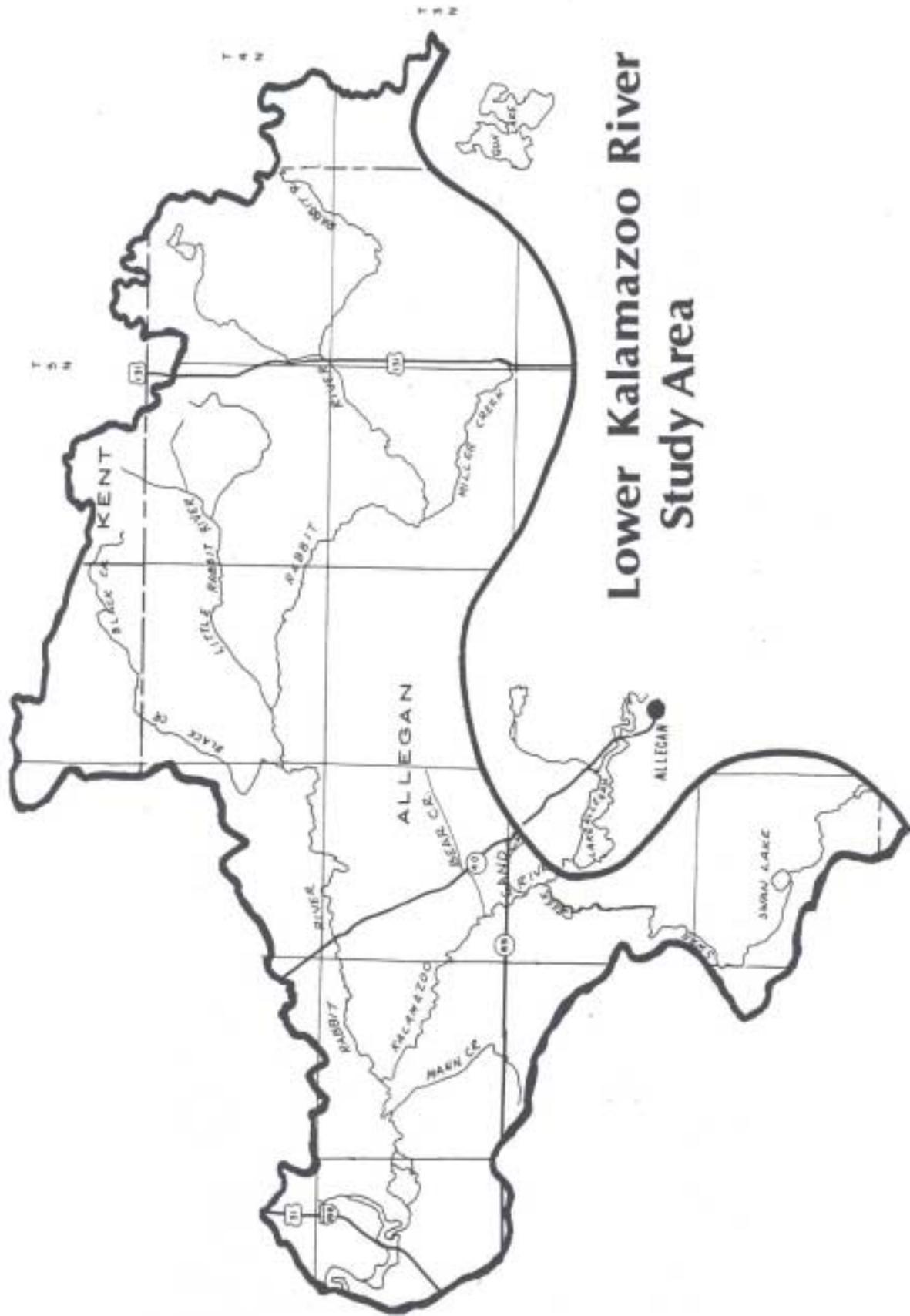


## THE WATERSHED AND STUDY AREA

### A. General Description

- 1) **The Watershed.** The Kalamazoo River system drains an area of approximately 2,020 square miles as it flows through portions of the southwest Michigan counties of Allegan, Barry, Eaton, Van Buren, Kalamazoo, Calhoun, Jackson, Hillsdale, Kent and Ottawa. The North and South branches originate within a few miles of each other. The North Branch heads in Farewell and Pine Hills lakes in southern Jackson County while the South Branch rises in marshy areas south of Moscow in northeastern Hillsdale County. The two branches join at Albion, forming the mainstream which flows northwesterly for approximately 123 miles before entering Kalamazoo Lake and eventually Lake Michigan near the towns of Douglas and Saugatuck.
- 2) **The Study Area.** The Kalamazoo River system contains approximately 542 linear miles of streams. Although the mainstream is roughly 123 miles long, only the 23-mile stretch between the Calkins Bridge Dam and I-196 is considered in the study area at this time. The drainage area in the study area is estimated at 460 square miles (294,400 acres). One hundred and thirty-five miles of tributaries were included in the study. Other sections of the river may be added in the future.





# Lower Kalamazoo River Study Area

## B. Physiography and Soils

The surface topography of the watershed was determined by the last continental glacial period, the Wisconsin. A wide variety of glacial or glacial-related deposits make up the surface area. These include ground moraines of variably textured materials, terminal moraines, coarse-textured outwash, alluvial ponded areas, and other types of deposits. The glacial materials extend to a depth of several hundred feet in the western portions of the watershed and generally are 50 feet or less in depth east of Battle Creek.

Soils are as varied as the glacial materials in which they are developed. They range from clay and silt to sand and organic materials. About 25 percent of the soils have clay loam or clay textures. These soils, such as the Miami, Marlette and Bount soils, are found principally in Eaton County and to a lesser extent in Allegan and Van Buren counties. Forty percent of the soils are sandy loams, and loams of intermediate texture. These soils, which include the Hillsdale, Kalamazoo and Boyer, are found primarily in Calhoun, Allegan, Barry and Kalamazoo counties.

Soils with loamy sand and sandy textures, which include the Oakville, Spinks and Rubicon soils, are found on approximately 30 percent of the land. These sandy soils are largely in the western part of the basin. The remaining five percent of the soils are organic and are distributed throughout the basin, usually in river bottoms.

A general soil association map delineates 16 soil associations, each of which have certain predominant soil characteristics. These characteristics impose limitations on the suitability of the soils for various uses.

The north branch of the Kalamazoo River originates in Farewell and Pine Hills lakes, Jackson County, at an elevation of 1,042 feet above sea level, while the South Branch rises in marshy areas in Hillsdale County at an elevation of 1,120 feet above sea level. The two branches join at Albion and drop to an elevation of 580 feet above sea level at Lake Michigan.

Within the study area, the low areas along the Kalamazoo River are for the most part old glacial drainage ways. These valley plains are generally not more than a mile or two wide and are traversed by streams. The streams in places have cut a lower plain a few feet deep which is floored with recent flood plain alluvium. The plains are nearly flat but are intersected in places by inflowing streams from the adjacent highlands. Although dry in places, most of these extensive flats have a high water table, large areas of muck soil and swampy land bordering the river channel. In addition to the large areas of muck soils, these areas contain wet sandy loams and loams of medium fertility.

Upland areas adjacent to the rivers are flat to gently undulating glacial outwash plains. The predominant soils in these plains and the study area are the dry sandy soils which are usually acid and low in fertility. An exception to these dry sandy soils are the areas along the Rabbit River which contain the more fertile sandy loams, loams and silt loam soils.



### C. Stream Characteristics

The table below is a partial list of streams within the Kalamazoo River system. Lengths are shown in miles. (Many small streams and drains are not included.)

Stream		Stream	
Kalamazoo River (mainstream)	123.0	Spring Brook	6.0
North Branch Kalamazoo River	28.0	Gun River	13.0
South Branch Kalamazoo River	43.0	Miner Creek	7.0
Rice Creek (North & South Branches)	29.5	School Section Creek	3.0
Wilder Creek	10.5	Schnable Brook	4.0
Seven Mile Creek	4.0	*Swan Creek	16.5
Wabascon Creek	16.0	*Bear Creek	6.5
Battle Creek River	46.0	*Sand Creek	3.5
Wanadaga Creek	12.0	*Mann Creek	6.0
Indian Creek	9.0	*Rabbit River	46.5
Big Creek	6.0	*Little Rabbit	14.0
Augusta Creek	15.0	*Red Run Drain	7.0
Portage Creek (includes West Branch)	18.5	*Black Creek	15.0
Pine Creek	6.0	*Miller Creek	7.0
Baseline Creek	4.0	*Miller Creek	3.5
Sand Creek	4.0	*Silver Creek	2.0
		*Green Lake Creek	7.0
		TOTAL	542.0 miles

\*Tributaries draining into the mainstream within the study area.



Approximately 2,450 lakes and ponds totaling 37,500 acres are scattered throughout the watershed. These lakes range in size from Gun Lake at 2,611 acres to numerous small ponds. There are 52 lakes or impoundments of 100 acres or more in size:

County	Number of Lakes 100+ Acres	Total Surface Acres
Allegan	17	5,510
Barry	11	5,560
Kent	0	0
Calhoun	12	2,360
Eaton	1	130
Hillsdale	0	0
Jackson	2	340
Kalamazoo	9	3,880
Ottawa	0	0
Van Buren	0	0
<b>WATERSHED</b>	52	17,780

The mainstream is dammed in nine locations and the majority of these dams were constructed for generating electric power. The Department acquired three dams in the Plainwell-Otsego area to be used for waterfowl hunting habitat. These areas were also to be managed for food production. Vandalism and high maintenance costs have forced the department to draw these down to a low-sill head. There are three dams on tributary streams in the study area. One located on Swan Creek has become the base for a popular campground. A second dam on lower Swan Creek creates a diversion to maintain goose habitat in the Swan Creek Marsh. The third is Hamilton Mill Pond on the Rabbit River. Further, there is a control dam at the outlet for Palmer Bayou at the M-89 Bridge.

Water quality in the mainstream sections of the Kalamazoo and the study area is protected for the following uses: agriculture, industrial water supply, navigation, public water supply, recreation, warm water fish and partial body contact. The same conditions apply on the tributary streams under study except for those streams classified for cold water fish.

Despite increasingly effective wastewater treatment facilities and enforcement efforts, pollution problems still arise. The Michigan Department of Public Health advises against eating fish taken in the Kalamazoo River below Kalamazoo because PCB in the fish exceeds Food and Drug Administration limits.

Legislation to control PCB in Michigan was initiated by the Part 147, PCB of P.A. 451. This law limited concentrations of the chemical and regulated the sale, labeling, transportation and disposal of PCB products. PCB is also controlled at the federal level by the Toxic Substances Control Act (TSCA), P.L. 94-469. This law became effective on January 1, 1977 and prohibited the manufacture, processing, distribution and use of PCB after July 2, 1979, unless specifically exempted by the Environmental Protection Agency.

These stringent measures will control future introductions, but because of past practices PCB will continue to be an environmental contaminant for some time due to its persistence in the environment and its historic widespread use. However, the flushing action of the river, over time, should cleanse it of these toxic chemicals.

The Kalamazoo River has a relatively slow to moderate stream gradient dropping 540 feet in elevation from its headwaters on the South Branch to Lake Michigan. Although there are areas where the gradient is greater, the average drop in elevation over the 166 miles of mainstream and South Branch is just over three feet per mile. The following chart indicates basic flow data for the Kalamazoo River including the study area:

Station	Period of Record	Average Discharge (CFS)	Annual Mean Discharge (CFS)		Extremes for Period Of Record (CFS)	
			Maximum	Minimum	Maximum	Minimum
Marshall	1948-77	313	829	52	2,130	12
Battle Creek	1937-77	640	1,610	167	7,290	50
Comstock	1933-77	844	1,790	305	6,910	119
**Fennville	1929-77	1,383	4,150	143	17,500	50*
					4/11/47	8/19/76

\*Caused by shutting off flow at Calkins (Lake Allegan) Dam.

\*\*Within the study area.

The North Branch of the Kalamazoo River above Concord is a small, clear water stream that varies in size from ten feet wide by four inches deep below Farewell Lake to 35 feet wide by one foot deep above the Concord impoundment. The bottom type, in general, through this stretch of stream is sand with some areas of gravel.

The South Branch of the Kalamazoo River from Homer to Albion is a larger river averaging 40 feet wide by 18 inches deep in the upper areas to 70 feet wide by two feet deep in the lower areas. There are a few flat areas in marsh situations where the river may widen up to 100 feet and the water is quite shallow (eight inches or less). Bottom types are mostly sands and gravel with some rubble and boulders in the riffle areas.

More than half the length of the mainstream between Albion and Ceresco is impounded or heavily developed in the cities of Albion and Marshall. The mainstream of the Kalamazoo River from Ceresco to the southwestern edge of Battle Creek is fairly scenic. A number of islands are present in the stream which adds to its attractiveness. The river is about 80 to 100 feet wide and averages 1-2 feet deep. A moderate current moves the canoeist or boater at a good speed in wide, flat areas. Although the bottom has many areas of gravel and rock, the major bottom type is sand and contains heavy growth of aquatic weeds (curly leaf pondweed). The river through Battle Creek and down to Augusta is almost entirely within the urban developed areas of the city.

The river from Augusta to Galesburg has no development except in the villages. The river is wide and deep, averaging 110 feet wide and four feet deep. Low stream banks

are well vegetated with soft maple, willow and ash. Oak is dominant in areas of high ground. Below Galesburg, the river flows into Morrow Pond, a cooling pond for Consumers Power Company fossil fuel plant. Below this pond, the river flows through the urbanized areas of Kalamazoo. The river's gradient increases to 2.6 feet per mile between Plainwell and Allegan. This natural feature of the river was instrumental in bringing about the construction of five dams between the latter two cities. Three of these impoundments have been drawn down, but there still exists a great deal of slack water in this stretch of the Kalamazoo.



The mainstream throughout the study area is free-flowing and varies from 50 to 150 feet in width, but generally is 100 feet wide by four to six feet deep. The bottom type is mostly sand and silt in this area. Most of the riverbanks are low, two to six feet in height, with extensive flood plains along the main channel. In the mid to lower reaches of the river, the main channel splits into smaller channels creating a number of islands. It is also in these mid to lower areas where adjacent flood plains have been turned into extensive waterfowl marshes. During normal summer flows, the water is relatively clear.

The river becomes very turbid below the Rabbit River after heavy rains, a result of suspended silt.

The Rabbit River is the major tributary of the Kalamazoo in the study area. Originating in the northeast corner of Allegan County, the stream flows through extensive agricultural areas. Although this stream contains some areas of gravel and rubble, the major bottom type is sand, silt and clay. The Rabbit River is a sizeable stream by the time it reaches Hamilton, with widths of about 50 to 60 feet. Average depth in this area is about 18 inches to two feet.

The other tributaries under consideration in the study area are Swan, Bear, Mann and Sand creeks. These are all small clear water streams containing significant spring seepage. Sand Creek is classed as top quality trout water, while the others are classed second quality trout water. Stream size varies from ten to 15 feet in width by six to ten inches deep on Mann and Sand creeks, to 30 feet in width by six to 18 inches deep on Swan Creek. Although most of these streams are mainly sand bottomed, they do contain some areas of gravel. The exception is Bear Creek which contains a bottom of gravel, rubble and sand in its lower reaches. These streams are well vegetated along their banks and the smaller streams in particular have dense growths of tag alder in certain areas.

#### D. Vegetation

As a result of the action of the Wisconsin glacier, the region is topographically diverse, possessing hills, valleys, plains, ponds, lakes and a variety of soil types that provide excellent habitat for a vast number of plants. In addition, the influence of nearby Lake Michigan somewhat moderates the climate of this region so that a number of plant species thrive or survive that otherwise might not.

Seven major types of native plant communities are recognized in the watershed and are listed below. While each of these is considered as a distinct community, many ecotones, or gradual transition zones, exist between these communities. Some of the dominant species have a fairly wide tolerance of habitats and, therefore, may be prevalent in more than one habitat. All of these species are considered abundant where they occur.

Community	Characteristics
Dry Southern Hardwood Forest	Forests of dry upland sites with bur oak, black oak, or white oak dominating.
Mesic Southern Hardwood Forest	Forests that occur in moist soils and are dominated by beech and sugar maple.
Wet Lowland Forest	Forests characterized by willow or cottonwood, or silver maple or ash.
Sphagnum Bogs	Open, treeless wet areas dominated by heath-like shrubs and sphagnum moss.
Grassland-Savanna Complex	Includes the combination of prairies, sedge meadows and savannas. Characterized as treeless or with scattered trees and dominated by grasses or sedges either wet or dry.
Marshes and Emergent Aquatic Communities	Treeless areas in which the water table is above the soil surface during most of the growing season.
Submerged Aquatic Communities	Dominant plant species are below or on the water surface. These communities are essentially lakes and ponds.

Broad floodplains are characteristic of the lower Kalamazoo River. The floodplains along the rivers and streams in the study area are generally covered with lowland forest or are in marshy wetlands. Woody vegetation consists of varying mixtures of willow, cottonwood, silver maple and ash. Sycamores are scattered singly or in clumps along the entire lowland area. Where conditions are right, a few black walnut occur, which have grown to large sizes. The marsh areas contain various amounts of sedges, rushes, cattail, smartweed and aquatic species such as pondweeds and waterlilies.

There are three identified sites within the study area which contain one or more rare plant species. These sites are listed below:

- |    |                                     |                                  |                                    |
|----|-------------------------------------|----------------------------------|------------------------------------|
| 1. | Ely, Little Tom & Crooked Lake Area | Allegan County, Clyde Township   | Bog plants, coastal plains species |
| 2. | Fennville Bog                       | Allegan County, Manlius Township | Native orchids, other bog species  |
| 3. | Prairie Areas                       | Allegan County, Valley Township  | Sandy prairie species              |

#### E. Climate

Climate varies from modified marine (Great Lakes influence) in the study area to continental in the eastern portions of the watershed. Average annual precipitation is about 32 inches, and snowfall exceeds 40 inches annually. In the study area, annual snowfall approaches 100 inches. The average July temperature is 72 degrees and average January temperature is about 24 degrees. Average January temperature is slightly

warmer near Lake Michigan, being about 26 degrees. The annual mean temperature for the area is about 49 degrees. The average growing season ranges from about 153 days at the eastern end of the watershed to about 184 days along Lake Michigan.

#### F. Accessibility

The Kalamazoo River system lies within easy access of the population centers of Holland, Grand Rapids, Lansing and Jackson, while Albion, Marshall, Battle Creek and Kalamazoo lie within the watershed boundaries. Highway access to the river system and study area is good. The watershed is crossed in a north-south direction by I-196 at the western edge, US-131 in the western third, I-69 in the eastern third, and US-127 just east of the headwater areas. I-94 crosses over two-thirds of the watershed in an east-west direction. In addition to the major highways, there are many paved state and county roads crossing the watershed.

In reference to the study area, US-131 crosses the watershed in a north-south direction east of the study area, while US-31 crosses the river at the western end near Saugatuck. M-89 crosses the study area east to west, south of the river, and M-40 cuts diagonally along the northern portion of the watershed crossing the Rabbit River at Hamilton.

#### G. Ownership

The Kalamazoo River watershed contains roughly 1,292,800 acres of land. Of this total, 1,245,550 acres (96 percent) are in private ownership. The remaining 48,250 acres are in public ownership as follows: Allegan State Game Area – 44,290 acres, Fort Custer Recreation Area – 2,960 acres, and Yankee Springs Recreation Area – 1,000 acres. Note: The Yankee Springs Recreation Area contains 5,000 acres of state land, however, only an estimated 1,000 acres is within the Kalamazoo River watershed. Ownership along the mainstream of the Kalamazoo River and those tributaries being recommended for designation in the Natural Rivers Program is summarized as follows:



OWNERSHIP – KALAMAZOO RIVER  
(recommended portions)

Stream	LINEAR MILES			FRONTAGE		
	Public	Private	Total	Public	Private	Total
Kalamazoo Mainstream	11	11	22	22	24	44
Rabbit River	0	17	17	0	34	34
Mann Creek	0	2	2	0	4	4
Bear Creek	3.5	1.5	5	7	3	10
Sand Creek	1.5	.5	2	3	1	4
Tributary Totals	5	21	26	10	42	52
<b>OVERALL TOTALS</b>	<b>16</b>	<b>32</b>	<b>48</b>	<b>32</b>	<b>64</b>	<b>96</b>