

SOCIOECONOMIC SETTING

The demand for water in the Kankakee River Basin is directly linked to the area's population, economy and land use. Agricultural irrigation creates the greatest total demand for water in the basin, particularly during the crop-growing season. Water demand also is high in and near highly populated urban centers, where large quantities of water are needed for public supply and industrial purposes. In rural areas, water is needed primarily for domestic and agricultural uses. Moreover, large amounts of surface water are withdrawn from the Kankakee River for cooling purposes at a power generating station in northern Jasper County.

POPULATION

In 1980, the estimated population of the Kankakee River Basin (223,186) constituted about 4 percent of Indiana's total population (5,490,224). More than three-fourths of the basin population in 1980 resided in LaPorte, Lake, Marshall, Jasper, St. Joseph and Porter Counties, which are located primarily along the northern and eastern basin boundary (figure 4). Each of these six counties had at least 20,000 in-basin residents in 1980.

About 22 percent of the basin's total population in 1980 lived in urban areas of at least 2,500 persons. LaPorte, the basin's largest city, had a 1980 population of 21,796. Valparaiso, most of which is located just north of the basin boundary, had a 1980 population of 22,247 (table 2). Crown Point, which also lies near the northern basin boundary but is not considered further in this report, had a 1980 population of 16,455.

Cedar Lake, Plymouth and Lowell had between 5,000 and 10,000 residents in 1980. Rensselaer, St. John, Knox, Bremen, Westville and Hebron had populations of 2,500 to 5,000 (table 2). The remainder of the basin's residents in 1980 lived in rural areas, which are defined by the U.S. Bureau of the Census as non-urban farm and non-farm areas of less than 2,500 persons.

Historic and projected population

Historic and *projected* population totals for in-basin portions of the 13 counties comprising the Kankakee River Basin are presented in appendix 1. The appendix also includes population values for entire counties, from which the in-basin values were derived. Figure 5 illustrates the historic and projected population

Table 2. Recent and projected population of selected cities and towns

{Tabulation includes only cities and towns having at least 2,500 residents in 1980. Population values for 1960-80 are from U.S. Bureau of the Census (1982). Values for 1990 and 2000 are Division of Water projections.}

City or town	County	1960	1970	1980	1990	2000
Bremen	Marshall	3062	3487	3565	4070	4250
Cedar Lake	Lake	5766	7589	8754	9190	9780
Hebron	Porter	1401	1624	2696	2880	3010
Knox	Starke	3458	3519	3674	3320	3290
LaPorte	LaPorte	21157	22146	21796	21700	21020
Lowell	Lake	2270	3839	5827	6290	6690
Plymouth	Marshall	7558	7661	7693	8260	8620
Rensselaer	Jasper	4740	4688	4944	4660	4750
St. John ¹	Lake	1128	1757	3974	4560	4850
Valparaiso ¹	Porter	15227	20020	22247	25570	28090
Westville	LaPorte	789	2614	2887	2670	2580

¹Corporate limit lies partially (St. John) or primarily (Valparaiso) outside of the basin boundary.

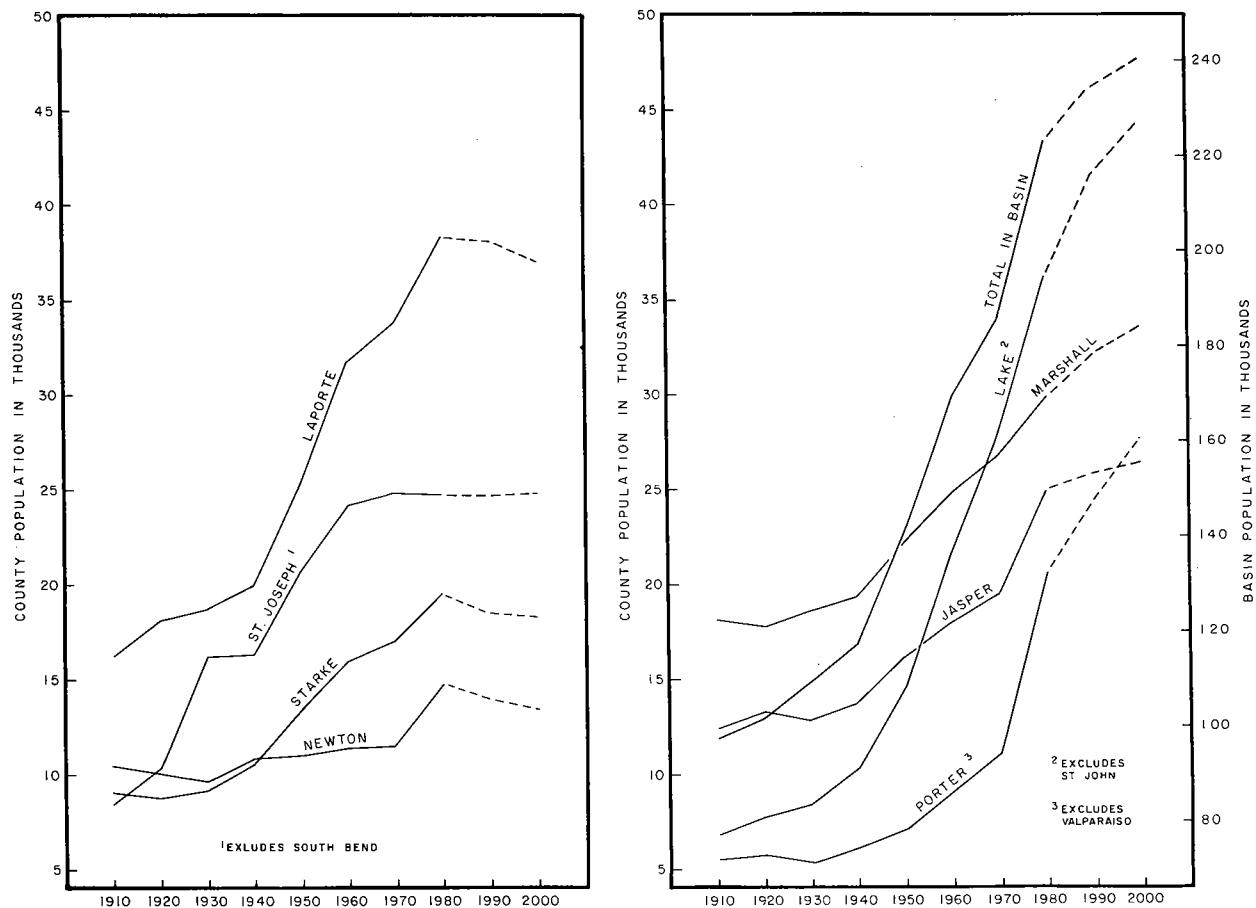


Figure 5. Historic and projected population for in-basin portions of the eight most populous counties

changes for the entire basin and for the in-basin portions of the eight most populous counties.

As figure 5 and appendix 1 show, the total population of the Kankakee River Basin has more than doubled between 1910 and 1980. The most rapid population growth occurred during the 1940s, 1950s and 1970s. According to projections by the Division of Water, a moderate increase in the basin population is expected in the 1990s.

The basin's eight most populous counties have experienced varying degrees of historic population growth (figure 5). The in-basin portion of Porter County is expected to experience the largest percent increase in population during the 1990s (appendix 1).

According to Division of Water projections, a population increase is expected in the basin portion of Lake County, even though the county's total popula-

tion is expected to continue its decline (appendix 1). The contrasting projections for Lake County primarily reflect the southward shift in population from highly urbanized areas lying north of the Kankakee River Basin to urban and suburban areas lying within the basin.

The growth rates of cities and towns in the basin have varied widely in recent decades. Between 1960 and 1980, the population of Lowell doubled and the population of Westville tripled. The population of other cities and towns increased less dramatically (table 2).

Division of Water projections show an increasing trend in the population of most cities and towns during the 1990s. Slight decreases are anticipated in LaPorte, Knox and Westville (table 2).

Table 3. Per capita income

{Values, for entire counties, are for 1985.}

County	Per capita income		Estimated population
	Dollars	Percent of state average	
Benton	8,885	89	9,800
Jasper	8,939	90	26,300
Lake	9,737	98	491,700
LaPorte	9,634	97	106,100
Marshall	9,235	93	41,300
Newton	8,682	87	13,900
Porter	10,778	108	123,100
St. Joseph	10,517	105	241,400
Starke	7,375	74	21,400

ECONOMY

Economic activity within the Kankakee River Basin is an important factor determining water use because different types of industry have different water resource requirements. In turn, the availability of water resources partially determines which industries can be located in an area. A region's economic dependence on an industry can be measured by the number of residents employed and the proportion of county earnings produced by that industry.

Economic data for the major counties of the basin were obtained from a computerized database (STATIS) maintained by the Indiana Business Research Center. It should be noted that the following discussion refers to entire counties, and thus includes areas lying outside the basin boundary.

In the nine major counties of the basin, estimated *per capita income* in 1985 averaged \$9,309 (see table 3), or about 93 percent of the statewide average of \$9,978. Unemployment rates ranged from 4.9 percent to 16.2 percent of the labor force during the 10-year period 1979-88 (table 4).

Manufacturing, services, and wholesale and retail trade constitute the four largest employment classes in eight of the basin's nine major counties (table 5). Manufacturing accounts for the largest percentage of total earnings in seven of the nine major counties. Most manufacturing in the basin region occurs in urban areas, particularly in the cities of LaPorte, Plymouth, Cedar Lake, Lowell and Rensselaer. Services, wholesale and retail trade, and government activities also are concentrated in urban areas.

Table 4. Average annual unemployment rate

{Values, for entire counties, are for 1979-88.}

County	Average	Range
Benton	7.9	5.1-10.1
Jasper	9.2	6.8-12.6
Lake	11.8	7.0-16.2
LaPorte	9.5	6.4-14.4
Marshall	7.8	5.2-11.0
Newton	8.1	5.5-10.6
Porter	9.4	4.9-14.0
St. Joseph	7.5	5.5- 9.9
Starke	11.4	6.8-14.9

Transportation and public utilities generally constitute less than 8 percent of county employment and earnings. In Jasper County, however, this category is among the leading sources of employment and provides the greatest percentage of total earnings (table 5). Most earnings in this category are derived from the R.M. Schahfer generating station, operated by the Northern Indiana Public Service Company.

Although agriculture is the major land-use category in the Kankakee River Basin, it is the leading source of employment and earnings only in Benton County (table 5). Farming is one of the major employment categories in Jasper, Newton and Starke Counties; however, farm earnings are less than earnings from other *industries*.

Agricultural data from the U.S. Bureau of the Census (1984a, 1989) show a net increase in average farm size for the nine major basin counties during the 10-year period 1978-87, but a net decrease in the number of farms and land in farms in eight of the nine counties. The overall trend of increasing farm size and decreasing number of farms parallels trends which have been evident on a statewide basis since at least the 1950s.

Small farms are common in the rolling morainal areas of the eastern Kankakee River Basin. In 1987, Marshall, LaPorte and St. Joseph Counties had the largest number of farms (between 900 and 1100). St. Joseph and Marshall Counties had farms of the smallest average size (about 200 acres).

The southwestern part of the basin is characterized by fewer numbers of relatively large farms, many of which are corporately owned. The average size of farms in Benton, Newton and Jasper Counties in 1987 ranged from about 390 to 470 acres, which was more

than twice the average farm size in eastern parts of the basin.

Corn and soybean production in the nine-county basin region is among the highest of any region in Indiana. Benton and Jasper Counties led the state in soybean production in 1987, and Jasper, LaPorte and Benton Counties ranked in the top six Indiana counties for corn production (U.S. Department of Agriculture, 1987b).

Winter wheat, hay and oats are significant crops in portions of northern Indiana. Among the nine major counties of the Kankakee River Basin, winter wheat production during 1987 was highest in LaPorte County; hay production was highest in Marshall and LaPorte Counties; and oat production was highest in Marshall, Porter and Lake Counties (U.S. Department of Agriculture, 1987b).

Apples, peaches, berries, vegetables and other crops constitute only a minor percentage of the basin's total crop income. However, the production of mint for oil is significant on a state and national level. Berries and orchard crops are important to both local and regional farm economies.

Spearmint and peppermint are grown on the muck and peat soils of the Kankakee River valley. In 1987, Starke County led Indiana counties in the number of farms growing mint. Moreover, a significant part of the total mint production in the United States is derived from counties in the Kankakee River Basin.

Blueberries also are a common specialty crop in the low-lying Kankakee River valley, particularly in portions of Jasper, Marshall, LaPorte and St. Joseph Counties. North of the main valley on the Valparaiso Moraine, frost-sensitive orchard crops are fairly com-

Table 5. Employment and earnings by industry as a percent of total

{Values, for entire counties, are for 1986.}

Column headings are abbreviated as follows: Agri Serv, agricultural services, forestry, fisheries and others; Trade, wholesale and retail trade; Fin, financial, insurance and real estate; Serv, services; Const, construction; Manuf, manufacturing (durable and non-durable); Trans, Util, transportation and public utilities; Govern, federal civilian, federal military, state and local government.

County totals may not equal 100 percent because of differences in rounding and/or because data were not available, NA.

County	Farm	Agri Serv	Trade	Fin	Serv	Mining	Const	Manuf	Trans, Util	Govern
Employment										
Benton	23.6	1.0	NA	7.6	NA	NA	5.8	6.9	4.2	16.9
Jasper	12.8	0.7	20.1	5.5	18.8	0.3	6.1	11.3	11.8	13.0
Lake	0.5	0.4	22.8	5.4	24.7	0.0	5.6	21.3	6.1	13.1
LaPorte	3.3	0.9	20.4	4.8	22.0	0.1	4.2	25.7	4.2	14.0
Marshall	8.1	0.6	17.3	5.4	17.5	0.1	3.8	33.4	4.9	9.0
Newton	14.8	NA	17.4	5.0	19.0	NA	4.7	20.0	2.8	14.6
Porter	1.9	0.5	21.0	5.7	23.7	0.1	4.6	22.9	5.2	14.4
St. Joseph	1.2	0.5	24.2	6.6	29.6	0.0	4.7	18.9	4.2	10.0
Starke	12.3	0.7	21.4	4.9	18.6	NA	3.6	15.0	4.6	18.7
Earnings										
Benton	28.0	0.7	NA	4.9	NA	0.3	6.4	8.1	5.0	17.0
Jasper	9.4	0.4	16.1	2.9	12.7	0.3	9.3	14.1	22.7	12.1
Lake	0.5	0.2	13.2	3.1	19.7	0.2	7.4	37.0	8.5	10.3
LaPorte	1.8	0.5	13.3	2.9	18.3	0.3	5.5	36.0	7.7	13.7
Marshall	4.1	0.3	12.5	3.6	12.9	0.2	5.8	44.0	7.7	9.0
Newton	6.3	NA	15.9	3.8	14.9	NA	8.1	28.0	4.4	16.7
Porter	0.8	0.3	12.0	2.6	16.1	0.3	5.8	43.9	6.5	11.7
St. Joseph	0.4	0.3	17.5	5.4	25.6	0.2	6.2	28.9	6.1	9.4
Starke	8.9	0.3	18.5	2.9	16.3	NA	6.4	20.2	6.4	20.0

mon, partly because of the milder climate induced by Lake Michigan. In 1987, LaPorte County had the largest acreage of land in orchards of any Indiana county.

Hogs and beef cattle are the leading source of livestock income in the nine-county basin region. The number of hogs and pigs in Jasper County was the eighth highest in Indiana during 1987 (U.S. Department of Agriculture, 1987b).

Poultry, poultry products, and milk production constitute a moderate portion of livestock income in the basin. Income from sheep production is fairly small relative to other livestock income.

Regional assessment

A report by the Indiana Department of Commerce (1988) identifies the economic strengths, weaknesses and growth potential of 14 regions in Indiana. Although the findings of the study are regional, they provide an overview of the economic status of the basin and surrounding areas.

The study concluded that Region 1 (Lake, Porter, LaPorte, Newton, Jasper, Starke and Pulaski Counties) has numerous economic factors below the state average. The percentage of the population with college degrees is below the state average. Although the region has an overall low student dropout rate and high per pupil expenditure, it also has the highest percentage of students failing to meet minimum scores on the state Basic Competency Skills Test.

Air pollution may limit growth in Region 1, mainly along the urban corridor of the Lake Michigan shore. Water quality is a concern because the capacity of some wastewater-treatment facilities may be exceeded.

Transportation access in Region 1 is good, except for the lack of air transportation service and the presence of many obsolete bridges. The proposed construction of a third Chicago-area airport in or near this region would significantly increase commuter and air carrier service.

Most factors of capital availability are at or slightly below state averages, except for bank deposits per capita, which are much below average. The region has a high level of per capita government indebtedness, much of which is being used to fund infrastructure in densely populated urban areas.

Region 2 (St. Joseph, Elkhart, Marshall and Kosciusko Counties) has a mix of positive and negative

development factors. Although the educational level of the work force exceeds the state average, the student dropout rate also is high, and per pupil expenditures are below the state average.

Air pollution may limit industrial growth in St. Joseph and Elkhart Counties. Some wastewater-treatment facilities may be approaching their capacity.

Region 2 is the only region with two airports providing commercial air carrier service. Access to divided highways is limited, and the percentage of obsolete bridges is above the state average.

The economic strength of Region 2 is its fiscal stability. Measures of capital availability are high, and levels of government indebtedness are low.

LAND USE

The landscape of the Kankakee River Basin today bears little resemblance to the natural landscape of pre-settlement times. Until the early 1800s, the basin was characterized by forests, wetlands, and both dry and wet prairies. Hardwood forests were common throughout the basin, particularly on the morainal uplands and sand ridges. Many areas, particularly south of the Kankakee River and in the Iroquois River Basin, were dominated by prairie grasses and oak *savannas*. Most of the Kankakee River valley was covered by a vast *marsh* and wooded *swamp*.

The current landscape of the Kankakee River Basin is dominated by agricultural crops and artificial drainage networks. Remnants of the natural prairie, savanna and wetland landscapes remain only in isolated parcels.

The U.S. Geological Survey has produced a series of land-use and land-cover maps by using aerial photographs and other remotely sensed data (see Anderson and others, 1976). Land use refers to man's activities which are directly related to the land. Land cover describes the vegetation, water, natural surface and artificial constructions at the land surface (U.S. Geological Survey, 1982).

Land uses in Indiana are grouped into six general categories, which are further subdivided into more specific categories. These categories are identified in the land-use and land-cover map for the Kankakee River Basin (figure 6).

It should be noted that only urban areas, bodies of water, gravel pits and certain agricultural areas of at least 10 acres are mapped in figure 6. For other land

Table 6. Selected land use data for farmland

{Values are for entire counties.}

Total area: Acreages are from county land areas listed in Marcus (1985).

Land in farms, total cropland, total woodland, other land: Upper numbers are for 1987 (U.S. Bureau of the Census, 1989); lower numbers are for 1978 (U.S. Bureau of the Census, 1984a).

County	Total area (acres)	Land in farms		Total cropland		Total woodland		Other land	
		Acres	Percent of total area	Acres	Percent of farmland	Acres	Percent of farmland	Acres	Percent of farmland
Benton	260,480	—	98	259,283	94'	3,920	1'	8,313	1'
		256,225		252,253		5,105		11,738	
Jasper	359,040	306,098	85	276,307	90	13,955	5	15,836	5
		300,638		263,005		16,043		21,590	
Lake	320,640	145,566	45	133,998	92	4,826	3	6,742	5
		146,177		130,919		4,561		10,697	
LaPorte	384,000	258,506	67	230,944	89	13,011	5	14,551	6
		276,416		239,903		16,375		20,138	
Marshall	284,160	222,394	78	194,272	87	15,542	7	12,580	6
		237,038		200,551		20,180		16,307	
Newton	257,280	227,126	88	209,701	92	6,626	3	10,799	5
		239,550		209,909		13,098		16,543	
Porter	268,160	162,544	61	147,170	90	6,233	4	9,141	6
		170,470		150,786		9,031		10,653	
St. Joseph	293,760	174,226	59	156,357	90	8,773	5	9,096	5
		180,941		157,615		11,789		11,537	
Starke	197,760	140,869	71	119,726	85	14,092	10	7,051	5
		149,094		121,086		15,674		12,334	

¹Based on 1982 data.

use categories, the minimum mapping unit is 40 acres (U.S. Geological Survey, 1982).

Because the land use map in figure 6 does not include numerical data, county and regional data obtained from state and federal agencies were used to derive acreage estimates for each of the six major land use categories defined by the U.S. Geological Survey. According to these estimates, agricultural land constitutes more than three-fourths of the land area within the basin boundary. Forest land accounts for about 9 percent of the basin's land area; urban or built-up land for about 8 percent; and water, wetlands and barren land for the remaining 8 percent.

Agricultural land

The U.S. Bureau of the Census compiles and publishes land use data for agricultural land, which is designated as "land in farms." A farm is defined by

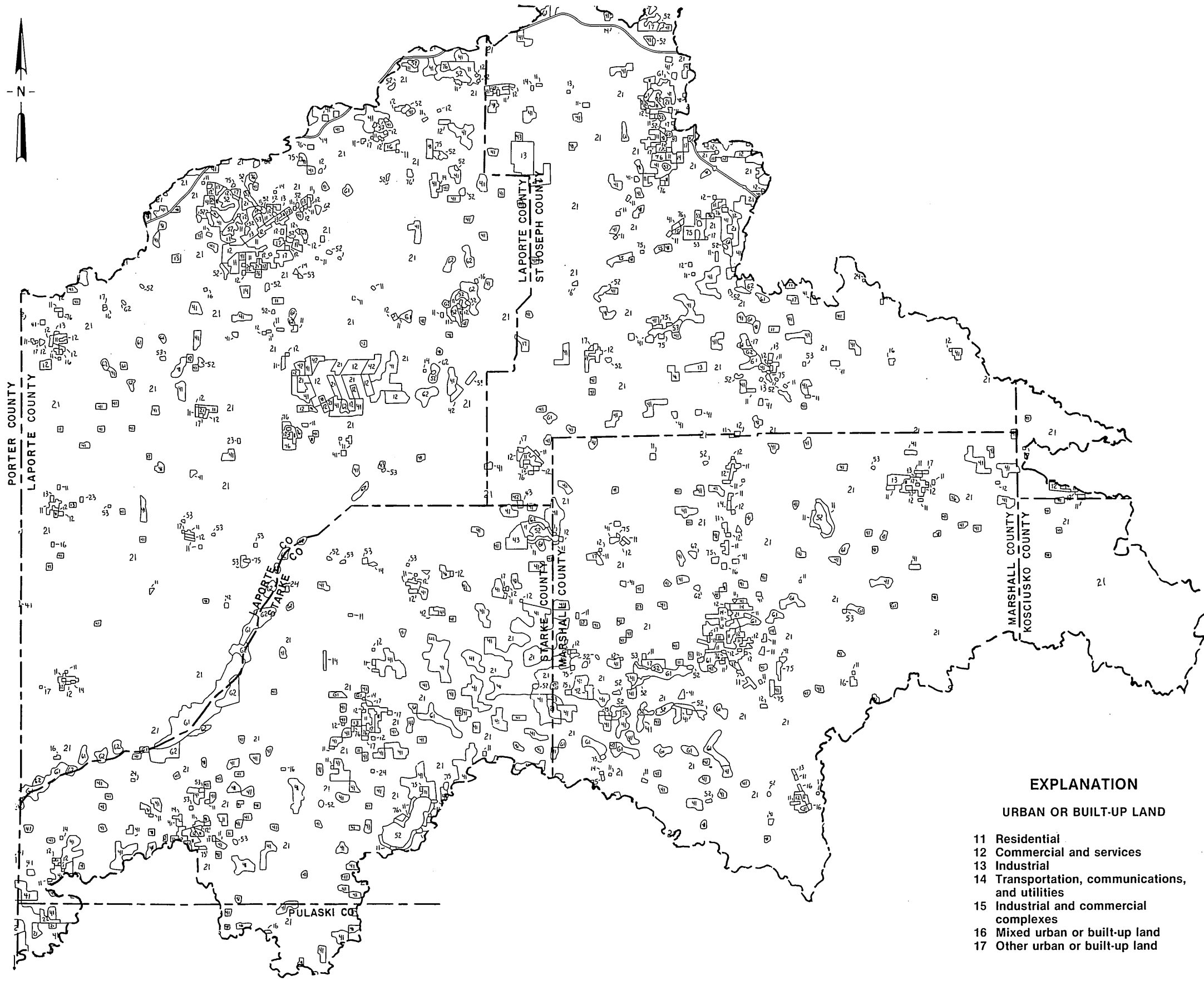
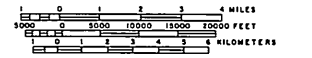
the bureau as any place from which the sale of agricultural products normally amounts to at least \$1,000 during the census year.

Of the five agricultural land use categories defined by the bureau, the following four are mutually exclusive: cropland, woodland, other land, and land set aside in federal farm programs. The fifth category, total pastureland, is the sum of cropland, woodland, and other land used for pasture or grazing.

Agricultural statistics published by the U.S. Bureau of the Census are available on a county basis, and thus include areas lying outside the Kankakee River Basin boundary. However, the data available for the nine major counties lying wholly or partially within the Kankakee River Basin nonetheless provide a general overview of agricultural land use.

Table 6 presents county data for the three major land uses on farmland. Cropland accounts for an average of about 90 percent of total farmland in the nine-county basin region. Most of the cropland in the basin region

**UPPER
KANKAKEE RIVER BASIN**



EXPLANATION

URBAN OR BUILT-UP LAND

- 11 Residential
- 12 Commercial and services
- 13 Industrial
- 14 Transportation, communications, and utilities
- 15 Industrial and commercial complexes
- 16 Mixed urban or built-up land
- 17 Other urban or built-up land

AGRICULTURAL LAND

- 21 Cropland and pasture
- 22 Orchards, groves, vineyards, nurseries, and ornamental horticultural areas
- 23 Confined feeding operations
- 24 Other agricultural land

FOREST LAND

- 41 Deciduous forest land
- 42 Evergreen forest land
- 43 Mixed forest land

WATER

- 51 Streams and canals
- 52 Lakes
- 53 Reservoirs

WETLAND

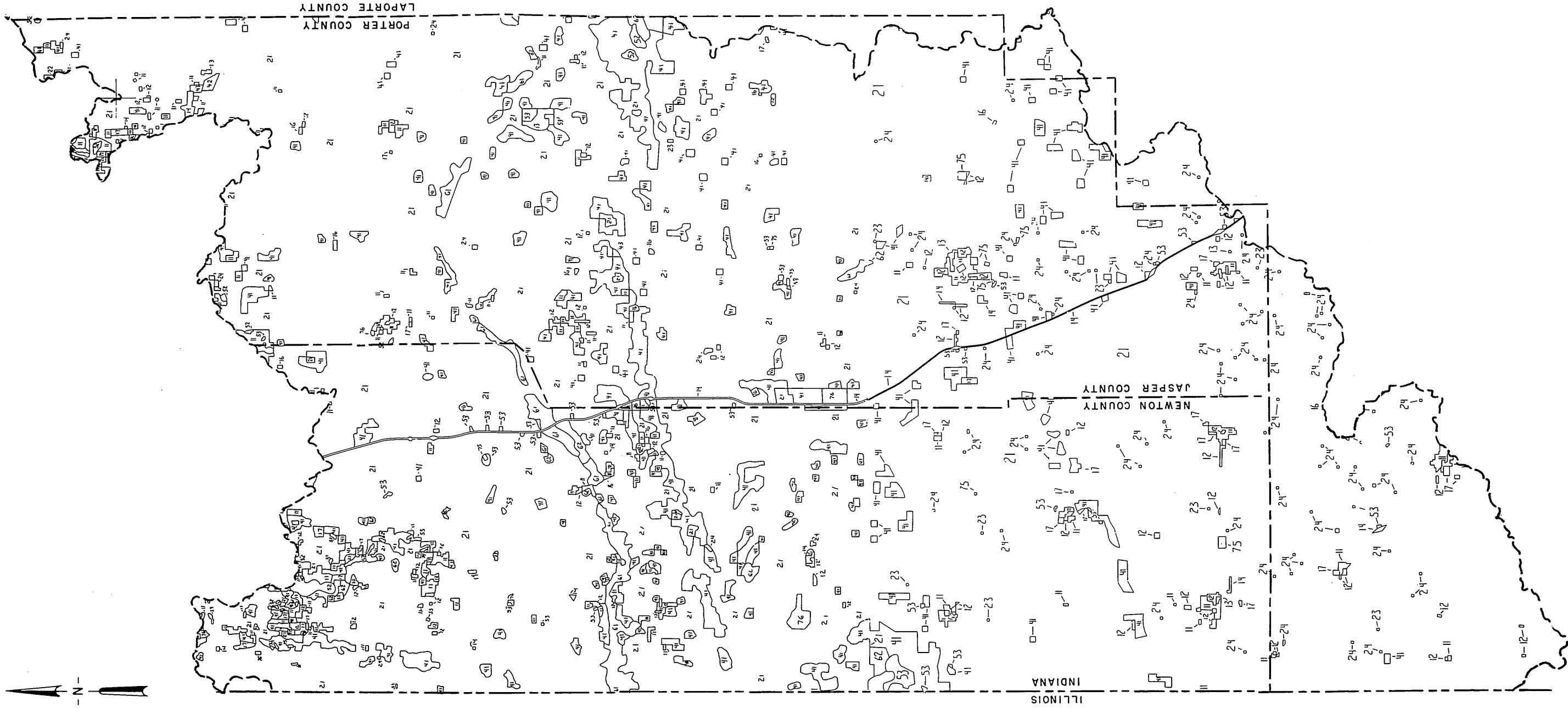
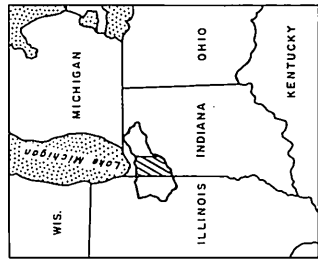
- 61 Forested wetland
- 62 Nonforested wetland

BARREN LAND

- 75 Strip mines, quarries, and gravel pits
- 76 Transitional areas

Figure 6a. Land use and land cover
(Adapted from U.S. Geological Survey, 1979, 1982)

**LOWER
KANKAKEE RIVER BASIN**



EXPLANATION

- URBAN OR BUILT-UP LAND**
 - 11 Residential
 - 12 Commercial and services
 - 13 Industrial
 - 14 Transportation, communications, and utilities
 - 15 Industrial and commercial complexes
 - 16 Mixed urban or built-up land
 - 17 Other urban or built-up land
- AGRICULTURAL LAND**
 - 21 Cropland and pasture
 - 22 Orchards, groves, vineyards, nurseries, and ornamental horticultural areas
 - 23 Confined feeding operations
 - 24 Other agricultural land
- FOREST LAND**
 - 41 Deciduous forest land
 - 42 Evergreen forest land
 - 43 Mixed forest land
- WATER**
 - 51 Streams and canals
 - 52 Lakes
 - 53 Reservoirs
- WETLAND**
 - 61 Forested wetland
 - 62 Nonforested wetland
- BARREN LAND**
 - 75 Strip mines, quarries and gravel pits
 - 76 Transitional areas

Figure 6b. Land use and land cover
(Adapted from U.S. Geological Survey, 1979, 1982)

is classified as harvested cropland, which includes not only land for field crops but also for orchards, vineyards, nurseries and greenhouses. Some small tracts of cropland are used for pasture, grazing, cultivated summer fallow, idle cropland or soil improvement crops. During the 10-year period 1978-87, cropland acreage showed a net increase in Benton, Jasper and Lake Counties, but a net decrease in other counties.

Woodland accounts for an average of about 5 percent of all land in farms in the nine-county region (table 6). Most woodland is used for woodlots, timber production and Christmas tree production. On average, about one-fourth of the woodland acreage is used for pasture or grazing. Woodland acreage in all basin counties except Lake County decreased during the 10-year period 1978-87 (table 6).

Farmland designated as "other land" (table 6) constitutes about 5 percent of all farmland, and includes primarily land in house and barn lots, ponds, roads and wasteland. Only small tracts are used solely for pasture or are considered as barren land. It should be noted that some of the barren land and land in lots or roads which the U.S. Bureau of the Census considers as agricultural land may be classified and mapped as barren, non-agricultural land by the U.S. Geological Survey.

Land used solely for pasture decreased in most basin counties during the period 1978-87. Land set aside in federal farm programs probably has increased since the establishment of the Conservation Reserve Program, which was created following enactment of the 1985 Food Security Act.

Table 7. Area of timberland

{Values, for entire counties, are from a 1986 inventory report by Smith and Golitz, 1988.}

County	Acres	Percent of county area
Benton	1,500	1
Jasper	27,000	8
Lake	17,800	6
LaPorte	41,400	11
Marshall	31,000	11
Newton	17,900	7
Porter	30,600	11
St. Joseph	22,500	8
Starke	26,900	14

Prime farmland is defined by the U.S. Department of Agriculture as land best suited for producing food, feed, forage, fiber, and oil-seed crops. This land has the soil quality, length of crop-growing season, and available moisture supply needed to sustain high yields of crops economically when the land is properly managed according to modern farming methods. Prime farmland may be in cropland, pasture, range, forest, or other uses (excluding waterbodies and urban areas) which make it available for agricultural conversion.

According to a generalized map (U.S. Department of Agriculture, 1977), the largest areas encompassing at least 75 percent prime farmland are located in the flat or nearly flat areas of the Kankakee, Iroquois and lower Yellow River watersheds. Smaller areas of prime farmland occur on nearly flat upland tills of southern St. Joseph County and extreme northern Marshall County.

Other land

Forest land, which constitutes about 9 percent of the basin's land area, generally occurs as small parcels scattered among cropland (figure 6). The predominant forest types in the basin are oak-hickory, elm-ash-soft maple, maple-beech, and cherry-ash-yellow poplar (Smith and Golitz, 1988).

The largest tracts of forested land are located along and south of the Kankakee River, particularly within the five state-owned fish and wildlife areas. (Many of the wooded areas on these properties and throughout the river valley also may be classified as forested wetlands by the U.S. Fish and Wildlife Service.) Upland forest south of the main Kankakee River Valley is found primarily on low sand ridges, particularly in Jasper and Newton Counties.

Data on timberland are available on a county basis from the U.S. Forest Service (Smith and Golitz, 1988). Timberland is defined as commercial forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

Table 7 presents timberland data for the nine major counties of the Kankakee River Basin. Because the tabulated values include not only forest land held for non-agricultural uses but also woodland on farms, there is some overlap between timberland values in table 7 and total woodland values in table 6.

The area of timberland reported in the U.S. Forest Service's 1986 inventory is greater than the area

reported in a 1967 inventory (Smith and Golitz, 1988). One factor in timberland increases may be procedural changes between the two surveys, including the reclassification as forest land of some areas previously classified as range, pasture and other land (see U.S. Department of Agriculture, 1989).

In Marshall County, much of the increase may be the result of pastureland reverting to timberland. The large increases in LaPorte, and to a lesser extent, in Lake and Porter Counties, may reflect both changes in agricultural land use within the Kankakee River Basin and increases in timberland near the Lake Michigan shoreline.

About 8 percent of the land area within the Kankakee River Basin is in **urban or built-up land**. As figure 6 shows, urban or built-up land is situated primarily in northern and eastern areas of the basin region. LaPorte is the major urban center lying totally within the basin. Large tracts of built-up land also are found in and near smaller towns and around a few of the large lakes such as Bass Lake, Cedar Lake, Lake of the Woods, and Koontz Lake.

Wetlands account for at least 5 percent of the basin's land area. Figure 6 gives a general indication of the abundance and distribution of some large wetlands. Hundreds of other wetlands are not shown on the map. Moreover, the figure is not appropriate for all purposes because various agencies may use significantly different classification schemes for wetlands.

Some areas mapped as cropland in figure 6 may be classified by the U.S. Fish and Wildlife Service as wetlands. Other areas mapped as forested wetlands may be classified by the U.S. Forest Service as riparian forest, or by the U.S. Bureau of the Census as wooded farmland. A discussion of wetlands and wetland classification used by the U.S. Fish and Wildlife Service is found in the *Surface-Water Hydrology* chapter of this report under the subheading **Wetlands**.

Minor land uses in the Kankakee River Basin are categorized by the U.S. Geological Survey as **water**, including lakes, reservoirs and rivers, and **barren land**, including sand and gravel operations and transitional areas. Figure 6 shows several of the largest natural and manmade lakes. These lakes and other large lakes not shown on the map account for about 1 percent of the basin's total land area. A discussion of major lakes is found in the *Surface-Water Hydrology* chapter of this report under the subheading **Lakes**.

WATER-USE OVERVIEW

The demand for water in the Kankakee River Basin is influenced by a variety of factors, including socioeconomic characteristics, the physical environment, and hydrologic systems. A brief overview of current water use in the basin is provided below as a prelude to discussions of climate, geology, soils and hydrology. Details of current and projected water use are presented in the final chapter of this report.

Withdrawal uses

Withdrawals involve the physical removal of water from its surface-water or ground-water source, and conveyance to its place of use. The water withdrawn can be used in either a consumptive or non-consumptive manner.

Water applied for irrigation, incorporated into a manufactured product, lost to *evapotranspiration*, or otherwise removed from the immediate water supply is considered to be consumed if it is unavailable for reuse in a short period of time. Other applications, such as public water supply, energy production and many industrial uses, typically return most of the withdrawn water to surface-water or ground-water systems.

Water-use data for Indiana historically has been obtained by combining limited data for public water supplies with various estimation techniques and voluntary responses to mailed questionnaires. Recent water-use summaries include those by the Indiana Department of Natural Resources (1982a, 1982b) and Solley and others (1983, 1988).

Since 1985, annual water-use data for large withdrawal facilities in Indiana have been compiled as mandated in the 1983 Water Resource Management Act (I.C. 13-2-6.1). This legislation requires owners of significant water withdrawal facilities to register these facilities and report annual water use to the Natural Resources Commission through the Indiana Department of Natural Resources, Division of Water. Significant facilities are defined as facilities capable of withdrawing at least 100,000 gallons per day of surface water, ground water, or surface water and ground water combined.

Reported water use for registered facilities typically is determined by metering devices, the multiplication of pump capacity and total time of pumpage, or by other methods approved by the Division of Water.

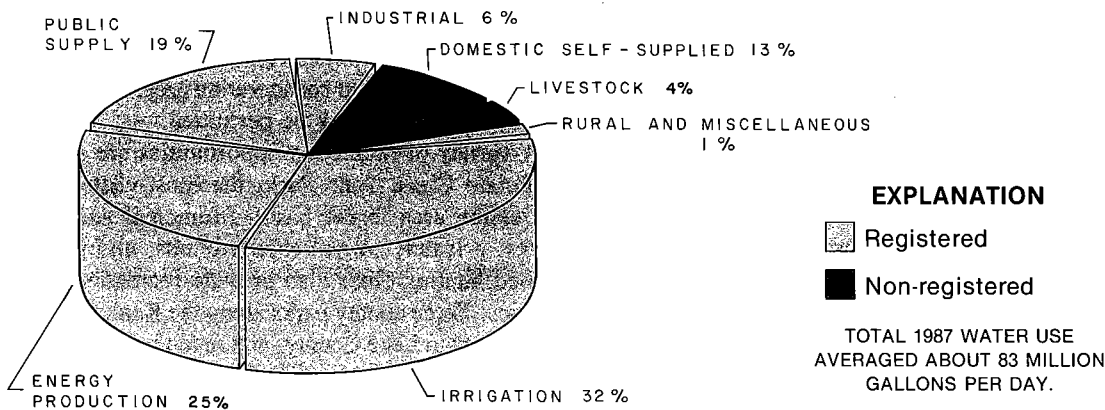


Figure 7. Percentage of water withdrawn by registered and non-registered facilities

Total non-registered water withdrawals generally are estimated using approximated values for population and per capita water use.

Although water withdrawals from a single well or surface-water intake may serve several purposes, each registered water withdrawal facility is grouped by the Division of Water into one of the following six categories: irrigation, energy production, public supply, industrial, rural and miscellaneous. These categories differ slightly from those used in the 1980 report by the Governor's Water Resources Study Commission.

Facilities capable of withdrawing less than 100,000 gallons of water per day are not required to register with the Division of Water or to monitor their annual water use. However, some types of facilities can create a large aggregate demand for water. Non-registered withdrawals for domestic self-supply and livestock watering purposes are included in water-use calculations to present a clearer picture of total water use in the basin.

Figure 7 shows the percentage of reported withdrawals by registered facilities and estimated withdrawals by non-registered facilities in 1987. As the figure shows, total registered and non-registered withdrawals averaged about 83 mgd (million gallons per day).

Irrigation is the major withdrawal use in the Kankakee River Basin, constituting about one-third (26 mgd) of all water withdrawals. The 446 registered irrigation facilities account for about 84 percent of all registered facilities. It should be noted, however, that only about 6 percent of all farms in the nine-county

basin region have irrigation equipment, and less than 5 percent of the basin's cropland acreage is irrigated.

Energy production is the second highest water use in the basin, accounting for about one-fourth (21 mgd) of total withdrawals (figure 7). Most of the water withdrawn for energy production is used at the R.M. Schahfer generating station in northern Jasper County, primarily for cooling purposes. Unlike withdrawals at the Schahfer plant, withdrawals by the other five registered facilities are relatively small and are not used directly for power generation.

Public supply, the third major water use in the Kankakee River Basin, constitutes about 19 percent (16 mgd) of total basin withdrawals. In general, withdrawals for this purpose are greatest in counties having large cities or towns.

About 63 percent of the basin residents obtain their water from non-registered, privately owned domestic wells rather than from public supply systems. Non-registered, **domestic self-supplied** withdrawals account for about 13 percent (11 mgd) of all water withdrawals (figure 7).

Industrial self-supplied water uses in the basin, which occur in both urban and rural areas, account for about 6 percent (5 mgd) of total water withdrawals (figure 7). Most of the water is withdrawn from stone quarries and gravel pits.

About 1 percent (1 mgd) of all water withdrawals in the basin are used for purposes such as recreation, flooding and drainage control, and fish rearing. These withdrawals are registered with the Division of Water under the **rural** and **miscellaneous** categories (figure 7).

Some withdrawals for **livestock** watering are included in either the irrigation or rural categories of registered significant water withdrawal facilities. For example, a large poultry operation based in White County is registered as a rural use.

In most cases, however, withdrawals for livestock watering are not included in water-use summaries by registered facilities. Estimated withdrawals from non-registered facilities constitute about 4 percent (3 mgd) of the basin's water use (figure 7). About three-fourths of the water for livestock is utilized by hogs and beef cattle.

Instream uses

Instream uses are defined as non-withdrawal uses taking place within a stream, lake or reservoir. Instream uses in the Kankakee River Basin primarily include recreation activities, fish and wildlife habitat, and waste assimilation.

The generation of **hydroelectric power** is a common instream use in some areas of Indiana where stream flows are sufficient and the hydraulic head (difference in water surface elevation) above and below the turbines is adequate. Because of the nearly flat stream gradient and low average velocity, no sites on the Kankakee River in Indiana are suitable for the economic production of hydroelectric power. However, a hydropower plant once operated on the Kankakee River in Illinois near the city of Kankakee (figure 2).

Water-based **recreation** activities such as fishing, swimming, boating (including motorboating, canoeing and sailing), water skiing, and ice skating are available throughout the Kankakee River Basin. Hunting, camping, nature study, birdwatching, walking, jogging, running, and bicycling are among the activities that are strongly associated with or enhanced by the presence of water. These water-oriented activities account for at least half of all recreation occasions in the basin.

Fishing and boating occur mainly on the major lakes and on the Kankakee, Yellow and Iroquois Rivers. Swimming opportunities are available primarily on large lakes, such as Worster Lake (Potato Creek Reservoir), Bass Lake and Cedar Lake.

Hunting and fishing are major activities at the five state-owned fish and wildlife areas, three of which are located along the mainstem Kankakee River. Other outdoor recreation activities compatible with fish and

wildlife management are permitted and encouraged. Hiking, boating and nature study are popular at the basin's three wetland conservation areas, where additional public uses may be permitted.

A variety of recreation opportunities are available at Potato Creek State Park, the most-visited public recreation area in the basin. Municipal and county parks, privately owned campgrounds, and privately owned hunting clubs also provide recreation opportunities. Three county parks along the Kankakee River are located in Lake County, and seven municipal parks along the Yellow River are located in Marshall and Starke Counties.

Most lakes and streams in the Kankakee River Basin are surrounded by land in private ownership, and public access to recreational waters is limited. However, the IDNR Division of Fish and Wildlife has developed public access sites on the Kankakee, Yellow and Iroquois Rivers. Access sites managed by the IDNR also have been developed on more than a dozen lakes. Rivers and lakes also may be accessible in public or private recreation areas, parks, or from highway bridges.

Water-dependent **wildlife habitat** in the Kankakee River Basin primarily is composed of the wetlands associated with natural lakes and streams. Open waters and the adjoining wetlands are excellent habitat for shorebirds, waterfowl, beaver, muskrat, raccoon and a variety of upland game. Although most wetland habitats have been drained or filled as a consequence of development, some high-quality wetlands still remain as remnants of former wetland complexes. The conservation of these areas is discussed in the **Surface-Water Hydrology** chapter of this report under the subheading **Wetlands**.

Warmwater **fisheries** are predominant in the basin's streams, although a few streams and one lake are stocked with trout, a coldwater species. Because the type of fish population found in streams and lakes largely depends on ambient water quality, fisheries are summarized in the **Surface-Water Hydrology** chapter of this report in the section entitled **Surface-Water Quality**.

The effluents of **wastewater treatment** plants normally are discharged into streams having a sufficient ability to assimilate the wastes. Wastewater discharges are discussed in the **Surface-Water Quality** section of this report.