.	225.
04164000	Clinton River near Fraser	2322.	3015.
04164100	East Pond Creek at Romeo	0.R	0.R
04164300	E. Br. Coon Creek at Armada	0.R	0.R
04164500	N. Br. Clinton R. nr. Mount Clemens	1672.	2162.
04165500	Clinton River at Mount Clemens	5186.	7319.
04166000	River Rouge at Birmingham	164.	247.
04166100	River Rouge at Southfield	0.R	0.B
04166200	Evans Ditch at Southfield	0.H	0.R
04166300	Upper R. Rouge at Farmington	0.R	0.B
04166500	River Rouge at Detroit	1465.	2157.
04167000	Middle R. Rouge near Garden City	667.	745.
04168000	Lower River Rouge at Inkster	679.	800.
04169500	Huron River at Commerce	169.	242.
04170000	Huron River at Milford	404.	563.
04170500	Huron River near New Hudson	422.	603.
04171500	Ore Creek near Brighton	112.	142.
04172000	Huron River near Hamburg	915.	1307.
04173000	Huron River near Dexter	1946.	2984.
04173500	Mill Creek near Dexter	554.	651.
04174500	Huron River at Ann Arbor	2719.	4088.
04175700	River Raisin near Tecumseh	835.	911.
04176000	River Raisin near Adrian	2009.	2136.
04176500	River Raisin near Monroe	7049.	9130.

B Insufficient natural record to define characteristic.

Table A-3.—Basin characteristics at gaging stations

Station number	Station name	Basin Characteristics										
		Drainage area (sq mi)	Slope (feet per mile)	Main channel length (miles)	Area of lakes and ponds (percent)	Elevation (feet)	Forest cover (percent)	Mean Annual precipitation (inches)	2-year 24-hour rainfall (inches)	Mean minimum temperature January (°F)	Average annual snowfall (inches)	Minimum infiltration rate (inches per hour)
4-0310.	Black River near Bessemer	200	21.4	16.4	8.1	1,510	93.7	35	2.4	6	120	3.0
4-0315.	Presque Isle River at Mareniscoo	171	3.8	21.2	19.4	1,640	91.5	36	2.35	4	90	3.5
4-0320.	Presque Isle River near Tula	261	6.3	38.8	14.9	1,580	93.2	36	2.35	5	110	3.5
4-0330.	Middle Br. Ontonagon R. nr. Paulding	164	3.3	32.6	11.1	1,680	94.0	32	2.3	3	70	3.0
4-0350.	East Br. Ontonagon R. nr. Mass	272	14.0	55.0	17.4	1,270	86.5	34	2.25	4	90	6.0
4-0405.	Sturgeon River near Sidnaw	171	20.3	32.1	18.1	1,610	97.0	31	2.2	5	90	3.0
4-0415.	Sturgeon River near Alston	346	19.1	57.6	13.1	1,480	95.2	31	2.2	5	90	4.0
4-0425.	Otter River near Elo	162	8.2	25.3	3.5	1,020	93.8	34	2.2	5	95	5.0
4-0430.	Sturgeon River near Arnheim	705	13.2	89.7	8.6	1,240	93.6	32	2.2	5	100	4.5
4-0455.	Tahquamenon R. nr. Tahquamenon Paradise	790	2.1	50.6	24.9	790	96.7	30	2.15	11	130	8.0
4-0460.	Black River near Garnet	28	10	8.5	36.1	780	88.1	30	2.1	11	70	8.0
4-0495.	Manistique River at Germfask	341	0.8	24.1	20.2	800	88.4	31	2.15	10	120	8.0
4-0545.	Duck Creek near Blaney	92	7.0	11.6	95.0	720	100	30	2.15	10	120	10.0
4-0550.	Manistique River near Blaney	704	1.1	44.0	31.0	790	88.9	30	2.15	10	110	9.0
4-0560.	W. Br. Manistique R. nr. Manistique	322	7.8	32.0	49.6	795	87.2	30	2.15	10	110	10.0
4-0565.	Manistique River near Manistique	1,100	1.0	53.5	39.9	780	88.9	30	2.15	10	110	9.5
4-0580.	Middle Br. Escanaba R. nr. Ishpeming	128	11.0	29.2	2.9	1,580	93.1	31	2.15	7	105	2.5
4-0585.	East Branch Escanaba River at Gwinn	124	10.0	32.5	1.8	1,300	89.6	31	2.15	9	90	2.0
4-0590.	Escanaba River at Cornell	870	5.4	88.0	18.9	1,330	93.2	30	2.2	8	90	4.0
4-0595.	Ford River near Hyde	450	6.7	92.4	30.2	1,170	92.9	30	2.25	8	60	3.5
4-0610.	Brule River near Florence, Wis.	389	7.2	60.7	9.8	1,530	91.4	32	2.3	2	70	2.0
4-0615.	Paint River at Crystal Falls	597	5.4	49.6	12.1	1,520	92.7	30	2.2	4	80	2.0
4-0653.	West Br. Sturgeon R. nr. Randville	56.1	12.8	17.4	12.8	1,290	95.2	30	2.25	4	60	6.0
4-0655.	Sturgeon River near Foster City	237	10.3	39.6	10.1	1,220	95.8	30	2.25	6	60	3.0
4-0975.	St. Joseph River at Three Rivers	1,350	3.1	99.8	8.5	940	19.0	35	2.6	19	40	5.0
4-0985.	Pawn River near White Pigeon	192	2.8	69.5	13.3	970	12.2	35	2.6	19	35	6.0
4-0990.	St. Joseph River at Mottville	1,866	2.8	115	9.2	950	17.7	35	2.6	19	40	6.0
4-1015.	St. Joseph River at Niles	3,666	2.5	163	7.5	920	13.6	35	2.6	19	40	6.0
4-1025.	Paw Paw River at Riverside	390	2.6	58.0	6.2	770	24.9	34	2.6	20	60	5.0
4-1035.	Kalamazoo River at Marshall	449	3.9	53.8	9.6	1,030	20.1	34	2.55	19	40	4.0
4-1050.	Battle Creek at Battle Creek	241	2.2	53.4	10.1	900	19.7	32	2.55	19	40	5.0
4-1055.	Kalamazoo River near Battle Creek	824	4.1	69.9	10.1	960	22.2	34	2.55	19	40	4.5
4-1060.	Kalamazoo River at Comstock	1,010	3.5	93.6	11.4	940	22.2	34	2.55	19	40	5.0
4-1065.	Portage Creek at Kalamazoo	48	9.3	11.5	8.2	870	22.0	34	2.55	19	45	6.0
4-1085.	Kalamazoo River near Fennville	1,600	2.5	145	9.3	900	22.8	34	2.55	19	40	6.0
4-1090.	Grand River at Jackson	174	3.1	33	14.5	1,000	21.1	33	2.5	19	40	6.0
4-1095.	Portage R. below L. Portage L. nr. Munith	55	4.9	11.6	25.8	940	14.1	32	2.4	19	40	9.0
4-1100.	Orchard Creek at Munith	49	2.3	9.4	10.5	945	17.6	32	2.4	18	40	3.0
4-1110.	Grand River near Eaton Rapids	661	1.5	70.2	12.7	965	18.2	32	2.5	18	40	4.0
4-1115.	Deer Creek near Dansville	16.3	7.5	7.4	7.9	930	16.4	32	2.4	17	40	3.0
4-1120.	Sloan Creek near Williamston	9.34	9.5	5.7	5.1	800	16.4	32	2.4	17	40	3.0
4-1125.	Red Cedar River at East Lansing	355	1.9	43.9	10.5	890	18.6	32	2.4	17	40	3.5
4-1130.	Grand River at Lansing	1,230	1.4	96.0	10.6	935	18.1	32	2.5	18	40	3.5
4-1140.	Grand River at Portland	1,385	2.0	131	9.6	930	18.1	32	2.5	18	40	3.5
4-1145.	Lookingglass River near Eagle	281	1.6	60.8	11.8	840	12.6	31	2.35	17	40	3.5
4-1150.	Maple River at Maple Rapids	434	2.2	54.2	3.0	740	13.0	31	2.3	16	40	3.0

Table A-3.--Basin characteristics at gaging stations--Continued

Station number	Station name	Basin Characteristics										
		Drainage area (sq mi)	Slope (feet per mile)	Main channel length (miles)	Area of lakes and ponds (percent)	Elevation (feet)	Forest cover (percent)	Mean Annual precipitation (inches)	2-year 24-hour rainfall (inches)	Mean minimum temperature January (°F)	Average annual snowfall (inches)	Minimum infiltration rate (inches per hour)
4-1160.	Grand River at Ionia	2,840	2.2	157	7.0	860	15.5	32	2.5	17	40	3.5
4-1165.	Flat River at Smyrna	528	3.9	52.4	3.7	910	25.5	31	2.4	16	45	6.0
4-1170.	Quaker Brook near Nashville	7.60	14.1	4.3	7.2	905	8.2	34	2.5	18	40	3.0
4-1175.	Thornapple River near Hastings	385	2.1	43.5	2.8	910	20.4	33	2.5	18	40	3.5
4-1180.	Thornapple River near Caledonia	773	2.7	74.4	3.0	880	21.8	33	2.5	18	40	3.5
4-1185.	Rogue River near Rockford	234	3.1	44.1	2.9	840	41.2	32	2.4	16	60	4.5
4-1190.	Grand River at Grand Rapids	4,900	2.0	203	5.4	860	17.5	32	2.5	17	45	3.5
4-1210.	Muskegon River near Merritt	309	0.53	42.4	40.7	1,190	78.1	30	2.15	11	60	10.0
4-1215.	Muskegon River at Ewart	1,450	1.48	122	13.6	1,220	55.7	31	2.2	11	60	10.0
4-1220.	Muskegon River at Newaygo	2,350	2.13	198	9.7	1,150	43.0	31	2.3	12	60	9.0
4-1222.	White River near Whitehall	380	6.0	65.1	2.9	800	50.6	31	2.4	16	65	10.0
4-1225.	Pere Marquette River at Scottville	709	5.9	67.2	3.0	860	65.2	32	2.3	15	65	12.0
4-1230.	Big Sable River near Freesoil	127	4.4	31.6	8.7	705	78.7	30	2.3	18	70	11.0
4-1235.	Manistee River near Grayling	159	4.8	23.0	2.1	1,280	96.7	30	2.1	11	120	12.0
4-1240.	Manistee River near Sherman	900	3.2	118	6.3	1,190	69.2	30	2.2	12	90	9.0
4-1245.	East Branch Pine River near Tustin	63	21.7	10.8	3.5	1,260	19.0	30	2.2	14	65	6.0
4-1250.	Pine River near LeRoy	118	15.3	22.2	4.4	1,265	33.2	31	2.2	14	65	6.0
4-1255.	Pine River near Hoxeyville	251	9.4	53.5	2.4	1,220	43.9	31	2.25	14	65	7.0
4-1260.	Manistee River near Manistee	1,780	3.2	167	5.1	1,120	57.4	31	2.2	14	100	8.0
4-1262.	Little Manistee River near Freesoil	200	8.5	48.0	3.7	925	90.0	32	2.3	16	70	12.0
4-1270.	Boardman River near Mayfield	223	10.6	32.1	5.0	1,050	57.0	31	2.2	14	90	10.0
4-1280.	Sturgeon River near Wolverine	170	12.0	25.7	4.3	1,070	81.2	30	2.1	10	90	8.0
4-1285.	Indian River at Indian River	583	12.8	37.4	13.2	820	72.6	30	2.0	12	80	8.0
4-1290.	Pigeon River near Vanderbilt	63	19.6	19.2	10.1	1,130	86.6	29	2.05	10	75	9.0
4-1295.	Pigeon River at Afton	159	11.1	37.4	6.0	960	91.2	29	2.05	10	70	8.0
4-1300.	Cheboygan River near Cheboygan	865	9.0	51.8	13.8	900	73.6	30	2.0	10	90	8.0
4-1305.	Black River near Tower	313	6.1	50.9	14.3	905	91.2	28	2.0	12	70	7.0
4-1310.	Rainy River near Onaway	79	6.4	20.8	19.5	835	87.8	28	2.0	12	65	12.0
4-1315.	Rainy River near Oqueoc	85	8.0	25.8	19.6	825	84.7	27	2.0	12	65	7.0
4-1320.	Black River near Cheboygan	597	7.1	62.6	14.8	830	87.3	27	2.0	12	70	8.0
4-1325.	Thunder Bay River near Hillman	232	6.5	28.0	5.3	1,020	92.2	28	2.05	11	60	9.0
4-1340.	North Br. Thunder Bay R. nr. Bolton	184	2.5	41.6	13.2	805	73.5	28	2.0	12	65	6.0
4-1355.	Au Sable River at Grayling	110	5.4	32.3	4.9	1,280	89.2	30	2.1	11	90	12.0
4-1356.	East Branch Au Sable River at Grayling	76.0	9.0	23.3	6.0	1,255	85.0	29	2.1	10	80	12.0
4-1365.	Au Sable River at Mio	1,100	4.9	74.6	5.2	1,230	88.9	29	2.1	10	65	11.0
4-1380.	East Branch Au Gres River at McIvor	84	11.6	23.1	4.2	835	73.6	28	2.1	13	45	6.0
4-1385.	Au Gres River near National City	169	7.9	36.9	3.9	825	62.7	28	2.1	13	45	4.0
4-1390.	Houghton Creek near Lupton	22	36.5	11.4	2.0	1,120	55.0	28	2.1	10	50	6.0
4-1395.	Rifle River at "The Ranch" near Lupton	54	34.2	12.0	4.2	1,085	65.0	28	2.1	10	50	6.0
4-1400.	Prior Creek near Selkirk	19	44.1	9.9	3.5	1,045	35.0	28	2.1	10	50	3.0
4-1405.	Rifle River at Selkirk	110	15.5	19.1	5.8	1,055	55.0	28	2.1	10	50	4.0
4-1410.	South Br. Shepards Creek nr. Selkirk	1.20	60.0	2.6	2.5	930	15.0	28	2.15	10	50	3.0
4-1415.	West Branch Rifle River near Selkirk	52.0	12.6	15.6	4.0	1,095	52.0	28	2.15	10	55	4.0
4-1420.	Rifle River near Sterling	320	7.0	43.3	6.9	990	55.8	28	2.1	12	50	4.0
4-1435.	N. Br. Kawkawlin R. nr. Kawkawlin	101	3.4	31.8	2.8	675	17.2	28	2.2	17	40	4.0
4-1440.	Shiawassee River at Byron	368	4.3	31.1	6.3	945	25.0	31	2.3	17	35	3.0

Table A-3.--Basin characteristics at gaging stations--Continued

Station number	Station name	Basin Characteristics										Minimum infiltration rate (inches per hour)
		Drainage area (sq mi)	Slope (feet per mile)	Main channel length (miles)	Area of lakes and ponds (percent)	Elevation (feet)	Forest cover (percent)	Mean Annual precipitation (inches)	2-year 24-hour rainfall (inches)	Mean minimum temperature January (°F)	Average annual snowfall (inches)	
4-1445.	Shiawassee River at Owosso	538	3.3	68.2	4.6	905	22.0	31	2.3	17	35	3.0
4-1450.	Shiawassee River near Fergus	637	2.4	97.3	4.5	870	19.5	31	2.3	17	35	3.0
4-1455.	Bad River near Brant	89	5.4	29.9	0	695	14.0	30	2.3	16	40	2.0
4-1460.	Farmers Creek near Lapeer	57	7.8	12.7	13.0	950	18.9	31	2.3	17	35	10.0
4-1475.	Flint River near Otisville	547	5.0	52.5	5.1	895	11.4	31	2.25	16	35	6.0
4-1480.	Flint River at Genesee	593	4.8	60.7	5.3	885	12.1	31	2.25	16	35	6.0
4-1482.	Swartz Creek near Holly	11.9	11.7	6.3	39.0	985	20.5	31	2.3	16	35	3.0
4-1485.	Flint River near Flint	927	4.1	75.0	5.2	890	13.6	31	2.25	16	35	5.0
4-1500.	S. Br. Cass R. nr. Cass City	251	2.7	34.4	0.9	785	7.0	30	2.2	16	50	2.0
4-1505.	Cass River at Cass City	370	2.6	38.8	2.8	755	10.7	30	2.2	16	50	3.0
4-1510.	Cass River at Vassar	700	2.8	69.7	2.1	760	11.8	30	2.2	16	45	6.0
4-1515.	Cass River at Frankenmuth	848	2.6	81.7	2.3	755	11.8	30	2.2	16	45	7.0
4-1525.	Tobacco River at Beaverton	487	7.0	48.4	3.2	965	24.4	29	2.2	14	40	7.0
4-1535.	Salt River near North Bradley	138	6.3	28.6	2.3	745	18.4	29	2.2	17	40	5.0
4-1540.	Chippewa River near Mount Pleasant	416	5.0	67.8	8.7	980	27.4	30	2.25	16	40	6.0
4-1545.	Chippewa River near Midland	597	4.8	94.2	6.5	920	27.1	30	2.25	16	40	7.0
4-1550.	Pine River at Alma	288	3.7	59.3	4.3	875	21.9	30	2.3	17	40	5.0
4-1555.	Pine River near Midland	390	3.3	88.9	3.3	845	18.8	29	2.3	17	40	4.0
4-1560.	Tittabawassee River at Midland	2,400	5.8	59.4	8.0	860	32.1	29	2.2	15	40	6.0
4-1575.	Sebewaing River near Sebewaing	62	7.7	18.2	0	680	3.1	29	2.15	17	45	1.5
4-1580.	East Fork Sebewaing R. nr. Sebewaing	38	5.4	10.2	0	670	2.2	29	2.15	17	45	1.5
4-1585.	Pigeon River near Owendale	55	8.1	17.9	1.8	740	9.1	29	2.15	17	40	2.0
4-1595.	Black River near Fargo	480	2.0	41.3	2.6	785	12.2	30	2.2	17	45	2.0
4-1600.	Mill Creek near Abbottsford	185	3.2	51.2	2.0	815	17.4	30	2.2	16	35	2.5
4-1605.	Black River near Port Huron	684	3.3	68.5	2.3	790	14.5	30	2.2	17	40	2.5
4-1610.	Clinton River at Auburn Heights	123	4.6	38.1	16.0	990	27.5	31	2.3	17	35	5.0
4-1615.	Paint Creek near Lake Orion	38.5	6.7	15.1	11.9	1,040	27.4	31	2.3	18	35	10.0
4-1618.	Stony Creek near Washington	68.2	11.8	17.2	10.0	980	25.0	31	2.3	18	35	4.0
4-1629.	Big Beaver Creek near Warren	23.5	15.3	8.6	0.1	670	5.7	30	2.35	19	35	1.5
4-1635.	Plum Brook near Utica	22.9	18.2	5.9	1.5	705	8.4	31	2.35	18	35	3.0
4-1640.	Clinton River near Fraser	444	7.4	65.3	7.8	880	18.1	31	2.35	18	35	3.0
4-1641.	East Pond Creek at Romeo	21.8	18.9	13.4	9.5	955	19.5	31	2.3	18	35	4.0
4-1643.	East Branch Coon Creek at Armada	13.0	5.1	9.0	0.2	790	5.2	31	2.3	18	35	2.0
4-1645.	North Br. Clinton R. nr. Mount Clemens	199	7.9	40.4	1.6	800	10.6	31	2.3	18	35	2.0
4-1655.	Clinton River at Mount Clemens	734	7.3	69.6	5.2	835	14.8	31	2.35	18	35	3.0
4-1660.	River Rouge at Birmingham	36.9	10.3	9.0	6.0	865	12.3	31	2.35	19	35	4.0
4-1661.	River Rouge at Southfield	87.9	12.8	21.1	3.4	840	12.3	31	2.35	19	35	3.5
4-1662.	Evans Ditch at Southfield	9.49	17.9	7.4	0.4	685	6.4	31	2.35	19	35	4.0
4-1663.	Upper River Rouge at Farmington	17.5	25.7	8.4	3.8	855	22.2	32	2.35	19	35	3.0
4-1665.	River Rouge at Detroit	187	8.1	30.5	2.1	775	11.2	31	2.35	19	35	4.0
4-1670.	Middle R. Rouge nr. Garden City	99.9	14.2	25.7	3.0	815	15.6	31	2.35	19	30	4.0
4-1680.	Lower River Rouge at Inkster	83.2	7.2	21.8	0.3	710	10.3	31	2.4	19	30	4.0
4-1695.	Huron River at Commerce	51	6.0	19.2	19.1	990	27.5	32	2.3	18	40	10.0
4-1700.	Huron River at Milford	125	3.9	29.6	15.2	975	27.5	32	2.3	18	40	10.0
4-1705.	Huron River near New Hudson	143	3.6	35.8	14.8	975	27.5	32	2.35	18	40	10.0

Table A-3.—Basin characteristics at gaging stations—Continued

Station number	Station name	Basin Characteristics										
		Drainage area (sq mi)	Slope (feet per mile)	Main channel length (miles)	Area of lakes and ponds (percent)	Elevation (feet)	Forest cover (percent)	Mean Annual precipitation (inches)	24-hour rainfall (inches)	Mean minimum temperature January (°F)	Average annual snowfall (inches)	Minimum infiltration rate (inches per hour)
4-1715.	Ore Creek near Brighton	31	5.2	16.4	12.1	1,055	25.3	32	2.35	18	40	8.0
4-1720.	Huron River near Hamburg	299	2.9	48.8	12.4	975	26.2	32	2.35	18	40	8.0
4-1730.	Huron River near Dexter	506	2.3	59.4	11.4	955	24.4	32	2.35	18	35	8.0
4-1735.	Mill Creek near Dexter	134	9.6	15.1	4.3	945	18.4	32	2.4	19	35	6.0
4-1745.	Huron River at Ann Arbor	711	2.3	76.2	9.3	950	22.7	32	2.4	18	35	7.0
4-1757.	River Raisin near Tecumseh	266	6.1	50.2	10.8	955	17.5	31	2.45	19	35	6.0
4-1760.	River Raisin near Adrian	455	5.9	55.5	7.1	920	15.8	32	2.5	19	40	5.0
4-1765.	River Raisin near Monroe	1,034	3.2	116	4.0	830	14.5	31	2.5	19	40	5.0

Table A-4.--Summary of Regression Results
 Model is $Y = aA^{b_1}S^{b_2}L^{b_3}E^{b_4}F^{b_5}P^{b_6}I^{b_7}T^{b_8}B^{b_9}C^{b_{10}}$

Flow charac- teristic Y	Regression constant a	Exponent of basin characteristic										Standard error of estimate (percent)
		Drainage area A	Main channel slope S	Percent lakes (+1%) L	Mean basin elev. E	Percent forest (+1%) F	Mean annual precip. P	Precip. intensity I	Minimum January temp. (°F) T	Snow- fall B	Soil index C	
Q _A	.0252	1.01		-.07		.24		1.56		.34		23.4
q ₁	.0433	1.07		-.16		.15		1.79			.33	38.4
q ₂	1.25	1.05		-.20	-.32			1.53			.27	37.1
q ₃	86.9	1.01		-.10	-.53	-.14						26.6
q ₄	.202	.99		.08		.18				.45	-.28	24.4
q ₅	.137	1.04		.12		.31				.21	.19	26.1
q ₆	.00363	1.03				.36		2.47		.43		34.7
q ₇	.0000225	1.02		-.14	.46	.52		3.72		.37	.26	42.6
q ₈	2.92x10 ⁻⁷	1.10	.21	-.21	.78	.49		4.80		.40	.46	52.0
q ₉	7.33x10 ⁻⁷	1.12	.23	-.14	.73	.75		4.65			.48	55.4
q ₁₀	.000128	1.04	.20			.52		4.20		.45	.28	42.4
q ₁₁	.000975	1.04	.16			.35		2.88		.47	.24	32.6
q ₁₂	.0312	1.00		-.15		.34		2.01			.25	32.8
SD _A	.0795	.98	-.08	.14	-.46		1.35				-.42	23.0
SD ₁	723	1.01	-.21		-1.23		1.16			-.71	-.20	30.2
SD ₂	142,200	.99	-.20	-.12	-1.19					-1.02	-.18	30.9
SD ₃	1,340	1.00		.12	-.93					-.20	-.58	38.4
SD ₄	975	1.00		.14			1.96				-.55	38.8
SD ₅	.543	1.06		.34							-.69	51.0
SD ₆	.182	1.03		.14						.20	-.41	38.4
SD ₇	.209	1.03		.31							-.45	51.2
SD ₈	2.32x10 ⁻⁷	.98			.69		2.17			.36	.18	41.9
SD ₉	1.46x10 ⁻⁶	1.01		.13	.57		1.56			.48		52.3
SD ₁₀	.0528	.94		.25						.50	-.40	40.1
SD ₁₁	9.875	.98		.19	-.68					.31	-.34	28.5
SD ₁₂	2,700	.98		.08	-1.14					-.28	-.25	31.6
P ₂	55,100	.88	.18		-.68	-.22	-1.45			.69	-.74	43.1
P ₅	57,900	.86	.17		-.84			-1.61			-.85	48.9
P ₁₀	32,000	.84	.21		-1.08					.31	-.89	51.0
P ₂₅	18,490	.85	.23		-.82						-.84	55.1
P ₅₀	16,260	.84	.24		-.78						-.85	57.8
M7,2	5.92x10 ⁻⁷	1.10	.26	-.36		1.22		8.12			.84	74.7
M7,10	4.00x10 ⁻⁸	1.13	.31	-.50		1.50		9.39			.99	92.8
M7,20	1.57x10 ⁻⁸	1.14	.33	-.54		1.60		9.86			1.05	100
V7,2	9,660	.95			-.94				-.52	.23	-.47	31.8
V7,10	173,000	.94			-1.11				-.63		-.50	37.1
V7,50	136,800	.94			-1.04				-.60		-.50	41.9

Table A-5.--Gaging stations in operation and proposed for the network.

Column	Symbol	Description
1	B	Benchmark or long-term trend station.
2	C	Current-purpose station.
3-5	1	Accounting (such as OWDC accounting stations, Water Resources Review index stations, etc.).
	2	Operation (as for water management, powerplant regulation, etc.).
	3	Forecasting (as for Weather Bureau flood forecasting).
	4	Disposal (as for disposal by sewage-treatment or industrial plants).
	5	Water quality, including chemical, sediment, and biological (where discharge records are needed because water quality data are being collected).
	6	Compact or legal (as for FPC, international boundary commissions, or other).
	7	Research or special studies.
6	P	A principal stream station to meet objective of measuring principal unregulated streams.
	H	A hydrologic station to meet objective of defining regional streamflow characteristics except when station is classified as P.
	R	A station required for systems analysis of a regulated stream to meet objective of defining regulated flow.
	U	A station not recommended for inclusion in future program.
		The effect of regulation or diversion on low flow and monthly flow. Blank means no appreciable effect.
7	1	No appreciable effect on daily flow (diurnal fluctuation only).
	2	No appreciable effect on weekly low flow.
	3	Monthly flow not appreciably affected by diversion or affected not over 10 percent by regulation.
	4	Monthly flow affected, but published data available to adjust to natural conditions with an error of less than 10 percent (adjustments should be limited to diversions that completely bypass the station and to not more than two reservoirs.)
	5	Effect of regulation has not been evaluated.
	6	Effect on daily flow is appreciable (more than 10 percent).
	7	Effect on weekly low flow is appreciable (more than 10 percent).
	8	Monthly flow affected by more than 10 percent, and data not available to adjust to natural conditions with an error of less than 10 percent.
		The effect of regulation on peak flow. Blank means no appreciable effect.
8	1	Annual peak flow affected by less than 10 percent.
	2	Annual peak flow affected by more than 10 percent.
	3	Annual peak flow affected by undetermined amount.
		How the station is financed.
9	1	Federal
	2	Coop Program
	3	OFA
	4	Combination of 1 and 2
	5	Combination of 1 and 3

Table A-5.--Gaging stations in operation and proposed for the network.--Continued

Station Number	Station Name	1	2	3	4	5	6	7	8	9
4-0010.	Washington Creek at Windigo	B					H			1
0310.	Black River near Bessemer		C	2			H	1	-	2
0315.	Presque Isle River at Marenisco						H	1	-	2
0320.	Presque Isle River near Tula						U	-	-	
0330.	Middle Branch Ontonagon River near Paulding		C	6			H	-	-	2
0335.	Bond Falls Canal near Paulding		C	2			R	8	3	2
0345.	Middle Branch Ontonagon River near Trout Creek		C	2			R	4	2	2
0350.	East Branch Ontonagon River near Mass						U			
0355.	Middle Branch Ontonagon River near Rockland		C	2			R	4	3	2
0360.	West Branch Ontonagon River near Bergland		C	2			R	8	2	2
0375.	Cisco Branch Ontonagon River nr. Cisco Lake Outlet		C	2			R	8	2	2
0395.	South Branch Ontonagon River at Ewen		C	2			R	4	1	2
0400.	Ontonagon River near Rockland		C	2			R	8	1	2
0405.	Sturgeon River near Sidnaw	B	C	1			-	-	-	2
0415.	Sturgeon River near Alston		C	6			P	2	-	2
0425.	Otter River near Elo						U	-	-	
0430.	Sturgeon River near Arnheim		C	1			P	2	-	2
0430.5.	Trap Rock River near Lake Linden						H	-	-	2
0444.	Carp River near Negaunee		C	2			R	8	2	2
0445.83.	Cherry Creek near Harvey						U	-	-	
0455.	Tahquamenon River near Tahquamenon Paradise	B	C	1			P	-	-	1
	Munuscong River (establish, 400 sq. mi.)						P			
	Pine River (establish, 400 sq. mi.)						P			
0460.	Black River near Garnet	B					-	-	-	2
0495.	Manistique River at Germfask						U			
0550.	Manistique River near Blaney						U			
0565.	Manistique River near Manistique	B	C	1			P	3	-	2
	Whitefish River (establish, 400 sq. mi.)						P			
0570.	Indian River near Manistique						U			
0575.1.	Sturgeon River near Nahma Junction						H	-	-	2
0578.	Middle Branch Escanaba River at Humboldt		C	2			R	4	1	2
0580.	Middle Branch Escanaba River near Ishpeming		C	2	7		-	-	-	2
0581.	Middle Branch Escanaba River near Princeton		C	2			R	2	1	2
0582.	Schweitzer Creek near Palmer		C	2			R	8	2	2
0584.	Goose Lake Outlet near Sands Station		C	2			-	-	-	2
0585.	East Branch Escanaba River at Gwinn		C	2	7		-	1	-	2
	Escanaba River (establish, 400 sq. mi.)						P			
0590.	Escanaba River at Cornell		C	1	2		P	2	-	1
0595.	Ford River near Hyde	B					P	-	-	2
0605.	Iron River at Caspian						U			
0610.	Brule River near Florence, Wis.	B	C	6			P	3	-	2
0615.	Paint River at Crystal Falls		C	6			P	1	-	2
0620.	Paint River near Alpha		C	2			R	8	2	2
0622.	Peshekee River near Champion		C	2			H	-	-	2
0622.3.	Michigamme River near Michigamme		C	2			-	-	-	2
0623.	Michigamme River at Republic		C	2			R	3	1	2
0624.	Michigamme River near Witch Lake		C	2	5		-	-	-	2
0625.	Michigamme River near Crystal Falls		C	2			R	8	3	2
0630.	Menominee River near Florence		C	2			R	8	3	2
0653.	West Branch Sturgeon River near Randville		C	2			-	4	-	2
0655.	Sturgeon River near Foster City						H	4	-	2
0964.	St. Joseph River near Burlington						H	-	-	2
0966.	Coldwater River near Hodunk						H	-	-	2
	St. Joseph River (establish, 400 sq. mi.)						P			
0969.	Nottawa Creek near Athens						H	-	-	2
0971.7.	Portage River near Vicksburg		C	7			-	-	-	2
0971.95.	Gourdneck Canal near Schoolcraft		C	2			-	-	-	2
0972.	Gourdneck Creek near Schoolcraft		C	2			-	-	-	2
0975.	St. Joseph River at Three Rivers						P	2	1	3
0975.4.	Prairie River near Nottawa						H	-	-	2
0985.	Pawn River near White Pigeon						H	-	-	2
0990.	St. Joseph River at Mottville		C	6	2		P	3	-	2
1015.	St. Joseph River at Niles		C	1			P	3	-	1
1018.	Dowagiac River at Summerville						H	-	-	2
1025.	Paw Paw River at Riverside						P	-	-	1

Table A-5.--Gaging stations in operation and proposed for the network.--Continued

Station Number	Station Name	1	2	3	4	5	6	7	8	9
4-1027.	Black River near Bangor						H	-	-	2
1035.	Kalamazoo River at Marshall						P	2	-	3
1050.	Battle Creek at Battle Creek	B					H	-	-	2
1055.	Kalamazoo River near Battle Creek						U			
1057.	Augusta Creek near Augusta		C	7			H	-	-	2
1058.	Gull Creek near Galesburg		C	7			H	-	-	2
1060.	Kalamazoo River at Comstock						U			
1063.	Portage Creek near Kalamazoo		C	2			-	-	-	2
1064.	West Fork Portage Creek at Kalamazoo		C	2	7		-	-	-	2
1085.	Kalamazoo River near Fennville		C	6	1		R	3	-	2
1086.	Rabbit River near Hopkins						H	-	-	2
1088.	Black River near Zeeland						H	-	-	2
1090.	Grand River at Jackson		C	4				-	-	2
1110.	Grand River near Eaton Rapids						P	2	-	1
1115.	Deer Creek near Dansville		C	5	7			-	-	2
1120.	Sloan Creek near Williamston		C	5	7			-	-	2
1125.	Red Cedar River at East Lansing		C	1			P	-	-	2
1130.	Grand River at Lansing		C	4	3		P	3	-	2
1140.	Grand River at Portland						U			
1145.	Lookingglass River near Eagle		C	2			H	-	-	2
1150.	Maple River at Maple Rapids						P	-	-	2
1160.	Grand River at Ionia		C	3			P	2	-	3
1165.	Flat River at Smyrna						P	-	-	1
1170.	Quaker Brook near Nashville		C	7				-	-	2
1175.	Thornapple River near Hastings	B					P	-	-	2
1180.	Thornapple River near Caledonia						U			
1185.	Rogue River near Rockford		C	4			H	-	-	1
1190.	Grand River at Grand Rapids		C	1	3	4	P	-	-	1
1210.	Muskegon River near Merritt						U			
1213.	Clam River at Vogel Center						H	-	-	2
1215.	Muskegon River at Evart		C	1			P	-	-	2
1219.	Little Muskegon River near Morley						H	-	-	2
1220.	Muskegon River at Nawaygo		C	1			P	5	1	2
1221.	Bear Creek near Muskegon		C	4			-	-	-	2
1222.	White River near Whitehall						H	-	-	2
1225.	Pere Marquette River at Scottville	B					P	-	-	2
1230.	Big Sable River near Freesoil						U			
1235.	Manistee River near Grayling						U			
	Manistee River (establish, 400 sq mi)						P			
1240.	Manistee River near Sherman	B					P	-	-	2
1255.	Pine River near Hoxeyville						H	-	-	2
1260.	Manistee River near Manistee		C	1	6		R	3	3	2
1262.	Little Manistee River near Freesoil						H	-	-	2
1270.	Boardman River near Mayfield		C	6			R	3	3	2
1278.	Jordan River near East Jordan						H	-	-	2
1280.	Sturgeon River near Wolverine	B					H	-	-	3
1285.	Indian River at Indian River						U			
1290.	Pigeon River near Vanderbilt						H			2
1295.	Pigeon River at Afton						U			
1300.	Cheboygan River near Cheboygan		C	1	2			5	3	3
1305.	Black River near Tower		C	6				5	3	2
1315.	Rainy River near Ocqueoc						H	-	-	2
1320.	Black River near Cheboygan		C	1	6			5	3	2
1325.	Thunder Bay River near Hillman						U			
1335.	Thunder Bay River near Bolton						U			
1340.	N. Branch Thunder Bay River near Bolton						H	2	-	2
1355.	Au Sable River at Grayling						H	-	-	2
1356.	East Branch Au Sable River at Grayling		C	2				1	-	2
1357.	South Branch Au Sable River near Luzerne						H	-	-	2
1365.	Au Sable River at Mio		C	1	6			2	-	2
1380.	East Branch Au Gres River at McIvor						U			
1385.	Au Gres River near National City						H	-	-	1
1390.	Houghton Creek near Lupton						U			
1395.	Rifle River at "The Ranch" near Lupton						U			
1400.	Prior Creek near Selkirk						U			

Table A-5.--Gaging stations in operation and proposed for the network.--Continued

Station Name	Station Name	1	2	3	4	5	6	7	8	9
4-1405.	Rifle River at Selkirk						H	-	-	2
1410.	South Branch Shepards Creek near Selkirk						H	-	-	2
1420.	Rifle River near Sterling	B	C	5				-	-	2
1435.	North Branch Kawkawlin River near Kawkawlin						H	-	-	3
1439.	Shiawassee River at Linden		C	4			H	-	-	2
1440.	Shiawassee River at Byron						P			3
1445.	Shiawassee River at Owosso		C	3	5	4		-	-	2
1450.	Shiawassee River near Fergus		C	1			P	-	-	3
1460.	Farmers Creek near Lapeer	B	C	4			H	-	-	2
1475.	Flint River near Otisville		C	4			R	4	1	2
1481.4.	Kearsley Creek near Davison						H	-	-	2
1482.	Swartz Creek near Holly						H	-	-	2
1485.	Flint River near Flint		C	4			R	4	-	2
1490.	Flint River near Fosters		C	1			-	-	-	1
1500.	South Branch Cass River near Cass City		C	7				-	-	3
1505.	Cass River at Cass City						P	-	-	3
1508.	Cass River at Wahjamega		C	4			-	-	-	2
1510.	Cass River at Vassar						U			
1515.	Cass River at Frankenmuth		C	1	4		P	-	-	2
1525.	Tobacco River at Beaverton						H	5	3	1
1535.	Salt River near North Bradley						U			
1540.	Chippewa River near Mount Pleasant	B					P	2	-	2
1545.	Chippewa River near Midland						U			
1550.	Pine River at Alma		C	4				2	-	2
1555.	Pine River near Midland						P	2	-	3
1560.	Tittabawassee River at Midland		C	1	4		P	5	-	2
1585.	Pigeon River near Owendale						H	-	-	2
1595.	Black River near Fargo		C	5			P	-	-	2
1599.	Mill Creek near Avoca						H	-	-	2
1605.7.	North Branch Belle River at Inlay City		C	4						2
1606.	Belle River at Memphis						H	-	-	2
1608.	Sashabaw Creek near Drayton Plains						H	-	-	2
1609.	Clinton River near Drayton Plains						H	-	-	2
1610.	Clinton River at Auburn Heights		C	4				5	1	2
1611.	Galloway Creek near Auburn Heights						H	-	-	2
1615.	Paint Creek near Lake Orion						H	-	-	2
1615.4.	Paint Creek at Rochester						H	-	-	2
1615.8.	Stony Creek near Romeo		C	2			-	-	-	2
1618.	Stony Creek near Washington		C	2			R	4	3	2
1629.	Big Beaver Creek near Warren		C	4	7		H	3	-	2
1635.	Plum Brook near Utica						H	-	-	2
1640.	Clinton River near Fraser		C	5	4		P	3	-	1
1641.	East Pond Creek at Romeo		C	7			H	-	-	2
1641.5.	North Branch Clinton River near Meade		C	7			-	-	-	2
1642.	Coon Creek near Armada		C	7			-	-	-	2
1643.	East Branch Coon Creek at Armada		C	7			H	-	-	2
1643.5.	Highbank Creek near Armada		C	7			-	-	-	2
1643.6.	East Branch Coon Creek near New Haven		C	7			-	-	-	2
1645.	North Branch Clinton River near Mount Clemens	B					H	-	-	1
1648.	Middle Branch Clinton River at Macomb						H	-	-	2
1655.	Clinton River at Mount Clemens		C	1			P	3	-	5
1660.	River Rouge at Birmingham						H	1	-	2
1661.	River Rouge at Southfield						H	-	-	2
1662.	Evans Ditch at Southfield						H	-	-	2
1663.	Upper River Rouge at Farmington						H	-	-	2
1665.	River Rouge at Detroit		C	7				-	-	2
1670.	Middle River Rouge near Garden City						U			
1680.	Lower River Rouge at Inkster						H	-	-	2
1695.	Huron River at Commerce						U			
1700.	Huron River at Milford		C	2			H	-	-	2
1705.	Huron River near New Hudson		C	2				5	3	2
1720.	Huron River near Hamburg						P	5	3	2
1725.	Portage River near Pinckney						U			
1730.	Huron River near Dexter						U			
1735.	Mill Creek near Dexter						H	-	-	1
1745.	Huron River at Ann Arbor		C	1	4		P	4	3	3
1757.	River Raisin near Tecumseh						H	-	-	2
1760.	River Raisin near Adrian						P	-	-	2
1764.	Saline River near Saline		C	4						2
1765.	River Raisin near Monroe	B	C	1	5		P	-	-	2