Region Three-A

LaGrange, Steuben, Noble, Whitley, and Huntington Counties, located in northeastern Indiana, form Region Three-A. The region contains approximately 1,825 square miles and is bounded by Michigan to the north; the Indiana-Ohio state line, Dekalb, Allen, and Wells Counties to the east; Wells and Grant Counties to the south; and Wabash, Kosciusko, and Elkhart Counties to the west, as shown in Figure 87.

The population of Region Three-A was 138,500 in 1975. The official Indiana population projections for 1975 to 2000 indicate the region's population may increase to approximately 200,000 by the year 2000. The 1975 population and projections for each county are presented in the following table.

Table 59
The 1975 and projected populations for Region Three-A.

County	*1975*	*1980*	*1990*	*2000*
Huntington	35,232	37,300	40,000	42,100
LaGrange	23,157	25,900	32,600	41,100
Noble	32,761	35,300	40,300	46,100
Steuben	22,314	25,400	29,400	32,800
Whitley	25,033	27,200	32,200	38,200
Total	138,497	151,100	174,500	200,300

The major population centers within the region are Huntington in Huntington County, Kendallville in Noble County, Angola in Steuben County, and Columbia City in Whitely County. These urban centers contained sixteen percent of the region's 1975 population.

Agriculture is the dominant land use within the region with more than seventy-nine percent of the area devoted to agricultural purposes. Approximately nine

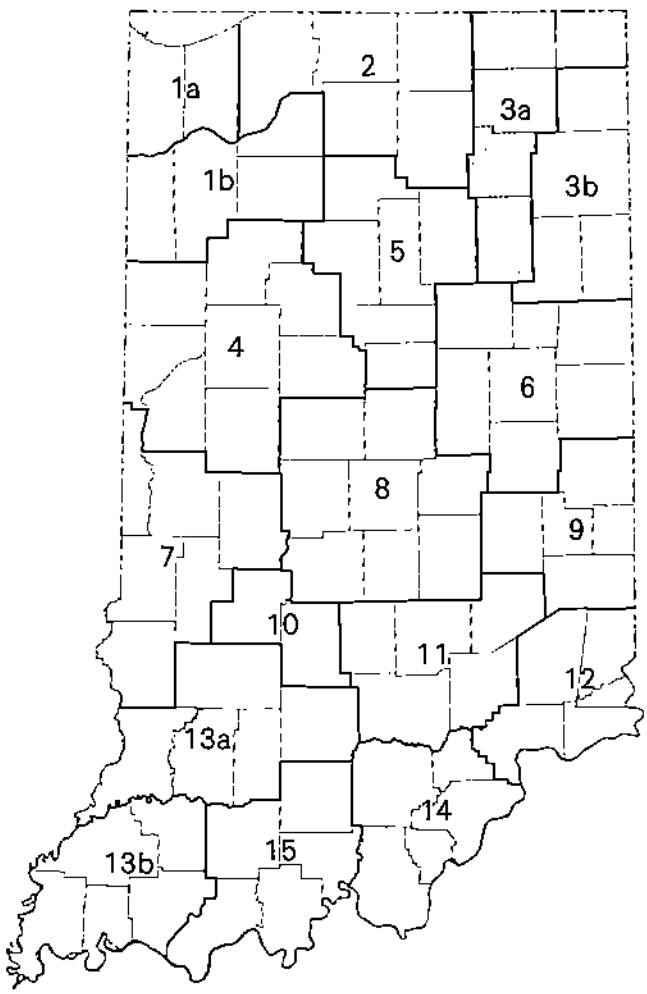

Figure 87
Map of Indiana showing the location of Region Three-A.

percent of the land is forested, six percent comprises lakes and associated wetlands, and six percent comprises urban and miscellaneous uses.

Approximately thirty-five percent of the work force was employed within the region plus an additional 2,800 persons from outside the region in 1975. The major employers are the electrical machinery, fabricated metal products, and transportation industries.

The region is generally characterized by flat or gently rolling areas and low, morainal ridges. A series of northeast to southwest trending ridges are located in southern Noble and northern Whitley Counties. These moraines cause nearby rivers to be deflected toward the north or south. Small lakes dating from postglacial times are scattered throughout the northern portion of the region.

Region Three-A receives approximately 36.0 inches of precipitation annually. This varies from a high of 3.9 inches in June and July to a low of 1.7 inches in February. Of the 36.0 inches of precipitation, approximately 10.0 inches appear as streamflow while 26.0 inches are consumed through evapotranspiration. The region has moderate temperatures with averages ranging from 24.5°F. in January to 72.5°F. in July. The average annual temperature is 50°F. Data from airports in South Bend and Fort Wayne indicate the annual prevailing wind is from the southeast at 10.3 miles per hour.

THE WATER RESOURCE

Ground Water

The effects of past glacial action have been important factors in the occurrence of ground water within Region Three-A. Thick deposits of till, outwash sand and gravel, ice contact, stratified drift, windblown sand, and alluvium have resulted from successive advances of glacial ice which ended with the Wisconsinan glaciers that retreated from the area about 12,000 years ago. Numerous natural ice-block lakes and deposits of sand and gravel dot the landscape of northern Noble, LaGrange, and northwestern Steuben Counties. Extensive outwash sand and gravel aquifers are also found in these areas. In Whitley and Huntington Counties glacial till and end moraines are the predominant glacial deposits.

Bedrock formations range from Silurian limestones and shales in Huntington and Whitley Counties to Devonian limestones, dolomites and shales in Whitley and Noble Counties, and Mississippian age shales in LaGrange and Steuben Counties. The shales underlying Noble, LaGrange, and Steuben Counties are not considered a source of ground water. The Devonian limestones are sources of ground water in southern Whitley and in Huntington Counties. The Silurian limestone is frequently utilized as a water source.

Region Three-A contains some of the most significant ground-water resources in Indiana with an excellent potential for large scale ground-water development. The availability of ground water is associated with the nature and type of aquifer materials present in a given area. As Figure 88 indicates, well yields in the region decrease in a southerly direction with the highest yields associated with the permeable sand and gravel aquifers of LaGrange, Noble, and Steuben Counties. In most of LaGrange County, except for the southeast corner, properly constructed wells can produce over 1,000 gallons-per-minute (gpm). In the southeast corner of the county, and some scattered areas throughout the county, wells of 600 gpm can be expected. In Steuben County, wells yielding 600 gpm can usually be expected in the western part, while well yields further east range from 200 to 400 gpm. In Noble County, well yields of 600 to 1,000 gpm can usually be anticipated in the northern and western parts while in the eastern and southeastern areas, wells could yield in the range of 100 to 400 gpm. Further to the south in Whitley and Huntington Counties, sand and gravel deposits within the glacial drift offer yields of 200 to 400 gpm. The Silurian limestone and dolomite sequence can generally be expected to yield similar quantities of water. Some northwestern and eastern areas of Whitley County could provide wells yielding up to 600 gpm, and wells in one area near the center of the county could yield up to 1,000 gpm. In the northern half of Huntington County and the southwestern tip of Whitley County, well yields of 200 gpm could be expected with two small areas possibly yielding only 100 gpm. Wells in the southern half of Huntington County yield approximately 400 gpm.

Ground water is usually hard with concentrations ranging from 300 to 400 parts-per-million. Iron concentrations are usually between 0.1 and 3.0 parts-per-million. Iron treatment or removal is required for many purposes.

Surface Water

Streamflow The streams in Steuben, LaGrange, and Noble Counties are primarily flowing in a westerly direction and lie within the St. Joseph River basin draining into Lake Michigan. The exception is the southeast corners of Steuben and Noble Counties where the drainage is to the southeast into the Maumee River basin. The major streams in these counties include the north and south branches of the Pigeon and Elkhart Rivers. In general, the streams in Whitley and Huntington Counties lie within the Wabash River drainage

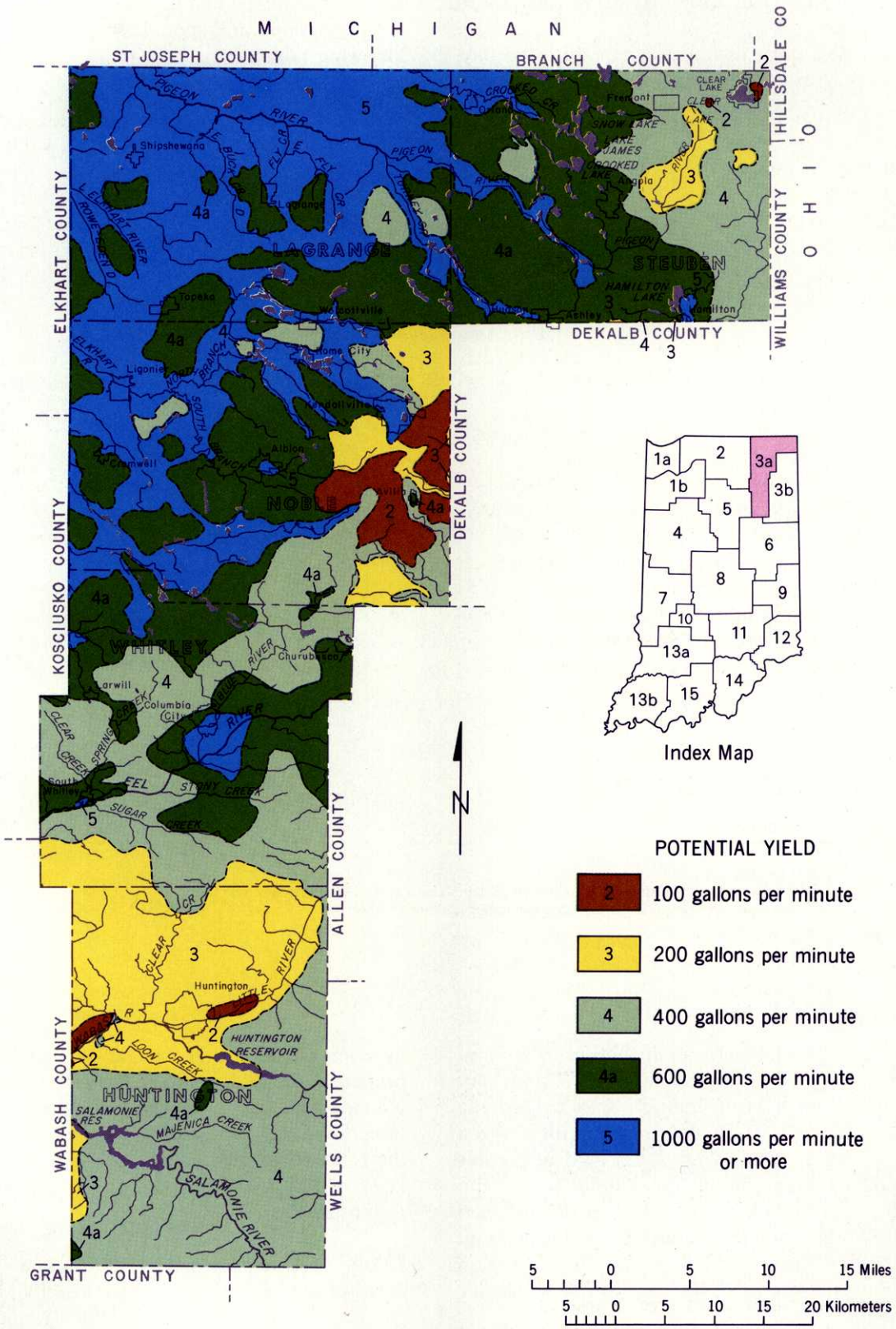

Figure 88
Map of Region Three-A showing the general location and potential yield of ground water from properly constructed large diameter wells.

basin and include the Eel, Little, Wabash, and Salamonie Rivers.

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 in Region Three-A are indicated in the following table.

Table 60
Flow characteristics of streams.

Stream	*Drainage Area (square miles)*	*Million-Gallons-Per-Day*		
		Average Annual	*Q7-10*	*Q1-30*
Aboite Creek near Aboite[a]	53	6.1	0.4	na
Blue River near Columbia City[a]	61	9.7	2.0	na
Eel River near Columbia City[a]	77	15.5	3.7	na
Forker Creek near Burr Oak[a]	19	3.0	0	0
Little River near Huntington[b]	263	150.0	2.3	1.0
North Branch Elkhart River near Cosperville	133	68.0	2.8	1.4
Pigeon Creek near Angola	102	46.0	3.9	2.5
Pretty Lake inlet near Stroh[a]	2	0.1	0	0
Salamonie River near Warren	425	240.0	4.7	3.1
Sugar Creek at South Whitley[a]	31	2.9	0.2	na

na: not available
[a]Flow characteristics estimated from stream gaging stations with short periods of record.
[b]Flows were recorded prior to the construction of Huntington Reservoir.

Despite good ground-water contribution to streamflow, especially in the northern half of the region, very few systems drain a large enough area to provide substantial low flows. The only streams with a seven day, once in ten year low flow of ten mgd or greater are the Elkhart River below the confluence of the North and South Branches, the Eel River downstream from South Whitley, and the Wabash River downstream from Huntington Reservoir. No streams in the region have a one day, once in thirty year low flow greater than ten mgd.

The low flow characteristics indicate that the region is dominated by many small to medium stream systems rather than any particularly large one. Because of the short period of record for many stream gages, flow duration curves are not available. However, the north branch of the Elkhart River near Cosperville will have a dependable flow of eleven mgd ninety percent of the time. Similarly, the Salamonie River near Warren and the Little River near Huntington will have dependable flows of 10.0 and 6.7 mgd respectively ninety percent of the time.

Lakes The lakes within the region that are at least 50 acres in size or have a storage capacity of 32.5 million gallons or more are listed in Table 61, and are located on Figure 89. These one hundred and fifty lakes have a combined surface area of approximately 18,800 acres and a gross storage capacity of approximately 10,900 million gallons.

Table 61

Lakes at least fifty acres in size with 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	Adams Lake	5.62	308.0	2,505
2	Appleman Lake	na	52.0	192
3	Atwood Lake	1.23	170.0	508
4	Big Long Lake	4.77	388.0	na
5	Big Turkey Lake	35.80	450.0	2,378
6	Blackman Lake	0.98	67.0	394
7	Buck Lake	na	18.0	48
8	Cass Lake	0.68	89.0	284
9	Cedar Lake	1.60	120.0	332
10	Cline Lake	na	20.0	114
11	Dallas Lake	39.80	283.0	3,248
12	Emma Lake	13.60	42.0	228
13	Eve Lake	na	31.0	218
14	Fish Lake	10.60	100.0	1,319
15	Fish Lake	6.21	139.0	834
16	Hackenburg Lake	55.40	42.0	166
17	Lake of the Woods	5.25	136.0	1,782
18	Little Turkey Lake	56.50	135.0	505
19	Martin Lake	4.93	26.0	290
20	Mateer Lake	na	18.0	48
21	McClish Lake	1.28	35.0	394
22	Messick Lake	56.40	68.0	472
23	Mongo Reservoir	213.00	76.0	237
24	Nasby Mill Pond	na	43.2	114
25	North Twin Lake	1.54	135.0	690
26	Olin Lake	5.81	103.0	2,991
27	Oliver Lake	11.10	362.0	na
28	Ontario Millpond	na	31.2	175
29	Pigeon Lake	na	61.0	377
30	Pretty Lake	2.89	184.0	1,538
31	Rainbow Lake	na	16.0	81
32	Royer Lake	4.69	69.0	531
33	Shipshewana Lake	6.74	202.0	439
34	South Twin Lake	2.22	116.0	1,173
35	Still Lake	na	30.0	202
36	Stone Lake	1.51	152.0	671
37	Wall Lake	1.61	141.0	534
38	Westler Lake	37.80	88.0	576
39	Witmer Lake	36.10	204.0	2,293
40	Ball Lake	11.60	87.0	1,146
41	Barton Lake	na	94.0	436
42	Bass Lake	0.39	61.0	146
43	Bell Lake	na	38.0	166
44	Big Otter Lake	21.30	69.0	580
45	Bower Lake	84.60	25.0	91
46	Center Lake	na	46.0	127
47	Clear Lake	6.86	800.0	8,143
48	Crooked Lake	10.40	828.0	3,440
49	Fish Lake	na	59.0	244
50	Fox Lake	1.25	142.0	1,026
51	Golden Lake	88.80	119.0	589
52	Hamilton Lake	16.50	802.0	5,409
53	Handy Lake	na	16.0	94
54	Hog Lake	na	48.0	185
55	Hogback Lake	103.00	146.0	472
56	Howard Lake	3.90	27.0	42
57	Jimmerson Lake	51.60	434.0	1,431
58	Lake Anne	na	17.0	91
59	Lake Gage	17.30	332.0	3,304

Table 61 (continued)

Lake Number	*Lake Name*	*Drainage Area (square miles)*	*Surface Area (acres)*	*Gross Storage (million gallons)*
60	Lake George	14.80	488.0	na
61	Lake James	47.80	1,034.0	10,943
62	Lake Pleasant	3.18	424.0	1,137
63	Lime Lake	na	30.0	107
64	Lime Lake	17.50	57.0	139
65	Little Turkey Lake	na	58.0	254
66	Little Otter Lake	15.70	34.0	241
67	Long Lake	2.80	154.0	241
68	Long Lake	67.90	92.0	501
69	Loon Lake	2.13	138.0	205
70	Mirror Lake	na	9.0	39
71	Otter Lake	6.91	118.0	638
72	Pigeon Lake	35.30	61.0	303
73	Pleasant Lake	1.12	53.0	387
74	Round Lake	7.25	30.0	110
75	Silver Lake	3.79	238.0	827
76	Snow Lake	40.20	310.0	2,606
77	Walters Lake	na	53.0	179
78	Bartley Lake	na	34.0	140
79	Baugher Lake	31.00	32.0	127
80	Bear Lake	6.98	136.0	987
81	Big Lake	8.89	228.0	1,834
82	Bixler Lake	5.28	120.0	681
83	Bowen Lake	na	30.0	351
84	Bristol Lake	na	27.0	241
85	Crane Lake	na	28.0	117
86	Cree Lake	4.85	58.0	296
87	Crooked Lake	1.51	206.0	2,945
88	Deer Lake	na	36.0	136
89	Diamond Lake	4.80	105.0	840
90	Dock Lake	na	16.0	74
91	Duely Lake	11.20	21.0	58
92	Eagle Lake	3.22	81.0	342
93	Engle Lake	4.19	48.0	218
94	Gilbert Lake	0.37	28.0	159
95	Gordy Lake	9.40	31.0	221
96	Harper Lake	2.76	11.0	52
97	High Lake	4.43	123.0	404
98	Hindman Lake	8.66	13.0	45
99	Horseshoe Lake	1.62	18.0	81
100	Jones Lake	70.30	114.0	312
101	Knapp Lake	6.02	88.0	990
102	Latta Lake	2.52	42.0	293
103	Little Long Lake	4.55	71.0	570
104	Long Lake	12.00	40.0	205
105	Lower Long Lake	4.35	66.0	508
106	Marl Lake	na	30.0	166
107	Marvin Morgan Lake	na	na	42
108	Miller Lake	na	11.0	52
109	Millers Lake	na	28.0	133
110	Muncie Lake	42.80	47.0	188
111	Niezer Lake	0.14	26.0	48
112	Norman Lake	na	14.0	91
113	Northport Feeder Lake	na	658.2	2,851
114	Pleasant Lake	0.29	20.0	175
115	Port Mitchell Lake	na	15.0	58
116	Richard Grieger Lake	na	na	55
117	River Lake	18.60	24.0	123
118	Round Lake	3.47	99.0	697
119	Sacarider Lake	1.43	33.0	241

Table 61 (continued)

Lake Number	*Lake Name*	*Drainage Area (square miles)*	*Surface Area (acres)*	*Gross Storage (million gallons)*
120	Sand Lake	14.90	47.0	413
121	Schockopee Lake	na	21.0	91
122	Silver Lake	0.28	34.0	71
123	Skinner Lake	14.00	125.0	570
124	Smalley Lake	27.10	69.0	495
125	Sparta Lake	0.69	31.0	55
126	Steinbarger Lake	24.30	73.0	518
127	Sweet Lake	na	16.0	68
128	Sylvan Lake	33.80	575.0	na
129	Tamarack Lake	15.90	50.0	286
130	Tamarack Lake	19.40	84.0	436
131	Upper long Lake	2.08	86.0	619
132	Village Lake	12.00	12.0	52
133	Waldron Lake	134.00	216.0	1,016
134	Wible Lake	na	49.0	211
135	Williams Lake	na	46.0	348
136	Black Lake	na	24.0	130
137	Blue Lake	3.58	239.0	1,632
138	Brown Lake	na	23.0	188
139	Cedar Lake	0.79	131.0	na
140	Goose Lake	1.51	84.0	na
141	Larwill Lake	na	9.0	55
142	Little Wilson Lake	0.52	8.0	42
143	Loon Lake	11.10	222.0	1,867
144	New Lake	0.29	50.0	286
145	Old Lake	2.81	32.0	202
146	Round Lake	3.36	125.0	na
147	Shriner Lake	0.94	111.0	na
148	Troy Cedar Lake	5.33	93.0	827
149	Wilson Lake	0.46	29.0	127
150	Huntington Lake	721.00	905.0	4,066

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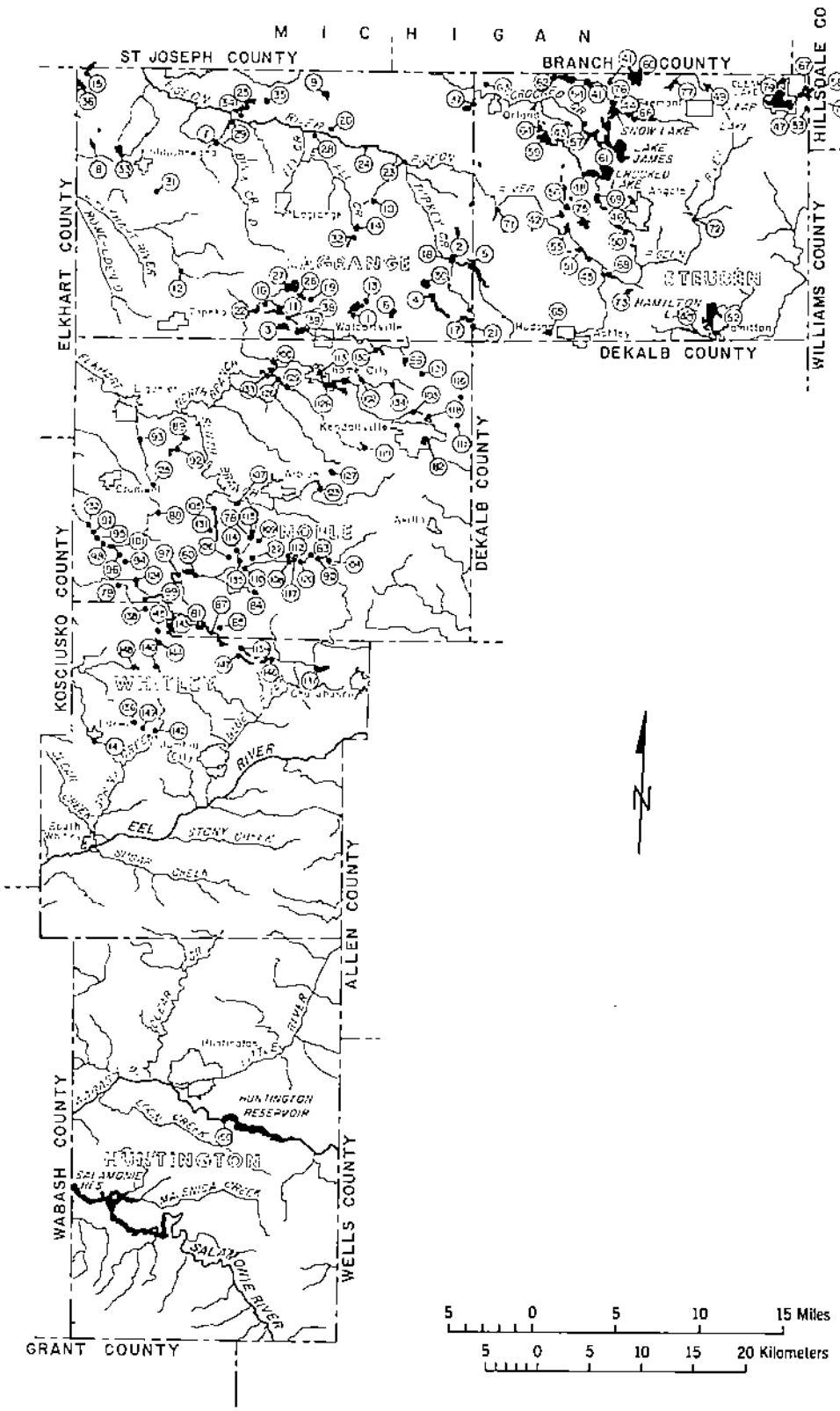

Figure 89
Map of Region Three-A showing the location of lakes that are at least 50.0 acres in size or with a storage capacity of 32.5 million gallons or more.

UTILIZATION OF THE WATER RESOURCE

Instream Uses

The supply and demand analysis for recreational uses of water by the residents of Region Three-A is presented in Table 62. The existing supply for recreational activities is expressed as a percentage of the demand. Therefore, when this percentage exceeds one hundred the supply exceeds the demand. Conversely, when the supply as a percentage of demand is less than one hundred the supply is less than the projected demand.

Boating and Waterskiing Three of the lakes rank among the largest twenty-five of the state. Salamonie Lake, Lake James, and Huntington Lake represent the best water in the region for boating recreation. The control structure of Salamonie Lake lies within Region Five, but the lake extends into Region Three-A. Pigeon River State Fish and Wildlife Area and Chain-O'Lakes State Park offer boating opportunities to smaller craft. Additionally, many of the numerous private lakes in the region offer boating and waterskiing opportunities to residents of those localities.

Table 62
The outdoor recreation demand and supply analysis.

Activity	*Percent of Population Participating*	*Density Guideline*	*Approximate Supply*	*Existing Supply as a Percentage of Projected Demand*		
				1980	*1990*	*2000*
Boating	31	19.6 boats/acre/year	21,800 acres	100+	100+	100+
Waterskiing	7	34.4 skiers/acre/year	7,900 acres	100+	100+	100+
Canoeing	8	585 canoes/mile/year	93 miles	100+	100+	100+
Swimming	42	76,600 swimmers/acre/year	94 acres	100+	100+	100+
Ice-Skating	9	6,678 skaters/acre/year	4 acres	44	40	36
Fishing	56	66 persons/acre/year	29,000 acres	100+	92	88

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

There are currently no existing or projected shortages in meeting the demand for boating and waterskiing. However, shortages do exist in Region Three-B, east of Region Three-A, and many of the boating and waterskiing enthusiasts in the region look to the waters of Region Three-A for recreational opportunities. Seventy-five percent of Pokagon State Park's visitation and over fifty percent of Chain O'Lakes State Park's visitation originate outside of Region Three-A. Similarly, eleven percent of the visitation to Salamonie Lake originates outside Region Three-A.

Canoeing Ninety-three miles of lakes and streams provide canoeing, which is adequate to meet the demand generated within the region. Of all the canoe trips in the region, Pigeon River with thirty-six miles is the longest and in itself meets the current and projected demand generated by residents of Region Three-A.

Swimming and Ice-Skating Swimming for residents within the region is currently met by the existing number of lakes with public beaches as well as by public pools. Private swimming areas are available at a number of lakes.

Ice-skaters experience a shortage of available opportunities in the region. Currently forty-four percent of the demand by ice-skaters is met by available supply and projected to decline to thirty-six percent by the year 2000. This estimate does not include opportunities available to residents with access to private lakes.

Fishing The quality of the fisheries habitat is shown on Figure 90. The warmwater fishery is one of the finest in the state. Major rivers support good populations of smallmouth bass, rock bass, northern pike, and channel catfish. Additionally, trout are stocked in Bloody Run, Little Elkhart River, Pigeon River, Rowe-Eden Ditch, Turkey Creek, Curtis Creek, Clock Creek, the North Branch of the Elkhart River, and Fawn River.

Fishing in the hundreds of lakes in Region Three-A exceeds the opportunities for stream fishing. Steuben and Noble Counties each have over one hundred natural lakes in excess of five surface areas; however, most of these are not available to the public. Twelve of the lakes are stocked with trout. Others offer walleye and northern pike, especially those lakes in the Pigeon River and Elkhart River drainages. Sunfish, yellow perch, and catfish abound in most of the lakes. Cisco is

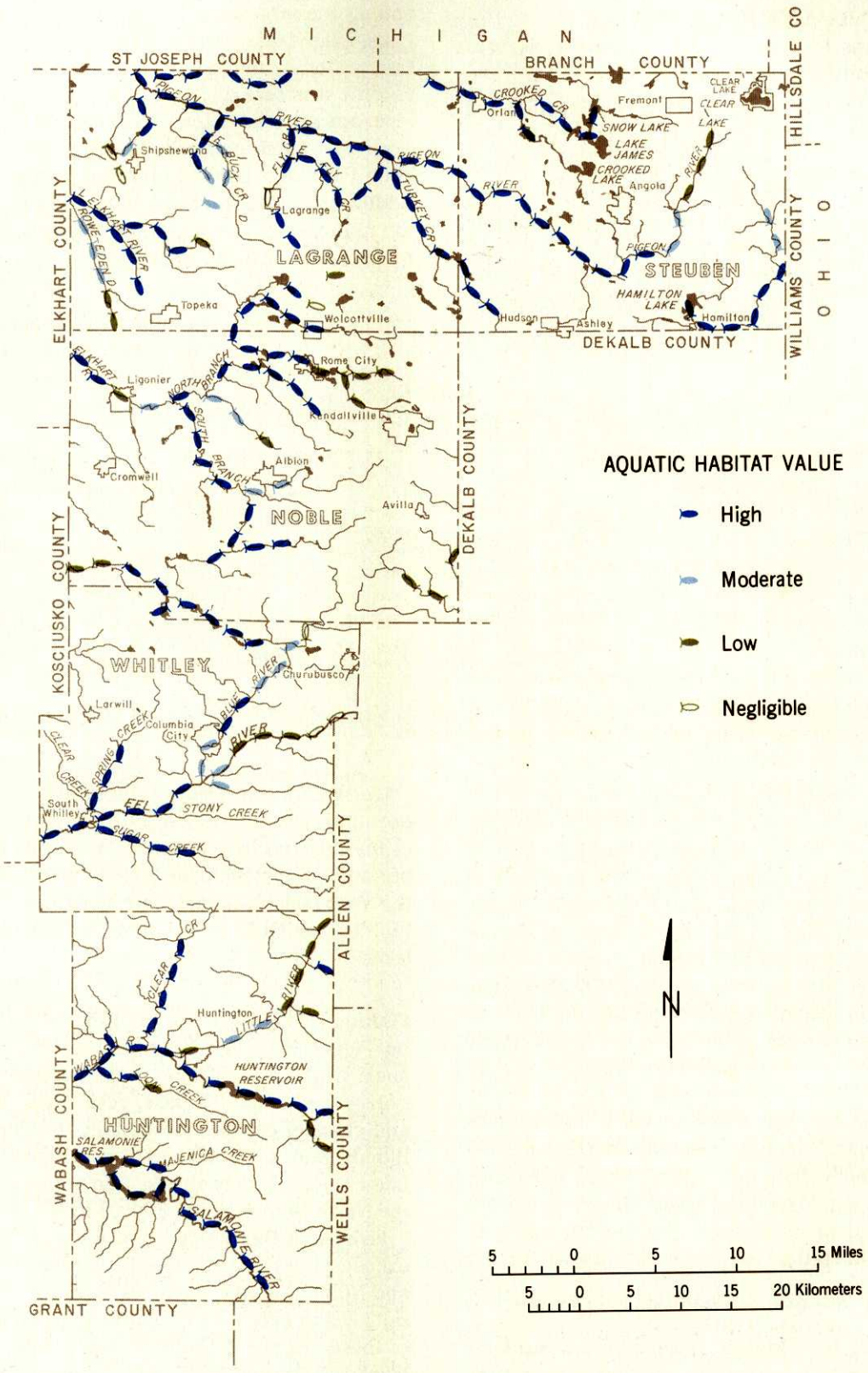

Figure 90
Map of Region Three-A showing the quality of the fisheries habitat.

found in a few lakes, most notably Crooked Lake in Noble and Whitley Counties.

Public access to Pigeon River is available at Scott and the Pigeon River Fish and Wildlife Area. Dukes Bridge, near Wawaka, and the Mallard Roost Wetland Conservation Area provide fishing access to the North Branch and the South Branch of the Elkhart River, respectively. Other state properties: Marsh Lake Wetland Conservation Area, Pokagon and Chain O'Lakes State Parks, and Huntington and Salamonie Lakes provide public lake fishing opportunities. Thirty-five public access sites are found on various lakes with shorelines in private ownership. City and county parks and road crossings may provide additional public access to lakes and streams.

Fishing opportunities currently satisfy the demand of the region's residents. However, the demand may exceed the supply by the year 1990.

Riparian Habitat The quality of the riparian habitat associated with lakes and streams is shown in Figure 91. Riparian habitat is mainly comprised of the extensive wetlands associated with the natural lakes and streams of the northern two-thirds of the region and the wooded streambanks in the southern third. The South Branch of the Elkhart River is particularly noted for its adjacent wetlands providing habitat for waterfowl, shorebirds, and most active wildlife species. Many lakes in the region are bordered, at least partially, by sizable marshes and swamps. Waterfowl, shorebirds, furbearers, and upland game are common.

State properties allowing public hunting include Pigeon River and Tri-County Fish and Wildlife Areas, Marsh Lake and Mallard Roost Wetland Conservation Areas, and areas adjacent to the Salamonie and Huntington Lakes.

Hydroelectric Power Rinkel Dam, located on the Fawn River in LaGrange County, is the only hydroelectric plant in the region. The Rinkel Dam plant has the capacity to generate 144 kilowatts of electricity. Region Three-A has neither adequate sites to provide the required difference of elevation nor the adequate sustained flow to support a large hydroelectric plant.

Withdrawal Uses

Public Water Supplies Huntington, LaGrange, Noble, Steuben, and Whitley Counties are served by twenty public water utilities. An estimated 51,200 residents of Region Three-A were served by a public water utility in 1975. Noble County contains six systems, Huntington County has five, while the remaining three counties each have three systems.

The Huntington public water utility, the largest in the region, withdrew an average of 2.2 mgd in 1975. Of the remaining communities, only Kendallville approached withdrawal rates of one mgd. Angola and Columbia City each withdrew approximately 0.6 mgd. The service areas for the public water utilities in Region Three-A are shown in Figure 92.

The twenty public water utilities withdrew an average of 6.8 mgd with a maximum withdrawal of approximately 11.5 mgd. Rural water systems do not occur due to the widespread availability of ground water.

Because of the widespread availability of ground water, all utilities except the Huntington utility have made ground water their sole source of supply. Huntington withdraws twenty-five percent of its supply from surface water. Well fields are located in or near the communities served.

Projections of public water supply withdrawals, as shown in the following table, indicate that withdrawals may increase from 6.8 mgd to 9.0 mgd by the year 2000.

Table 63

The 1977 and projected withdrawal and consumption rates for public water supplies by the year 2000, in million-gallons-per-day.

Public Water	*1977*	*1980*	*1990*	*2000*
Withdrawal	6.8	7.1	8.1	9.0
Consumption	0.7	0.7	0.8	0.9

Industrial Water Industrial establishments had an estimated water intake averaging 6.3 mgd in 1977. Of the total industrial intake, 2.8 mgd was self-supplied by the industries while 3.5 mgd was purchased from the region's public water utilities. Ground water is the major source of industrial, self-supplied water.

The largest water-using industry group is comprised of smaller industries, which utilize an estimated 1.5 mgd. Metal fabricating establishments are the second largest users, with a withdrawal rate of 1.1 mgd. Electrical industries in the region also use large quantities of water.

Industrial production by the year 2000 is expected to increase substantially (United States Water Resources Council). Industrial water requirements are likewise expected to increase to 7.6 mgd. The self-supplied withdrawals may then increase from the current rate of 2.8 mgd to 3.2 mgd by the year 2000. In spite of the predicted increase in industrial output, total industrial water intake is expected to fall initially due to increased plant efficiency and then rise slowly as output increases. Data for industrial self-supplied withdrawals is presented in Table 64.