

projected surpluses in canoeing, water skiing, and swimming needs. (It should be emphasized, however, that the data from which table 24 is derived were obtained from surveys taken in 1976 (IDNR, 1979). It is likely that new trends in recreational instream uses are being seen.)

As discussed in the "Rivers and Streams" section earlier in this report, fish habitat in the St. Joseph River basin is generally quite good, and quality sport fisheries are found throughout the basin. During a 1979 fisheries survey of Indiana's portion of the St. Joseph River, 46 fish species were collected. The St. Joseph River, as well as the Elkhart River, is particularly known for its smallmouth bass fishing. In addition, trout and salmon migrate annually up the St. Joseph River from Lake Michigan. When two planned fish ladders are completed, trout and salmon fishing will be brought to the river as far upstream as Mishawaka.

Put-and-take trout fisheries are maintained by IDNR on portions of the following streams: Fawn, Pigeon, Little Elkhart, and North Branch Elkhart Rivers; Solomon, Turkey, Cobus, Curtis, Clock, and Bloody Run Creeks; and Rowe-Eden Ditch. The following lakes are also stocked with trout: Clear, Gage, Lake-of-the-Woods, Martin, McClish, Olin, Oliver, Pretty, Rainbow Pit, Sand, South Twin, and Wyland.

High-quality riparian habitat is mainly comprised of the wetlands associated with natural lakes and streams. Currently existing marshes and wooded swamps are excellent habitat for waterfowl (such as mallards, blue-wing teal, and woodduck), various shorebirds, beaver, muskrat, raccoon, and upland game. Because urban development (particularly along portions of the Elkhart and St. Joseph rivers), residential development on the larger lakes, and agricultural development throughout the basin have significantly reduced suitable habitat for many desirable fish and wildlife species, the protection and conservation of wetland areas has been an ongoing concern of IDNR.

Areas protected under IDNR's Wetland Conservation Program and in association with state and federal laws were mentioned earlier in this report. Wetlands associated with stream segments that are included in IDNR's Natural and Scenic Rivers Program are also protected from detrimental development. Nearly 14 miles of the South Branch Elkhart River have been proposed for inclusion in the IDNR river system, but local opposition has prevented any further action. The proposed segment flows through Bender Woods Nature Preserve and the largest, contiguous wetland area remaining in the state, including Mallard Roost Wetlands Conservation Area. (No other streams in the basin have

been proposed for inclusion in this system: Indiana Natural and Scenic Rivers Report, Division of Outdoor Recreation, 1986.)

WATER USE PROJECTIONS

Public Supply

Table 25 shows the projected public water supply withdrawals for 1990 and 2000 in the St. Joseph basin. (App. 16 describes the methodology used.) The projected withdrawals were developed from both 1980 and 1985 data. Where the projections differ, both projections are shown.

The large difference between the two projections for Elkhart is due in part to two interceptor wells used by the City of Elkhart to reduce the amount of polluted ground water reaching water supply wells. The two wells accounted for 2.11 MGD in 1985. The City of Elkhart also had a very large increase in water use from 1980 to 1985, even after water withdrawn from the interceptor wells was neglected.

Irrigation

Soil associations with moderate to high irrigation potential are located primarily within outwash areas of the St. Joseph basin (fig. 28). A soil association has characteristic topography and repeating patterns of soils wherever it occurs. It normally consists of one or more major soils and at least one minor soil, and is named for the major soils. The soils in one association may occur in another, but in a different pattern.¹⁵ Descriptions of in-basin soil associations may be found in appendix 3.

Each soil association can be assigned to an irrigation potential category. These categories are based on the assumption that crop yields in sandier soils would significantly increase, whereas yields in deep loam, silt loam and finer textured soils would not increase suffi-

¹⁵ Soil associations on the general soil map in one soil survey may not fully agree with those on the general soil maps of adjacent counties. Differences are the result of improvements in the classification of soils, particularly the modification or refinement in soil series concepts. Another difference is caused by the range in slope that is permitted within associations in different surveys.

TABLE 25. Public Water Supply Projections^a

County	Estimated Use, 1980 ^b	Reported Use, 1985	Projected Withdrawals	
			1990	2000
Dekalb ^c	—	—	—	—
Elkhart	10.11	15.33	15.98 ^d 11.60	17.27 ^d 12.89
Kosciusko	0.48	0.49	0.54	0.58
LaGrange	0.46	0.59	0.63	0.83
Noble	2.01	2.42	2.62 ^d 2.42	3.00 ^d 2.79
St. Joseph	30.53	32.19	33.44	36.41
Steuben	1.03	1.33	1.46 ^d 1.30	1.66 ^d 1.50
Total	44.62	52.35	54.67 ^d 49.93	56.75 ^d 55.00

^aAll values in million gallons per day.

^bFrom Indiana Department of Natural Resources, 1982b.

^cData not available during report preparation.

^dProjections based upon reported 1985 use.

ciently to make irrigation profitable for grain crops at historic average corn price/cost ratios.

Soils in the St. Joseph River basin were grouped into four categories according to the favorability of crop response to irrigation. (Soil associations from Soil Conservation Service generalized county soil maps were used for the classification, as shown in fig. 28.) The results are shown in table 26.

Groups 1 and 2 are not considered further, because it is assumed that a profitable response less than half the time is economically unacceptable. Of the soils in Groups 3 and 4, only 86.5 percent (317,713 acres) are considered irrigable, since not all soils within a given association are irrigable. The percent of irrigable land (Groups 3 and 4) actually utilized will depend on the interaction of three major factors:

1) *Corn prices.* Corn is the major crop of the St. Joseph River Basin. If corn prices were to increase significantly due to an action such as increased exports, farmers may find it more economically feasible to install irrigation equipment. On the other hand, if corn prices were to fall dramatically, a shift in cropping pat-

terns could occur. Depending on the water demands of the crops which replace corn, irrigation could increase or decrease.

TABLE 26. Irrigation Potential by Soil Associations

Category	Area
1 - Little or no profitable response (none)	874.29 mi ² 559,546 acres
2 - Response 1-2 years in 5 years (slight)	251.10 mi ² 160,704 acres
3 - Response 3-4 years in 5 years (moderate)	384.66 mi ² 246,182 acres
4 - Response expected yearly (high)	188.96 mi ² 120,928 acres
Total	1699. mi ² 1,087,360 acres

TABLE 27. Irrigated Land by County (Acres)

Source		St. Joseph ¹	Elkhart	Kosciusko ¹	LaGrange	Noble ¹	Steuben
GWRS Survey	1977	3,000	9,000	2,800	11,500	2,000	1,000
Census of Agriculture	1978	5,853	11,313	2,640	12,581	1,895	1,739
Census of Agriculture	1982	7,128	15,875	7,150	17,898	2,265	1,760
Local Estimates (County Extension Agents)	1986 Near Future	little change within basin	20,000 continued growth but slower rate	10,000 15,000	20,000 continued growth but slower rate	little change	little change within basin

¹Figures shown are for the entire county. In-basin acreage is estimated from reported water use: St. Joseph - 1000 acres; Kosciusko - 6400 acres; and Noble - 2100 acres.

2) *Cost of energy.* If electricity prices fall, pumping costs to individuals would decrease, making irrigation a more viable option for farmers. Of course, increased energy costs would likely cause a decrease in the amount of irrigated land.

3) *Climatic anomalies.* Adequate moisture at the appropriate time during the growing season is essential to maximize crop production. An increasing incidence of drought in various parts of the state (as occurred in 1966, 1967, 1974, 1976, and 1983) can influence irrigation decisions. In the long term, development of a dry climate may cause increased irrigation if cropping patterns do not change. The amount of irrigated land may remain stable or decrease if corn were replaced by crops tolerant of dry conditions (for example some wheat varieties). A longer growing season could increase irrigation if farmers were able to raise two crops in one season. Naturally, a shift to a wetter climate would decrease irrigation.

Land use also plays an important role in irrigation expansion. How land is used affects water requirements, and water availability in turn affects how land is used. Although there is little quantitative data on St. Joseph River basin land use, the land use map (fig. 5), combined with information from topographic, soils, and water use maps can be helpful in detecting general patterns or trends. These maps are not suited for site specific planning, but are adequate for determining the interaction of some basin characteristics.

For example, the northwestern portion of the basin contains a large area of soils highly responsive to irrigation. A significant portion of this area, however, exists as urban land. So, it is a safe assumption that such land will not become irrigated agricultural land. Increased water demands here would come from residential and/or industrial expansion, not from irrigation. Agricultural lands adjacent to the urban areas are expected to experience development pressure and may convert to higher economic uses.

Other high irrigation response areas exist as forested land, which would be more likely to come into irrigated agricultural production than urban land. Increased irrigation demands would be most likely on moderate to high response soils already used for agriculture.

Recent trends may also give an indication of future irrigation growth. As table 27 shows, Elkhart and LaGrange Counties remain the largest irrigators within the basin in terms of acres irrigated. At the time of the last Census of Agriculture (1982), acreage of land irrigated in these two counties totalled 33,773 acres. Local estimates for 1986 totalled 40,000 irrigated acres for Elkhart and LaGrange Counties.

These two counties also have the highest potential for future irrigation in terms of favorable soil associations (fig. 28). Elkhart County has approximately 97,000 acres which are in groups 3 or 4, while LaGrange has approximately 88,800 acres. However, Elkhart is more highly urbanized along the outwash corridors than LaGrange, which may reduce the potential for continued irrigation expansion, as compared to LaGrange.

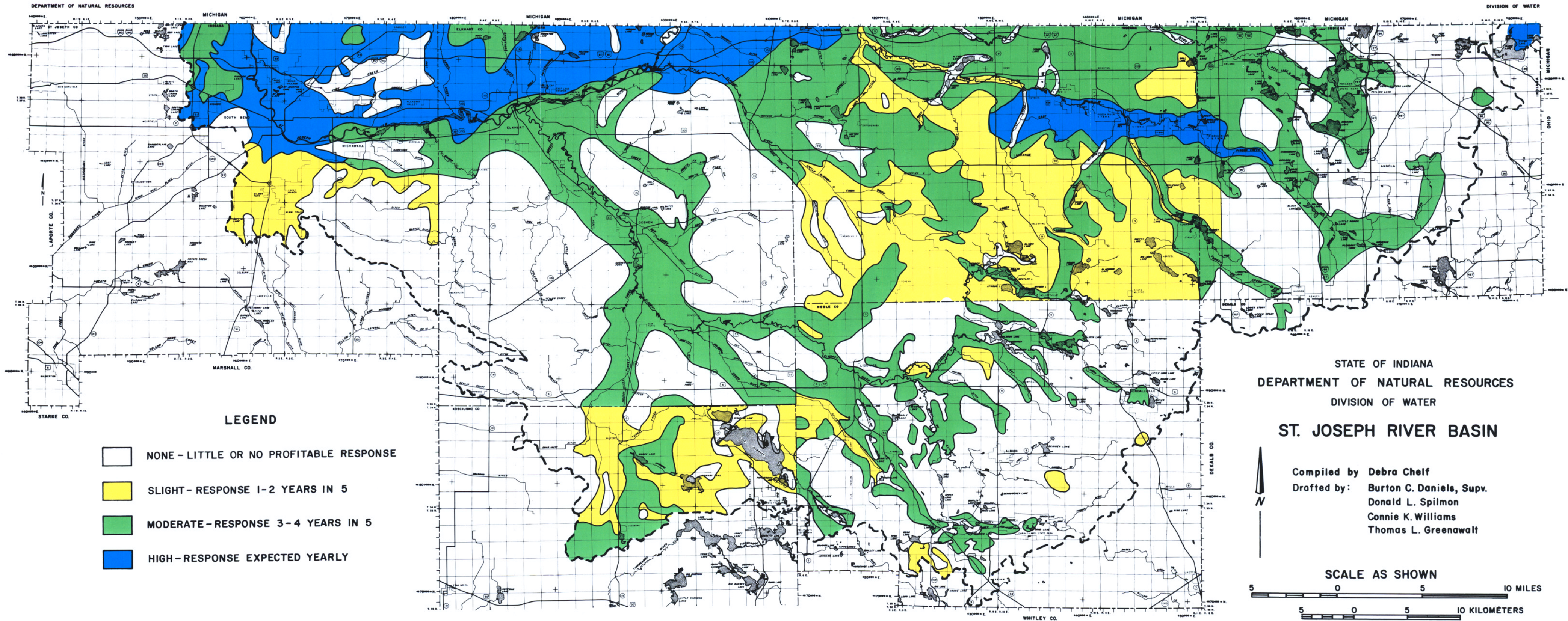


Figure 28. Irrigation potential

Two sets of water use projections were made for these counties based on the following two assumptions: (1) that the current rate of irrigation growth remains constant through the year 2000 (fig. 29) and (2) that the irrigated acreage doubles by the year 2000. Projections were also made for Kosciusko County because of the recent irrigation expansion. Both sets of projections are considered to be conservative. County extension agents anticipate lower rates of growth.

Irrigation expansion in the St. Joseph River basin within the foreseeable future (to year 2000) is primarily limited to Elkhart, LaGrange and Kosciusko Counties (table 28). If current growth rates were maintained, an increase in water use for irrigation of approximately 33 percent is projected for the basin.

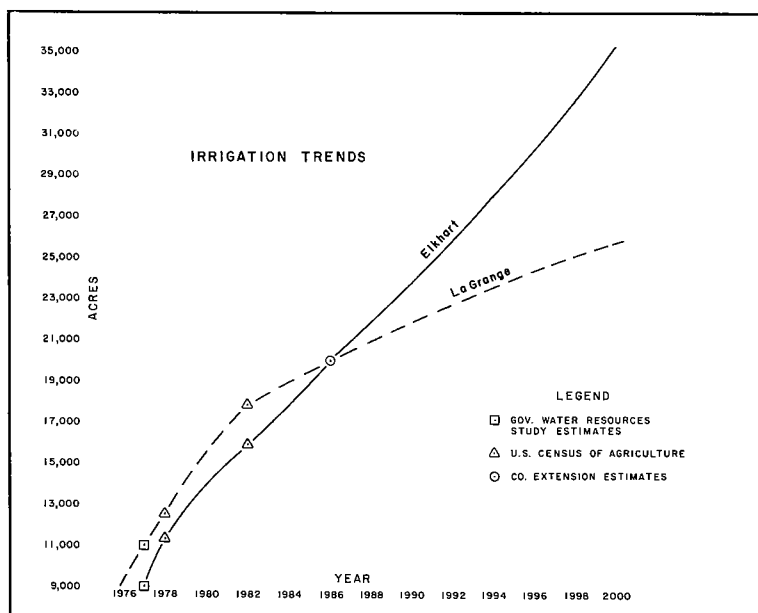


Figure 29.

TABLE 28. Irrigation Water Use Projections

	Elkhart	LaGrange	Kosciusko
Reported Water Use 1985*			
365 - day average MGD	9.78	7.07	2.00
90 - day average MGD	39.7	28.7	8.1
acres irrigated (approximate)	20,000	20,000	6,400
Predicted Water Use 1986**			
365 - day average MGD	13.4	13.4	4.3
90 - day average MGD	54.3	54.3	17.4
Projected Water Use 2000 (present growth trend)			
365 - day average MGD	23.4	17.4	6.4
90 - day average MGD	95.0	70.6	26.1
acres irrigated (approximate)	35,000	26,000	9,600
Projected Water Use 2000 (double present acreage)			
365 - day average MGD	26.8	26.8	8.7
90 - day average MGD	108.6	108.6	35.3
acres irrigated (approximate)	40,000	40,000	13,000

* The reported water use for 1985 includes only the registered significant withdrawal facilities which had reported by October 1986.

** Calculations are based on a requirement of 9 inches of irrigation water for an average precipitation year, per acre-inch.

TABLE 29. Industrial Self-Supplied Water Use Projections^a

County	1985 ^b	1990	2000
Dekalb	0.01	0.01	0.01
Elkhart	10.01	11.77	13.41
Kosciusko	0.73	0.75	0.73
LaGrange	0.04	0.04	0.03
Noble	0.68	0.70	0.73
St. Joseph	5.18	5.38	5.74
Steuben	0.24	0.29	0.32
Total	16.89	18.94	20.97

^aAll values in million gallons per day.

^bIncludes reported uses by registered facilities and estimated uses by non-registered facilities (obtained from a 1985 Division of Water questionnaire).

Industrial Self-Supplied

Most industries in the St. Joseph basin purchase water from utilities, but many, in addition to purchasing water, also supply their own. Most of the self-supplied water is ground water, but there are significant surface water withdrawals in St. Joseph and Elkhart, and Kosciusko Counties.

The largest water-using industries in the St. Joseph basin are: rubber and plastic; stone, clay and glass; chemicals and allied products; fabricated metals; and food and kindred products. (Included in the category "stone, clay and glass" was quarrying, which tech-

nically is mining and not manufacturing. Quarrying was included because there were significant water withdrawals from quarries in the St. Joseph basin.)

Industrial water withdrawal projections were developed using the methodology in the report by the Governor's Water Resource Study Commission (1980). Table 29 presents projected industrial self-supplied withdrawals for registered and nonregistered facilities. There is a projected increase of 12 percent in average daily use from 1985 to the year 1990 and a projected increase of 24 percent from 1985 to the year 2000.

TABLE 30. Proposed Hydropower Sites

Site Name	County	Stream	as listed-on Permit
Bainter Town	Elkhart	Elkhart River	200 KW
Benton	Elkhart	Elkhart River	300 KW
Elkhart	Elkhart	Elkhart River	500 KW
Goshen	Elkhart	Elkhart River	450 KW
Mishawaka	St. Joseph	St. Joseph River	1,900 KW
Mongo	LaGrange	Pigeon River	125 KW
Nevada Mills	Steuben	Crooked Creek	100 KW
Ontario #1	LaGrange	Pigeon River	100 KW
Ontario #2	LaGrange	Pigeon River	100 KW
St. Joseph	St. Joseph	St. Joseph River	2,720 KW

Energy Production

Favorable changes in federal and state policies concerning hydropower and recent cost increases for electric power generation may influence future energy production in the St. Joseph River basin. The State of Indiana has identified 20 sites which have the potential for either redevelopment of former hydropower plants or installation of hydropower generating equipment at low-head dams. Only 10 of the 20 sites, however, have

been considered under the Federal Energy Regulatory Commission permit system (table 30). The 10 plants have a total capacity of 6495 kilowatts. It is difficult to predict, at this time, if and when any of the plants will become a reality or if any will be categorized as a withdrawal facility.

Expansion of the gasahol plant just outside the basin boundary will largely be determined by alternative energy prices.