

PRESIDENTIAL ADDRESS

HISTORY OF A RIVER

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The Saint Joseph River in northern Indiana and southern Michigan has played a major role in the development of the communities within the watershed. The native American in his birch bark canoe was the pioneer in river transportation. It is no coincidence that South Bend is located on the southern bend of the main river. Today almost every drop which is removed from the river system, used, and then returned to the watershed is scrutinized by governmental agencies and the watchful eyes of residents.

The native Americans and explorers accepted the waterway for all the assets the natural conditions had to offer. Only the beaver (*Castor canadensis*), a skilled engineer, injected measures of control. However, the beaver was subjected to numerous ecological restraints. Thus, the impact of beaver activity not only developed gradually but never attained any great magnitude.

The attitude of pioneers and early settlers toward the water resources was the same as for the minerals, soils, plants and animals: i.e., complete freedom of the individual to use the seemingly inexhaustible supply of natural resources for whatever benefited him at the moment. His actions are documented very well by scars and artifacts, some of which have remained for over a century.

However, as the density of the population increased and technology developed, the demands on the Saint Joseph River became highly varied and reached levels of great magnitude. The demands on the river approached and exceeded the natural ecological carrying capacity without man even understanding the full impact of the carrying capacity concept. In an attempt to meet the growing, specific needs of man, changes and controls of our waterways became necessities. This, together with little or no foresight as to the long range effects, made disasters of various degrees imperative.

The Saint Joseph River watershed was formed by the action of glaciers. In glacial times the waterway functioned as a much larger system. A tremendous flow of water drained the present Saint Joseph River area directly into the Kankakee system and on to the Mississippi River. The swamps and low lands of the upper Kankakee and the greatly reduced Saint Joseph River watershed are vestiges of a much larger system. In post-glacial time the systems were separated by only a slight rise in land which became a well-known portage. The extensive use of the portage from the Saint Joseph River to the Kankakee by many native American tribes has been documented by early explorers, namely, the poet-priest Father James Marquette (1669) and Rene Robert Cavalier de La Salle (1679) and by well worn trails and other artifacts which are clearly evident today.

The main river was first called The River of the Miamis in reference to one of the three native tribes (Miami, Potawatomes, Ottawas). Later the name was changed to Saint Joseph's River of the Lakes, then to Saint Joseph's and finally Saint Joseph.

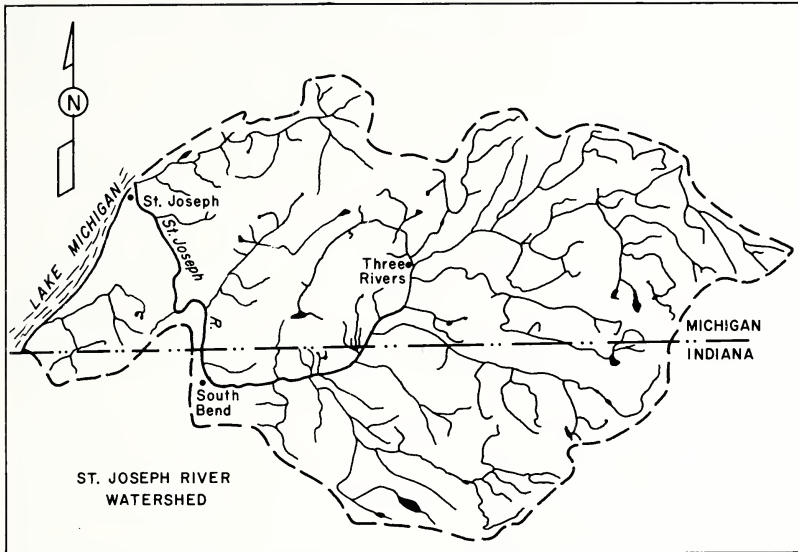


FIGURE 1. SAINT JOSEPH RIVER WATERSHED

The Saint Joseph River watershed, (Fig.1) now referred to as the Michiana watershed, drains only 11,137 kl^2 (4300 M^2). The 338 kilometers (210 miles) of main stream begins in Michigan, enters Indiana, and returns to Michigan where it empties into Lake Michigan. About 20 percent of the main stream and 27 percent of the watershed are in Indiana. Seven hundred miles of significant tributaries to the main stream and over 1000 lakes, 400 of which range in size from 9 to 15.5 kl^2 (3.5 to 6 M^2), complete the water network of the Michiana watershed. The pronounced fall of 183 meters (600 feet) from the source to the mouth has been an attractive feature for users of the river.

Now let us examine the history of some of the activities of man as they are related to the great natural resource, the Michiana watershed. The water supply has been a very attractive force in the growth and development of communities within the entire area. The uses as well as the misuses of the river as a natural resource have been highly varied and they form historical milestones in the development of the total area. The impact of these activities on the water resource warrants careful study. History has been properly termed—a vast warning system. Certainly in the case of the Saint Joseph River many warnings have been very clear but the response of man has been apathetic, or at best short sighted.

A rather complete report of the early navigation on the Saint Joseph River was published by Knoblock (8). The populations of native Americans traveled

on the rivers extensively while hunting and fishing. Also, they shifted by water from one area to another in response to pressures among the tribes and to seasonal changes. Fur trading developed and from 1700 until about 1831 furs carried in canoes were the predominant freight on the river. However, communities of immigrants grew and in order to meet the rapidly developing demand for the transportation of other freight, keel boats, which at first were actually only large canoes, were constructed. The first keel boat on the Saint Joseph River was built in 1831 and by 1833 a fleet of a dozen keel boats, some actually much too large for the capacity of the river, operated from the Lake Michigan to South Bend and points upstream. As agriculture developed and the towns along the river continued to grow, mills were constructed. Beginning about 1830 until 1900, all of the larger towns along the river had one or more flour, grist, and saw mills (7). The milling industry used the river for water power and to transport their products. At first direct power was used by way of races and channels. Then dams were built for better water control to produce power efficiently. In addition, the cutting of timber and converting a major portion of the area into agriculture had a significant impact on the watershed. The volume of water in the surface drainage was reduced and the rate of flow throughout the year fluctuated to a greater degree. These changes made navigation less and less feasible. However, steamboats came into use in 1833 on the river which helped overcome to some degree the reduced water capacity problem as well as the many natural and man-made physical obstacles which were discouraging navigation. Twenty-four steamboats operated from the mouth of the Saint Joseph River at Saint Joseph, Michigan (first called Newburyport) to South Bend and beyond during the period from 1832 to 1925. The primary function of the steamboats was to carry freight, but pleasure boating played a secondary role. In attempts to develop the Saint Joseph River as a navigable river, efforts were made to obtain major help from the government, but federal money was refused three times between 1832 and 1847. A futile attempt was made to join the Kankakee and the Saint Joseph River for navigation.

Planning to link the Saint Joseph River with other drainage systems did not disappear quickly nor completely. In 1879, government engineers made a survey of the river from Elkhart, Indiana, to the mouth. The report was adverse to making the river navigable. Even in the 20th century surveys and plans continued. However, efforts to retain and to develop the Saint Joseph River as a navigable river have been unsuccessful, chiefly due to the simple fact there is not enough water. However, railroads were developing rapidly during the upsurge of demands on the Saint Joseph River for the transport of freight. Thus, the river was spared the demand to carry freight.

As the watershed area was converted to agriculture, the destruction of fertile land by erosion received considerable attention. The deterioration of the river system by the deposits of sediments from the land was ignored for many years. The scientific literature included some excellent observations; i.e., the report in the Proceedings of the Indiana Academy by Dryer and Davis (4) in 1910 described the erosion factor related to a small stream over a period of 13 years. The eroded materials from poorly managed farms, and materials from disturbed banks, roadways, housing developments and even the construction of

modern shopping centers have had a continuously serious impact on the waterways, in particular on the small streams. These impacts have elicited far too little response to protect the water. However, when massive amounts of fertilizer were added annually to soils and extensive use of pesticides became commonplace, some of the top predator fishes in small streams were killed. Then and only then was the need to protect the waterways seriously noted. Likewise, when in recent time the total coliform counts and in some cases the fecal coliform counts reached high levels in small streams, there has been positive responses to protect the water resources.

In the last few decades, agriculture and other land use programs have included facets which indicate a clear cut awareness of the erosion problem as related to the water resources. However, to adequately protect the river and many of the smaller streams, strips of undisturbed areas along banks are needed, not only to protect against erosion, but also to provide cover and a movement path for wildlife. These filter strips or green belts as they are sometimes called, are excellent in principle to protect aquatic ecosystems. Nevertheless, most of the streams in the Michiana watershed have been striped naked or have been given what I call back door attention.

In spite of the many assets of water as a natural resource, we have turned our backs to rivers in the past. The waterways have become dumping grounds for solid wastes, highly varied in kind and of tremendous magnitude in volume. The Saint Joseph River has had its fair share of dumps. A canoe trip on the Saint Joseph River, in particular along the smaller tributaries, reveals many hidden records of serious damage to the waterway. Some dumps are very old, that is, almost obliterated by natural succession; while others are brand new wounds in nature. The idea that the best way to get rid of something is to throw it away in some body of water is deeply implanted in the minds of Americans.

Nevertheless, during the last few decades there has been a decided change in the attitude of the public toward our lakes and rivers. A plea to make the Saint Joseph River your front yard has been heard. A prime example is Indiana University of South Bend (built in 1961) which was constructed to face the river, with only a double-lane road as a distractive feature. A significant assumption is that youth will not allow a polluted river. Also in South Bend, Century Center, 1977, is a serious attempt to obtain the maximum use of a river front. A strange coincidence has been noted, that is, over a century ago rocks and boulders were removed from the river bed to improve navigation. Navigation improved for a while, waned and almost completely disappeared. In 1976, rocks and boulders were returned to the same river bed to create white water rapids for aesthetic reasons. Also, there might be a return of blackflies and other small dipterans.

The call to make the river your front yard has been heard by suburban developers. Extensive rows of homes now occupy the banks of the Saint Joseph River. The impact on the river has been greater and in many ways less desirable than the construction of public buildings. As houses began to line the banks, cement walls, sometimes for miles, were erected, lowlands were filled, and drainage inlets were tampered with. All of these changes in order to use the river for recreation made new demands on the river. The river front accommodates

boat houses, high speed motors and water skiing equipment. Unfortunately, seldom do you find a significant resemblance between the natural habitat of the river bank and the front yard of homes.

A long story could be told on the use of the river front property by industry. At first mills used the water for direct power which gave way to larger plants using dams for hydroelectric power. Then, the picture changed to almost exclusively fossil fuels plants on the river. Consequently, large and small industries moved away from the waterway because electricity could be transported and fossil fuels were not carried on the river. Railroads had taken over the burden of coal transportation. Nevertheless, many industries stayed close to the river for two reasons, a place to deposit waste products and the thermal aspect. As industry grew, the disposal of wastes and large quantities of heat became major problems. Until very recently, as a field, aquatic ecologist I found it most difficult if not impossible to approach the Saint Joseph River at industrial sites. Barricades of all descriptions had been erected and the attitude of management was hostile to say the least. In the minds of management not only the land but the river was owned by industry.

The disposal of solid and liquid industrial wastes into the Saint Joseph River began with mills in the first quarter of the nineteenth century. During the river milling period, numerous newspaper articles, urged by conservation minded organizations, noted changes in the river. Pollution and obstructions by dams were given as the major reasons for changes in the fish populations. One article in the early nineteenth century stated that, "about the only life in some sections is that of the turtle." The mills on the river vanished before any abatement was seriously considered. However, as industries developed and the wastes became highly varied, the ecological carrying capacity of the river was exceeded in many locations. The pathway toward abatement and improvement has been most difficult. First the waste problems had to be exposed, then analyses of damage and finally pressure for abatement.

In 1977 these point sources of solid and liquid pollution have been identified, the analyses of damage is in progress, and fortunately considerable abatement has been accomplished. The major question is, at what level should pollution be permitted. Likewise the same question is being asked in regard to thermal pollution. Many fossil fuel plants are located on the Saint Joseph River. The conversion of massive amounts of one type of energy to another follows the well-known laws of thermodynamics. Thermal pollution at a significant level has occurred in the Saint Joseph River. The question today is, to what extent do we wish to have changes in temperature, caused by industry, control the biotic status of the water resource?

The impact of domestic sewage on the Saint Joseph River has followed the same general pattern as on most midwestern waterways. Abatement to various degrees came long after the ecological carrying capacity of most segments of the river system had been seriously exceeded. This was due largely to the rapid population growth coupled with a reluctance to construct disposal plants. Scientific publications, and, frequently newspaper articles, stressed the deterioration of the river. Dolley (3), a student of the well-known parasitologist

Henry B. Ward, made an extensive study of the biology of the Saint Joseph River in 1933. He emphasized the grossly polluted conditions in urbanized sections of the river. Nevertheless, the first disposal plants in those same areas were not built until over twenty years later.

Even with modern technology in sewage waste disposal the Saint Joseph River is used as a "back up" system. In the event of heavy rainfall, overflow valves open up to permit sewage along with the run off water to empty directly into the river. In several cities, South Bend included, the number of overflow outlets has increased in the last decade. Also, if there is a mechanical or electrical failure in pump systems which are conveniently associated with the Saint Joseph River, the sewage flow doesn't stop, it simply dumps everything into the river. In general the impact of industrial and domestic wastes on the Saint Joseph River has been reduced to a considerable degree, however, this only covers the point sources of pollutants. The control of nonpoint sources is more difficult to locate and analyze. Control measures are just beginning.

The recreational uses of the Saint Joseph River began with swimming, canoeing, small hand-powered boats. Swimming lessened largely in reaction to pollution both domestic and industrial. Canoeing has had an upsurge in recent decades both as an individual sport and as annual organized events. A paddler's guide to one section of the river includes historical landmarks for the traveler. Large, slow moving boats are now common on the reservoir areas behind dams where homes line the banks. Pleasure boats began when river freight flourished in the early 19th century. The dams and great fluctuations in water levels have discouraged pleasure passenger boating over extensive sections. However, during the last few decades pleasure boats have regular schedules on several short sections of the Saint Joseph River where the water level is maintained by dams. Sportmen have encouraged speed boating and water skiing on the Saint Joseph River. These activities have been largely incompatible with the more passive recreational activities such as fishing, canoeing, and small craft boating. Also, there has been a complete disregard for biotic aspects, i.e., spawning beds of fishes. Zoning of the river for the various recreational activities has been considered possible but extremely difficult to enforce.

In the mid-twentieth century, youth camps and trailer camp grounds have become common along the smaller tributaries of the Saint Joseph River. Most of the impact of the recreational activities by these groups on the tributaries has not been extremely harmful. However, two species of clams have disappeared from one tributary due to eager collectors from a large trailer camp. I hope they produced many science fair winners in the Chicago school system. The impact has in some areas exceeded the carrying capacity of small natural streams.

Early settlers spoke of the biotic assets of the river in terms of plenty of life in the water and an abundance of birds and animals associated with the river. Research on the biotic aspects of the Saint Joseph River has been rather sparse and frequently limited to small areas on a single taxon. However, the fact that numerous changes have taken place has been sufficiently documented. As the human population of the watershed increased, mills, dams and roads were constructed, and wastes were deposited into the waterway. Thus, the impression of

plenty of clean natural water changed. Concerned citizens wrote in terms of deterioration and pollution of aquatic habitats.

The record of fishes in the Saint Joseph River watershed indicates many changes in species and number. However, much is really unknown due to a lack of comprehensive basic research. The story of changes in the population of mussels in the watershed is quite clear and it suggests similar patterns for many other taxa. In particular, the large bivalve (Unionidae) populations have declined in number of species and the size of populations. In addition to the basic research on mussels, the practical uses of mussels have been recorded; consequently, population data can be safely extrapolated. Van der Schalie (10) stated that mussels were once plentiful and all are potentially edible. This is clearly shown by the large piles of shells left as kitchen middens at camp sited by many native Americans and manuals on survival include mussels (10).

The Saint Joseph River watershed supplied a share of the large tonnage of commercially valuable mussel shells used for buttons and novelties. The button industry, which was established in the last decade of the nineteenth century and flourished for about 50 years (9), used many species which were common in the Saint Joseph River watershed. Only one of the three formerly most useful species is found in any significant number in the watershed today. Dineen (1,2), Goodrich & Van der Schalie (5), clearly established and the fact that at least twenty-one species formerly inhabited the portion of the Saint Joseph River watershed in Indiana. These studies and subsequent work produced only eleven living species and only two of the eleven species were common. The valves (shells) of ten other species were found, many of which were rare and greatly deteriorated. Why has the number of species of bivalves been reduced to almost fifty percent? First, all freshwater mussels are parasitic on fish in one stage of the life cycle. Thus, the construction of dams set restrictions on the distribution of mussels even though feeble attempts have been made to construct fish ladders. Secondly, the button industry reduced the populations in some sections. Sediments carried to the river by water erosion, from the time the first trees were cleared until today when almost the complete watershed area is managed, had some impact on the mussel populations. Also, domestic and industrial wastes, in spite of abatement measures, have influenced the molluscan populations. The total flow of water in the Saint Joseph River was greater and fluctuated less when the watershed was timber and wilderness as compared to present urban and agricultural watershed. In August 1959, when the annual precipitation was low and the dams controlled the flow to regulate the output of electricity, mussel beds were exposed to desiccation and to predation by raccoons and birds. Likewise, new wide bridges, roads, retaining walls and extensive land fill of floodplains and wetlands adjacent to the watershed have greatly reduced the area of suitable habitat for mussels. Small tributaries have been diverted into ponds and the vegetation along the banks removed. Consequently, the temperature of the water has increased beyond the tolerance of some mussels. No doubt habitat destruction has been the single most limiting factor.

The strictly aesthetic aspects of the Saint Joseph River have been emphasized by poets and naturalists. The native Americans loved the Saint Joseph River. However, practical forces have always taken top priority. Efforts

to retain or to improve the aesthetics, in terms of natural conditions, have been sporadic and limited to small segments.

In conclusion, a review of the history of the river as a natural resource and an analysis of the present conditions indicate that the status of the complete Michiana watershed, with the Saint Joseph River as the main artery, is rather critical and tenuous.

Water and air are actually the last two facets of the environment which, to a significant degree, are treated as commons. The principle of commons has been expressed explicitly by Hardin (6) in his "Tragedy of the Commons." The Saint Joseph River as a natural resource has had many uses over a period of a couple of centuries.

Consequently, when all of the numerous demands for the water supply of the Michiana watershed and the impact of erosion are considered, it becomes obvious that water must be managed as a cyclic commodity. The amount of water is finite, it is not inexhaustible. The natural ecological carrying capacity can be exceeded in many ways. There are no substitutes for many of the uses of water. Clean-up activities are frequent in the drainage area, but that only indicates that prevention must be given a higher priority. Today individuals and organizations form a strong collective force favoring total management of the water supply. Master plans must supersede segmented actions which have had long histories of use and misuse of the water resources. Master plans have been emerging but progress is extremely slow. The Michiana watershed includes two states, fifteen counties, and numerous townships, cities and towns. Yet this is a small watershed. Nevertheless, mutual understanding and cooperation must become the driving force supporting any significant plan for water management. A complete basic inventory of the water resources, formulating a plan, executing the plan and finally monitoring and adjusting the operation of the plan are all essential aspects of the total program. The first two steps of a total program are receiving much attention at the present time.

My major concern after reviewing the history of the Saint Joseph River and observing some areas for over twenty-five years is the obvious ever-increasing trend to change a beautiful river from a free flowing natural system toward a tightly controlled series of channels and ditches. There must be some middle ground area which would be most rewarding to man in the long range. To achieve this middle ground position the greatest need is to build a stronger foundation for whatever super structure which might be built and called a water management program. The building blocks for a firm foundation are the results of basic research. To The Academy, I make a strong plea for greater awareness of the serious need for basic research—the most significant justification for having The Academy.

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