



Region Thirteen-A



Daviess, Greene, Knox, Lawrence, and Martin Counties located in southwestern Indiana form Region Thirteen-A. The region contains approximately 2,300 square miles and is bounded by Sullivan, Clay, Owen, and Monroe Counties to the north; Jackson and Washington Counties to the east; Orange, Dubois, Pike, and Gibson Counties to the south; and Illinois to the west, as shown in Figure 215.

The population in 1975 was 145,721, with fifty-five percent residing in Knox and Lawrence Counties. The official Indiana County Population Projections indicate the region's population may increase eleven percent, by the year 2000, with the major growth occurring in Lawrence County. The 1975 population and projections by county are presented below.

Table 171

The 1975 and projected populations for Region Thirteen-A.

County	1975	1980	1990	2000
Daviess	26,127	27,200	27,600	27,500
Greene	28,156	29,700	32,500	35,600
Knox	39,943	40,200	38,500	36,600
Lawrence	40,377	44,200	49,400	53,800
Martin	11,118	11,100	11,000	10,700
Total	145,721	152,400	159,000	164,200

The major population centers are Washington in Daviess County, Linton in Greene County, Vincennes in Knox County, and Bedford in Lawrence County. These urban centers accounted for thirty-six percent of the region's 1975 population.

Agriculture is the dominant land use with more than sixty-one percent of the area devoted to farming.

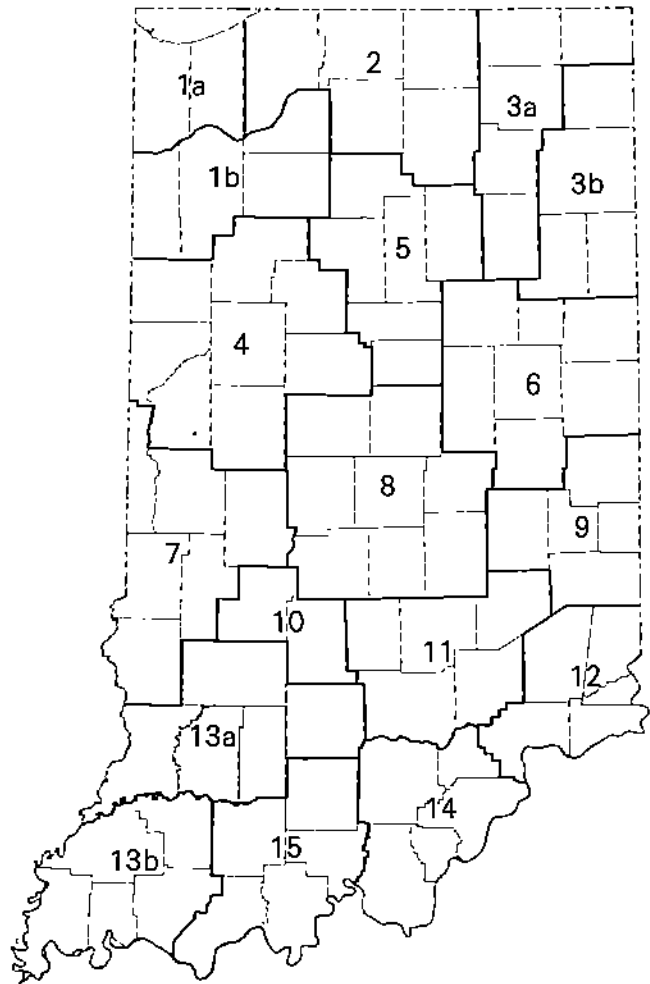


Figure 215

Map of Indiana showing the location of Region Thirteen-A.

Approximately twenty-five percent of the land is forested while the remaining fourteen percent represents urban and miscellaneous uses.

Although agriculture is by far the major land use, it is not the major source of employment. Manufacturing employs over thirty-seven percent of the work force, and wholesale and retail trade employs nearly thirty-six percent.

Average annual precipitation for the region is approximately 43.0 inches, with average monthly values ranging from a high of 4.7 inches in June to a low of 2.5 inches in October. Of the 43.0 inches of annual precipitation, approximately 29.0 inches are consumed through evapotranspiration. Average temperatures range from 31°F. in January to 77°F. in July. The average annual temperature is 55°F. Prevailing winds are from the southwest at 9 miles per hour.

THE WATER RESOURCE

Ground Water

The unconsolidated deposits found in Region Thirteen-A include weathered bedrock residuum, lake clays, wind-blown silt and sand, and outwash sand and gravel. Illinoian age glacial drift occurs in Knox, Daviess, and western Greene Counties. In other unglaciated areas there is very little cover over the underlying bedrock. Extensive sand and gravel deposits associated with the Wabash and White Rivers represent the most significant glacial aquifer within the region.

The bedrock formations are composed of Pennsylvanian sandstones, shales, limestones, and coals in Knox, Daviess, and the western portions of Martin and Greene Counties, while Mississippian age limestones, shales, and sandstones occur in Lawrence County and western Martin and Greene Counties. In general, the bedrock is of low permeability and is not a significant source of ground water.

The availability of ground water is associated with the nature and type of aquifer materials present in a given area. There is a pronounced variability in ground-water occurrence in the region, as shown in Figure 216 (page 395).

In general the valleys of the Wabash, East Fork, West Fork, and main stem of the White River contain thick deposits of sand and gravel capable of yielding over 1,000 gallons-per-minute (gpm) to properly constructed wells. Away from the major stream valleys, well yields are generally less than fifty gpm, and in most of the region well yields of less than ten gpm are possible from a fine sand deposit located in a buried valley north and east of Vincennes. Up to fifty gpm may be produced from fine sand and lake deposits in southwestern Greene County.

The quality of ground water is normally acceptable for most domestic, municipal, and commercial uses. Hardness levels range from 40 to 490 parts-per-million (ppm) with locally soft water being associated with deeper wells in the Pennsylvanian sandstone aquifers. The Pennsylvanian rocks also produce "soda water" in portions of Daviess and Greene Counties. Iron concentrations range from 0.1 to 7.3 ppm. The higher iron concentrations are associated with the aquifers bordering the West Fork of the White River through Greene, Knox, and Daviess Counties. The areas of low iron and manganese concentrations are located along the Wabash River in Knox County.

Surface Water

Streamflow The Wabash, White, and East Fork of the White River form the boundaries of portions of three of the five counties composing Region Thirteen-A. These streams, in addition to the Eel, Salt Creek, and West Fork White River, are the major drainage ways in the region and are served by a multitude of radiating tributary streams which extend into the strongly dissected upland areas. These stream systems drain in a southwesterly direction into the Wabash River basin.

The seven day, once in ten year (Q7-10), one day, once in thirty year (Q1-30), and the average annual flow in million-gallons-per-day (mgd) for streams with gaging stations within the region are presented in Table 172.

The low-flow characteristics indicate that the largest and most reliable streamflows are those in the Wabash and White Rivers. The one day, once in thirty year low flows for the Wabash River at Vincennes reveal that the river will have a sustained flow of at least 580 mgd, while the average annual flow exceeds 7,000 mgd.

The flow duration curve for the East Fork of the White River near Bedford has a minimal slope, as shown in Figure 217. The curve indicates that the stream will have a dependable flow of 280 mgd ninety

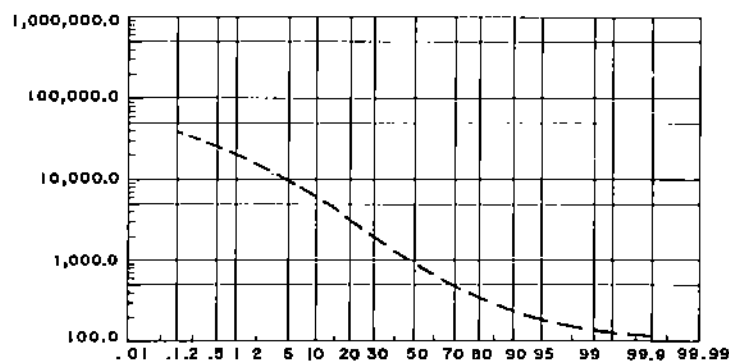


Figure 217

The flow duration curve for the East Fork of the White River near Bedford.

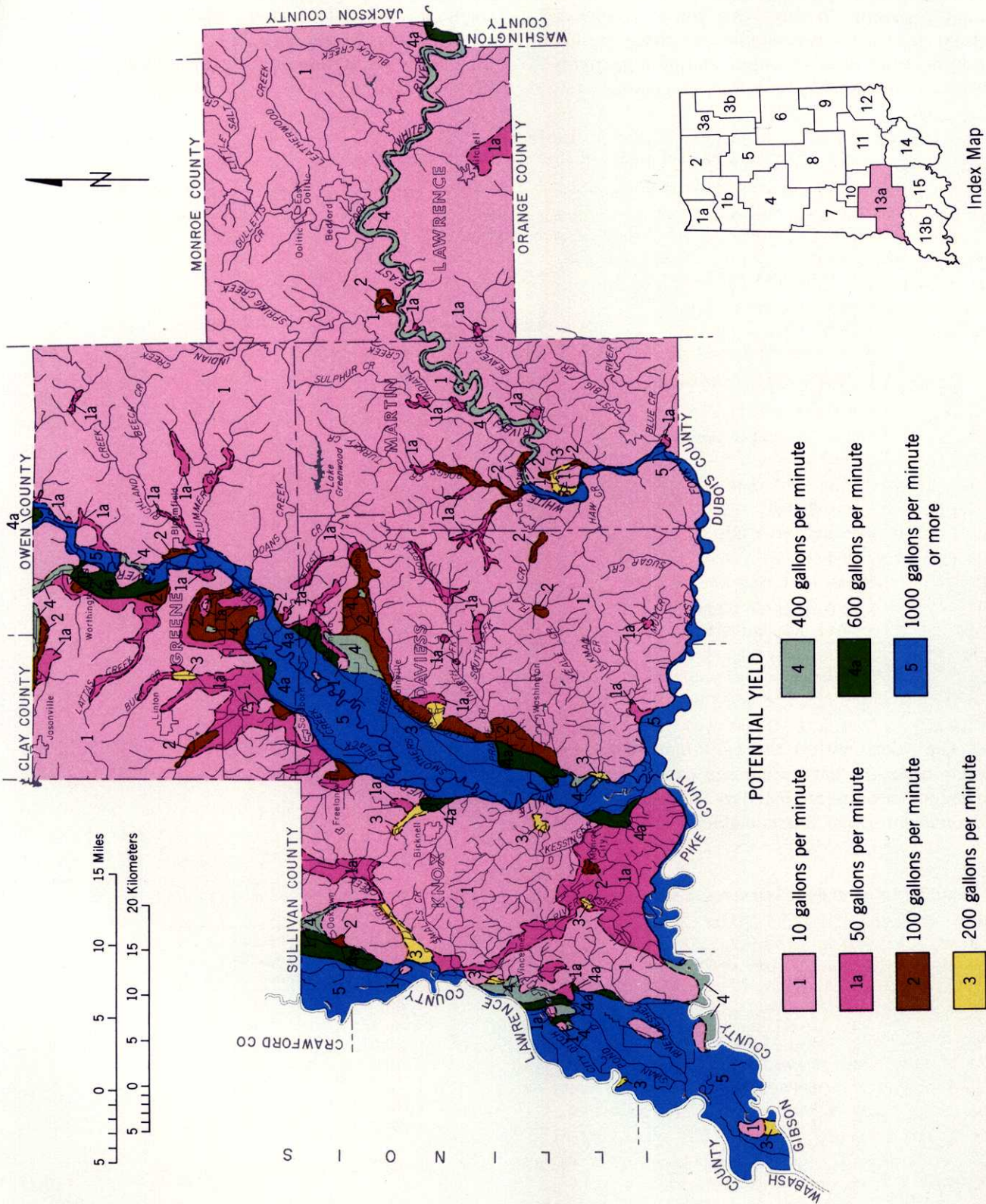


Figure 216
 Map of Region Thirteen-A showing the location and potential yield of ground water from properly constructed large diameter wells.

percent of the time. The slope also indicates that the East Fork of the White River drainage basin contains aquifers which provide significant ground-water contribution to streamflow. To verify this, the technique of hydrograph separation was applied to three annual hydrographs at the Bedford gaging station, representing "dry," "average," and "wet" years. The results indi-

cate that the ground-water contribution to streamflow amounts to thirty-six, thirty-six, and twenty-eight percent for dry, average, and wet years, respectively. Conversely, from sixty-four to seventy-two percent of the flow, depending on the year, is due directly to surface runoff from runoff-producing precipitation events or from snowmelt.

Table 172
Flow characteristics of streams within Region Thirteen-A.

Stream	Drainage Area (square miles)	Million-Gallons-Per-Day		
		Average Annual	Q7-10	Q1-30
East Fork River at Shoals	4,927	3,400	160.0	76.0
West Fork River at Newberry	4,688	2,900	204.0	160.0
White River at Petersburg	11,125	7,300	490.0	370.0
Wabash River at Vincennes	13,706	7,400	760.0	580.0
Salt Creek near Peerless	573	420	1.0	0.4
Indian Creek near Trinity Springs*	172	31	0.1	na
Prairie Creek near Washington*	120	10	0.06	na
Richland Creek near Bloomfield*	954	15	0.32	na
Maria Creek near Emison*	88	10	0.19	na
East Fork of the White River near Bedford	3,861	2,300	160.0	102.0

*Flow characteristics estimated from stream gaging stations with short periods of record.
na: not available.

Lakes The lakes within the region are at least 50.0 acres in size or have a storage capacity of 32.5 million gallons or more are listed in Table 173, and are located on Figure 218. These eighteen lakes have a

combined surface area of approximately 3,325 acres and a gross storage capacity of approximately 20,900 million gallons.

Table 173
Lakes at least 50.0 acres in size or having a storage capacity of 32.5 million gallons or more.

Lake Number	Lake Name	Drainage Area (square miles)	Surface Area (acres)	Gross Storage (million gallons)
1	Beechwood Lake	na	18.0	130
2	Lake Lenape	1.69	60.3	107
3	Moses Lake	0.95	29.9	224
4	Singer Ditch Lake	4.40	78.0	107
5	White Oak Lake	na	25.5	65
6	Dogwood Lake	13.90	1,313.0	6,647
7	Montgomery Lake	0.44	24.0	62
8	Prairie Creek Structure No. A-2-3	3.80	55.3	47
9	Prairie Creek Structure No. A-4-1	13.20	61.6	128
10	Prairie Creek Structure No. B-2-1	1.98	31.0	88

Table 173 (continued)

Lake Number	Lake Name	Drainage Area (square miles)	Surface Area (acres)	Gross Storage (million gallons)
11	Prairie Creek Structure No. B-4-7	12.80	101.0	117
12	Boggs Creek Lake	na	na	62
13	Greenwood Lake	na	na	7,299
14	Lake Greenwood	14.80	829.0	2,606
15	Seed Tick Lake	na	na	66
16	West Boggs Creek Lake	13.30	622.0	2,531
17	Ken-Ray Lake	1.88	74.0	544
18	Spring Mill Park Lake	na	27.6	74

na: not available.

UTILIZATION OF THE WATER RESOURCE

Instream Uses

The supply and demand analysis for recreational uses of water by the residents of the region are presented in Table 174. The existing supply for recreational activity is expressed as a percentage of the demand. Therefore, when this percentage exceeds one hundred the supply exceeds the demand. Conversely, when the supply is less than one hundred the supply is less than the projected demand.

Boating and Waterskiing Portions of the Wabash River and East and West Forks of the White River are used for boating and waterskiing. West Boggs Lake in Daviess County and Lake Sullivan in Knox County, and some of Greene County's strip mine lakes are available for boating and waterskiing. The supply of boating and waterskiing opportunities meets the current and projected demand for boating and waterskiing through the year 2000.

Canoeing The Wabash and the East and West Forks of the White River are available for canoeing. Other

Table 174
The outdoor recreation demand and supply.

Activity	Percent of Population Participating	Density Guideline	Approximate Supply	Existing Supply as a Percentage of Projected Demand		
				1980	1990	2000
Boating	25	19.6 boats/acre/year	11,000 acres	100+	100+	100+
Waterskiing	10	34.4 skiers/acre/year	1,200 acres	80	75	75
Canoeing	4	585 canoes/mile/year	363 miles	100+	100+	100+
Swimming	33	76,600 swimmers/acre/year	9 acres	100	100	90
Ice-Skating	5	6,678 skaters/acre/year	3 acres	33	33	33
Fishing	52	66 persons/acre/year	14,300 acres	64	61	60

This table is based upon the 1979 Indiana State Outdoor Recreation Plan. Only the supply and recreational demands by residents of the region are displayed. The available recreational opportunities outside the region are not considered, nor are the recreational demands of nonresidents considered.

streams may also be canoed but are not as accessible and may not have a dependable flow. A total of 363 miles of canoeing streams is available in the region, which exceeds the demand for canoeing opportunities. This surplus of supply is expected to continue through the year 2000.

Swimming and Ice-Skating The available supply of swimming opportunities is enough to meet the current and projected demand. The current and projected de-

mand for ice-skating opportunities exceed the available supply.

Fishing The quality of the fisheries habitat is indicated on Figure 219. Larger streams, such as the Wabash River, East and West Fork of the White River, and Indian Creek, have enough diversity of stream bed, sufficient water quality, and vegetation to provide excellent aquatic habitat. The Wabash and White Rivers offer abundant warmwater fisheries for sport fishing

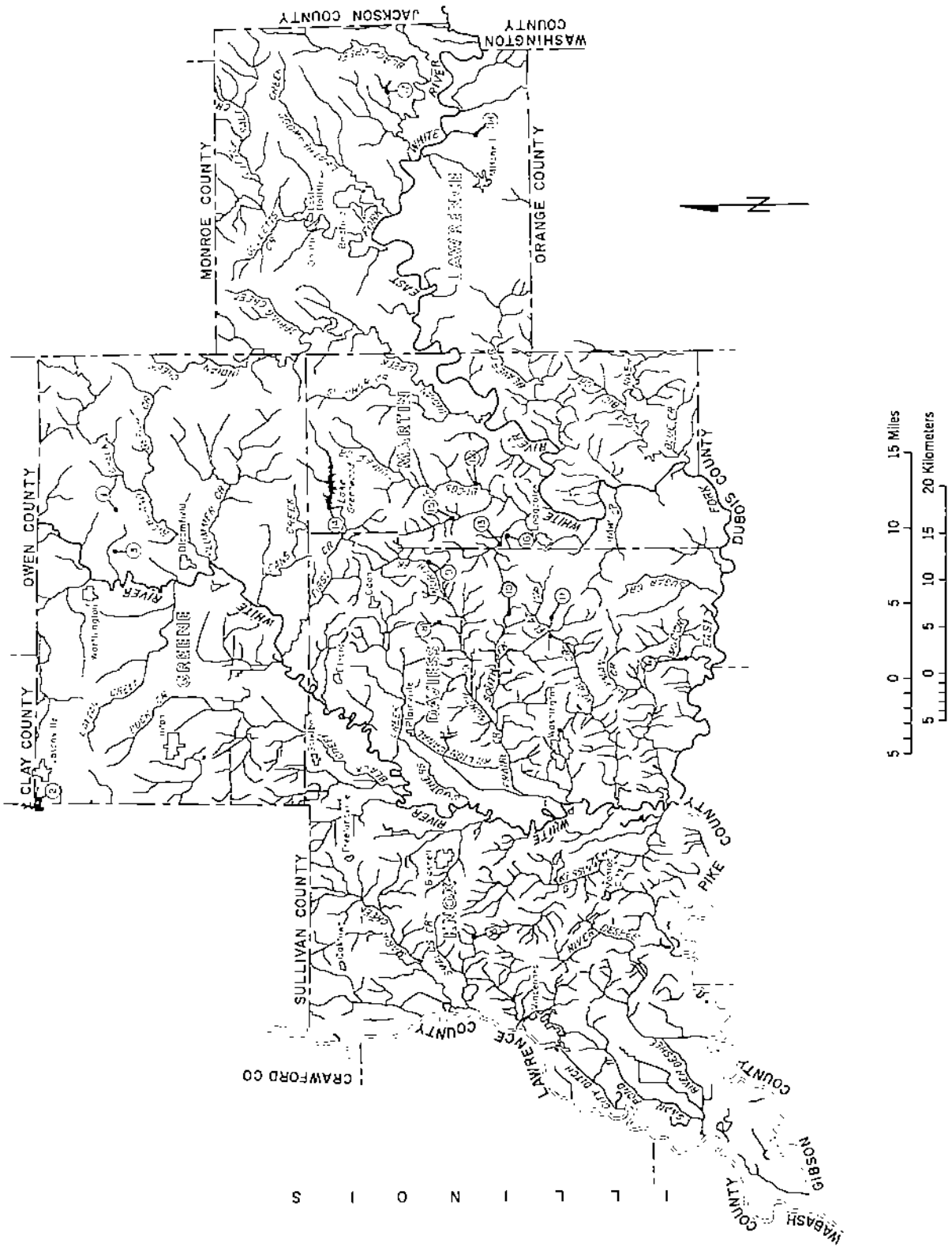
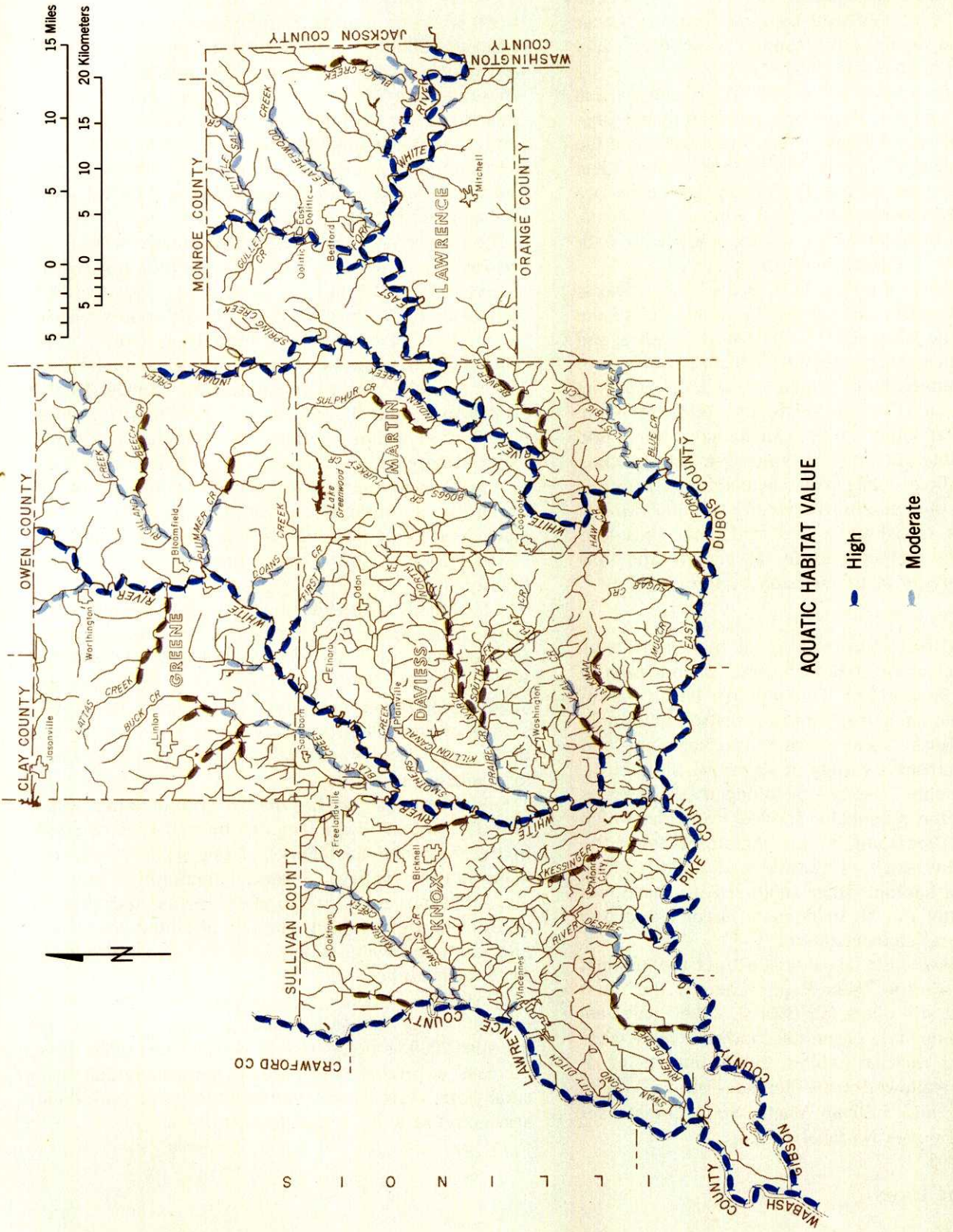


Figure 218
Map of Region Thirteen-A showing the location of lakes that are at least 50.0 acres in size or have a storage capacity of 32.5 million gallons or more.



AQUATIC HABITAT VALUE

- High
- Moderate
- Low
- Negligible

Figure 219
Map of Region Thirteen-A showing the quality of the fisheries habitat.

and commercial fishing. Indian Creek is noted for good smallmouth bass fishing. Aquatic habitat on many smaller streams, such as Lattas Creek in Greene County, has been reduced by channelization. Other small streams do not have enough water during dry seasons to support a game fishery.

Except for the oxbow lakes of the White and Wabash Rivers, most lakes in the region are man-made. Dogwood Lake, Spring Mill Lake, West Boggs Lake, and the strip mine lakes of Greene and Sullivan State Forest are known for good fishing. The fish in these lakes are predominantly warmwater species typical of Indiana. Wampler and Graveyard Lakes are stocked with wall-eye. Airline Pit is stocked with trout.

Public access to the West Fork of the White River is provided in Daviess and Greene Counties and to the East Fork of the White River in Daviess, Lawrence, and Martin Counties. Access to the Wabash River is provided in Vincennes. State-owned access for lake fishing is available in Glendale Fish and Wildlife Area, Greene-Sullivan State Forest, Shakamak State Park, Spring Mill State Park, and at White Oak Lake in Knox County. West Boggs Lake is also available to the public as are lakes contained in the Hoosier National Forest.

The supply of fishing waters will meet sixty-four percent of the demand within the region, and may meet sixty percent of the demand by the year 2000.

Riparian Habitat The quality of the riparian or wildlife habitat associated with streams and lakes is indicated on Figure 220. The region's best riparian habitat is found along the Wabash River and both forks of the White River. These streams offer sufficient food and cover to attract a variety of waterfowl, shorebirds, and other wildlife. The habitat along these rivers is improved by the seasonally flooded wetlands, which are the most abundant in this region. Some of the smaller streams, such as Guthrie and Julian Creeks, offer excellent habitat. Other small streams have less valuable habitat due to inadequate cover associated with agricultural channelization.

The least developed lakeshores attract the greatest diversity of wildlife. West Boggs Lake is the most developed but still offers fair habitat. Other lakes, especially those on state properties, and strip mine lakes have excellent riparian habitat. Public hunting of riparian habitat is allowed on the Glendale Fish and Wildlife Area, Greene and Sullivan Martin State Forests and parts of the Hoosier National Forest.

Withdrawal Uses

Public Water Supplies Daviess, Greene, Knox, Lawrence, and Martin Counties are served by forty-five

public water utilities. An estimated 98,000 persons were served by a public utility in 1975. Approximately 31,200 persons were served in Lawrence County; 10,300 in Martin County; 27,100 in Knox County; 14,800 in Daviess County; 14,600 in Greene County; and 10,300 were served by a public water utility in Martin County.

Twenty-one of the utilities have service areas confined to a single municipal area, while four water utilities serve a single subdivision. The remaining twenty public water utilities are rural water systems. The service areas and rates of withdrawal for the public water utilities are shown in Figure 221.

The City of Vincennes Water Department served approximately 19,400 persons in 1975. In 1977, it supplied an average of 3.5 million-gallons-per-day. Bedford withdrew 4.0 mgd in 1977. Bedford sells approximately 0.7 mgd to surrounding communities. Other large utilities in the region include Washington, withdrawing 2.5 mgd; Loogootee, 1.13 mgd; Linton, 0.8 mgd; Mitchell, 0.8 mgd; and Bloomfield, 0.5 mgd. In 1975, these public water utilities pumped an estimated 15.8 mgd.

Rural systems are clustered in a rather dense pattern in Lawrence County and Martin County outside of Crane Naval Ammunition Depot. Rural systems are also located in Eastern Greene County, southern Daviess County and in central and north central Knox County.

A few small utilities in northern Martin County are supplied by surface water from the Crane Naval Depot. Mitchell withdraws water from the East Fork of the White River and Salt Creek. The flows of Salt Creek are augmented by releases from Lake Monroe. The water supply of Lake Monroe is owned by the State of Indiana, which, under contract, provides the City of Bedford with up to 5.0 mgd.

Public utilities rely heavily on ground water withdrawals. Almost all are supplied by well fields located in the West and East Forks of the White River and Wabash River valleys. Several communities rely on ground water even though they are located several miles from the well field. The city of Linton, for example, withdraws water from a well field nine miles from town, near Elnora.

Projections of public water supply withdrawals indicate that they should increase to about 21.1 mgd by the year 2000 as presented in the following table. This increase is projected in part on the assumption that rural water systems will continue to expand both their service areas and number of customers.

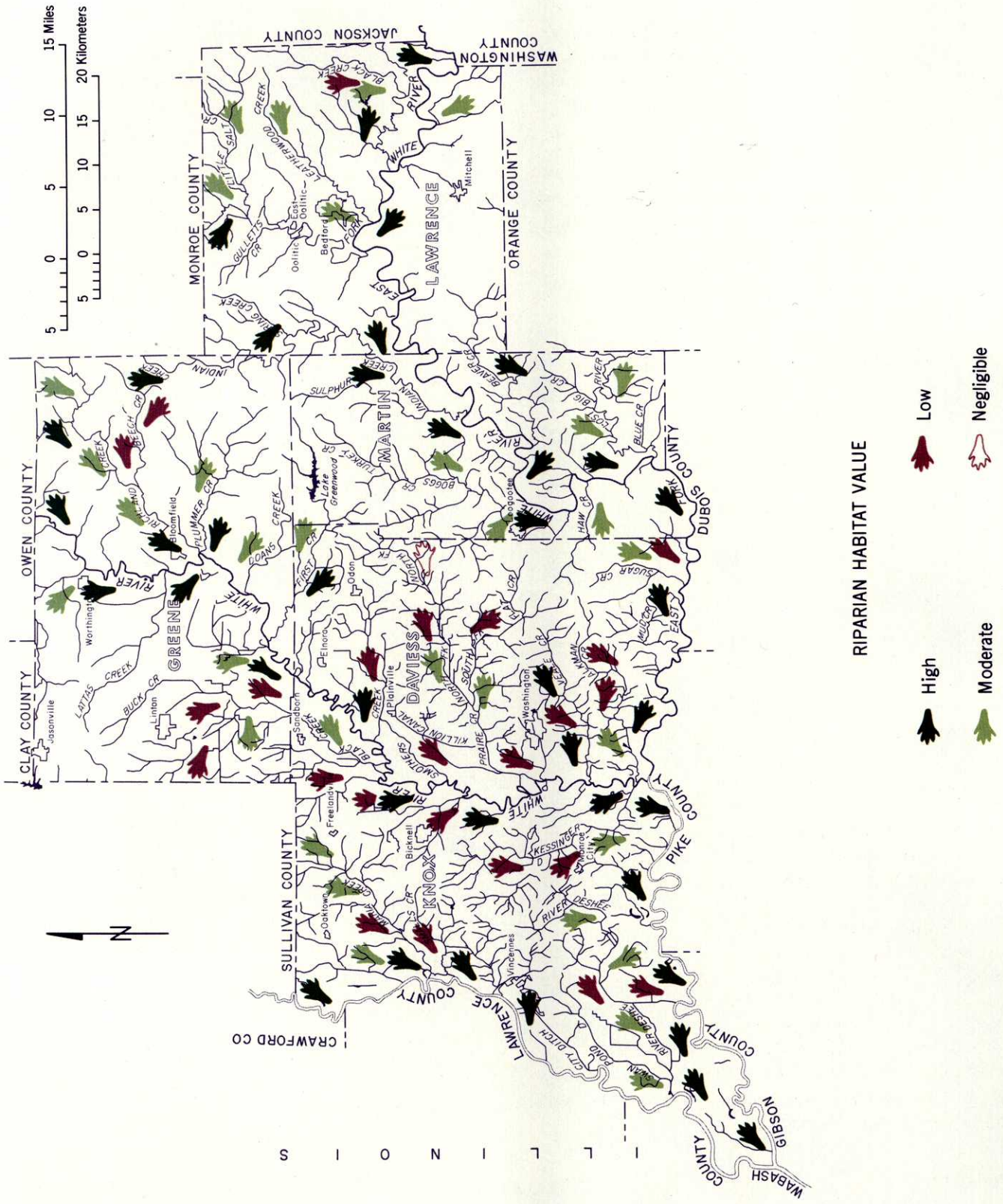


Figure 220
Map of Region Thirteen-A showing the quality of the riparian habitat.

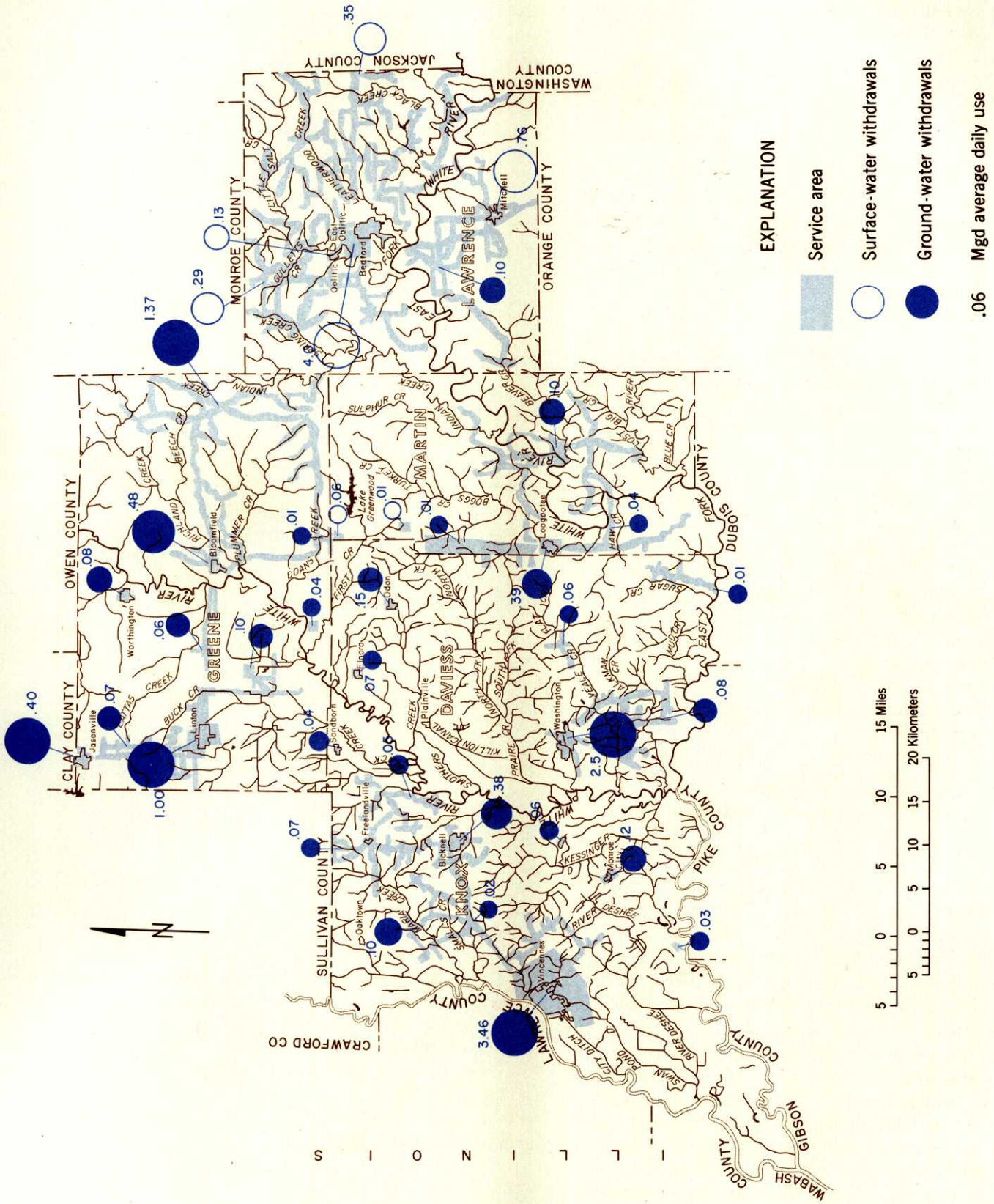


Figure 221
 Map of Region Thirteen-A showing the service areas of the public water utilities and average daily use in million-gallons-per-day.