Water Quality

As discussed previously, the purpose of the Governor's Water Resources Study Commission is to evaluate the effectiveness of current water resource management and existing legal authorities in light of current and projected demands on the water resource.

Therefore the subject of water quality is only addressed as it relates generally to the broad area of water resource management. The Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-217) establishes the standards for water quality in Indiana. The Indiana Stream Pollution Control Board is responsible for water quality management and has established a program to work with the federal and local governments to implement water quality standards. Detailed information on the quality of the water of the state is available through the Stream Pollution Control Board and, due to the highly technical and voluminous nature of this material, it is not duplicated in this report.

However, the Commission did evaluate the general relationship between water quality and the utilization of the water resource. In particular, the Commission addressed the issue of the potential impact that water quality management may have on the quantity of water available for instream and withdrawal uses. The following discussion of water quality presents the information upon which the relationship between water quality and water quantity is based.

GROUND WATER

The natural chemical quality of ground water is the direct result of the mineral composition of the formations through which it has passed. During the slow process of the movement of water from the surface downward through the earth and into the aquifer systems, it dissolves and takes into solution various chemical elements including chlorides, fluorides, iron manganese and sulfate, and a number of other dissolved constituents. Therefore, the term *pure water* has little meaning since all natural waters contain varying amounts of chemical constituents.

The presence of dissolved elements may or may not be a problem depending upon the concentration, the intended use for the water, and consumer habits and preference. For example, "sulfur water" is perceived as a problem by most, while some pay a good price for bottled sulfur water to drink. However, iron is generally considered an undesirable element since it will usually cause staining and discoloration to laundry when present in amounts greater than 0.3 parts-per-million (ppm). *Water hardness*, a term used to describe the amount of carbonates, articularly calcium carbonate and other constituents, is important to water as they make it more palatable to the taste. Fluoride, when present in quantities greater than 1.0 ppm, may decrease tooth decay or may cause discoloration of the teeth in excessive amounts. Therefore, the presence of the various elements may either be desirable or undesirable depending upon the amount present and the intended use of the water.

Ground-water quality throughout the state is quite variable depending upon the aquifer system being sampled, geologic setting, and depth of the formation. For example, the hardness content of ground water may range from less than 100 ppm to over 600 ppm. In general, the chemical quality of ground water in the state is good, meeting most of the basic requirements for household, municipal, industrial, and irrigation uses. However, the waters are normally hard, exceeding 180 ppm, and some form of iron or manganese treatment will be required in many situations.

Several key chemical constituents are of particular importance in assessing ground water for general household, municipal, and industrial uses. These usually include hardness, turbidity, iron, manganese, chloride, nitrate, sulfate, fluoride, and hydrogen-sulfide content. Table 23 presents selected chemical constituents, their significance, recommended maximum concentration, and the range of the normal values within the state.

Figure 44 shows selected, representative, regional water analyses for a number of the municipal water supplies. The analyses shown are predominantly for municipalities with ground-water sources; however, analyses for various stream sources, water supply reservoirs, and lakes scattered throughout the state also are displayed.

Table 23
Significance of selected chemical constituents in water.

Constituent	*Significance*	*Recommended Maximum Concentration*	*Normal Range of Values in Indiana*
Hardness ($CaCO_3$)	Hardness in water is due to the presence of calcium and magnesium compounds, such a bicarbonates, sulfates, and chlorides. Hardness is expressed as the calcium carbonate ($CaCO_3$) equivalent of the calcium and magnesium ions and a few other, but minor, ions. Hardness is a nuisance property, not a toxic or lethal factor. Water exceeding 120–180 ppm is considered "hard" and above 180 ppm it is considered "very hard". Most of Indiana's ground water exceeds 180 ppm, with typical ranges between 200–400 ppm. The major consequences of hard water in home usage are the formation of scum and curds, and reduced cleansing power of soaps and detergents. High hardness levels result in the formation of lime and scale deposits in water heaters, boilers, pipes, and utensils. Loss of efficiency, increases in fuel and repair costs, and high costs of soaps and detergents are associated expenses. In food processing hard water tends to toughen beans and peas and discolor beets and corn. Many industrial processes, including the manufacture of paper, textiles, chemicals, food, and beverages may be detrimentally affected by hard water, and treatment may be required.	none assigned	200–400
Iron (Fe)	Iron contained in ground water under natural conditions is found in the soluble ferrous state; however, when exposed to air it quickly oxidizes and converts to insoluble ferric oxide forming a brownish-yellow precipitate. The presence of "red water" is a common indicator of iron in water, with the resulting development of sediment and staining of clothing and plumbing fixtures. Iron adversely affects the quality of coffee, other beverages, and food, and imparts a taste to water. Iron is undesirable in many industrial processes and removal is often required. As little as 0.3 ppm of iron begins to create problems and at levels above 2.0 ppm control or removal is imperative. Iron in amounts above 0.5 ppm is common to most ground-water supplies in the state.	0.3	0–3.0
Manganese (Mn)	Even small quantities, 0.03 ppm, in combination with iron generally begin to be objectionable or detrimental for household and industrial use. Manganese oxidizes and precipitates much slower than iron and forms a dark brown or black precipitate that forms a filter-clogging sludge or slime. Manganese imparts an objectionable taste and is a potent stainer of materials, but is of little toxicological significance in drinking waters. Concentrations as small as 0.1 ppm are undesirable for some processing uses, and at 0.5 ppm the list of critical limitations is sizeable. Lakes and impoundments with limited flow-through or turn over capacity, and have little or no movement to create circulation, may form density layers (stratification) in which high concentrations of manganese are present in the deeper, more motionless waters. The complex chemical reactions relating to this condition are greatly facilitated by acidic waters draining from the debris of extensive hardwood areas. Concentrations of dissolved manganese as high as 7.0 ppm are known, and reports of 9 ppm to 17 ppm have been made for impoundments in the southern part of the state.	0.05	0.01–1.0

Table 23 (continued)

Constituent	*Significance*	*Recommended Maximum Concentration*	*Normal range of Values in Indiana*
Chloride (Cl)	Corrosive action and taste factors are the chief detrimental effects of chlorides in water. Concentrations are usually much lower than the 250 ppm "recommended" level, but small increases in chloride content cause drastic increases in both taste and corrosiveness. A "salty taste" is usually not noticed up to a concentration of 500 ppm (+ or − 200 ppm); however, adverse tastes can be imparted to tea, coffee, lemonade, and some cooked items at concentrations as low as 50 ppm. Varying amounts of chlorides are found in all of Indiana's ground waters. Deposits of sand and gravel usually contain low concentrations, while the chloride levels in bedrock formations vary considerably with concentrations almost always increasing with depth. Excessive concentrations of chlorides are known to occur as shallow as 100 feet below the surface in at least one area in Indiana, although normally wells will be much deeper before salty water is encountered.	250	10–50
Sulfate (SO_4)	High levels of sulfates form slimes, encrustation, and odorous waters. Commercial and industrial usage in metal, textile, food, and beverage processing may be adversely affected by concentrations as low as 100 ppm. The strength or concentration of sulfate in the state's ground waters varies greatly in response to such factors as depth, rock type, and geographic location. Concentrations ranging from 10 to 1,200 ppm are encountered in water supplies being used in Indiana. Sulfate in drinking water is more of a nuisance than a serious danger. Persons unaccustomed to using water high in sulfate, especially when the concentration is above 250 ppm, often have a cathartic reaction, which can be further aggravated by associated high sodium and/or magnesium levels.	250	0–1,000
Fluoride (Fl)	Fluorides occur naturally in most of Indiana's ground waters, although at levels below the accepted beneficial range. Fluoride concentrations from about 0.9 ppm to 1.7 ppm are considered to be beneficial to the structure and development of decay prevention in tooth enamel, especially in children. However, above 1.7 ppm fluoride may cause mottled teeth, and in excess of 6.0 ppm can cause serious mottling of teeth and adverse skeletal effects. Quantities in excess of the range of safety or desirability are not known in either shallow aquifers or in the deeper (nonpotable) aquifers in the state.	6.0	0.1–1.5
Nitrate (NO_3)	Nitrates impart a bitter taste to drinking water, and concentrations from 20–50 ppm are either noticeable or objectionable. Little is known about the long-range effects of consumption of water containing moderate nitrate concentrations. A nitrate content of even 5 ppm in the formula of infants under one year old can cause a blood-oxygen deficiency known as methemoglobinemia. Natural ground waters in Indiana generally contain much less than 5 ppm. Nitrate levels above 25 ppm, especially when prior analyses show lower concentrations, often indicate some form of contamination. Organic wastes, inorganic compounds, and chemical ferilizers are sources of nitrates associated with the activities of man.	45	0.1–3.0
Hydrogen Sulfide (H_2S)	Ground water containing hydrogen sulfide (H_2S), or the "rotten egg smell," quickly makes its presence known. Even very small quantities, as low as 0.1 ppm, are easily identifiable and highly objectionable. Hydrogen sulfide is generated by chemical reaction, and biological or bacteriological actions, on various sulfur compounds incorporated in the rocks through which the ground water has passed. H_2S or "sulfur water" is sometimes confused with water containing a high amount of iron, particularly in those incidences when complex reactions occur with the magnesium electrodes in electric hot water heaters. This is a definite nuisance although not a danger.	na	na
pH	The pH of water is a measure of the degree of acidity or alkalinity and is expressed in values ranging from 0 to 14. At a pH of 7 water is considered neutral; below 7 indicates acidity; above 7 it is alkaline. Most of Indiana's ground waters are neutral or so close to it as to pose no significance for most uses. Corrosive acid waters, with pH levels ranging from 3–6, are associated with the coal section (Pennsylvanian) formations in some areas. Also of interest is the fact that high "soda" or alkaline waters (pH ranges from 8–10) are found in other rock units within the Pennsylvanian formations.	none given	6.5–8.0

na: not available

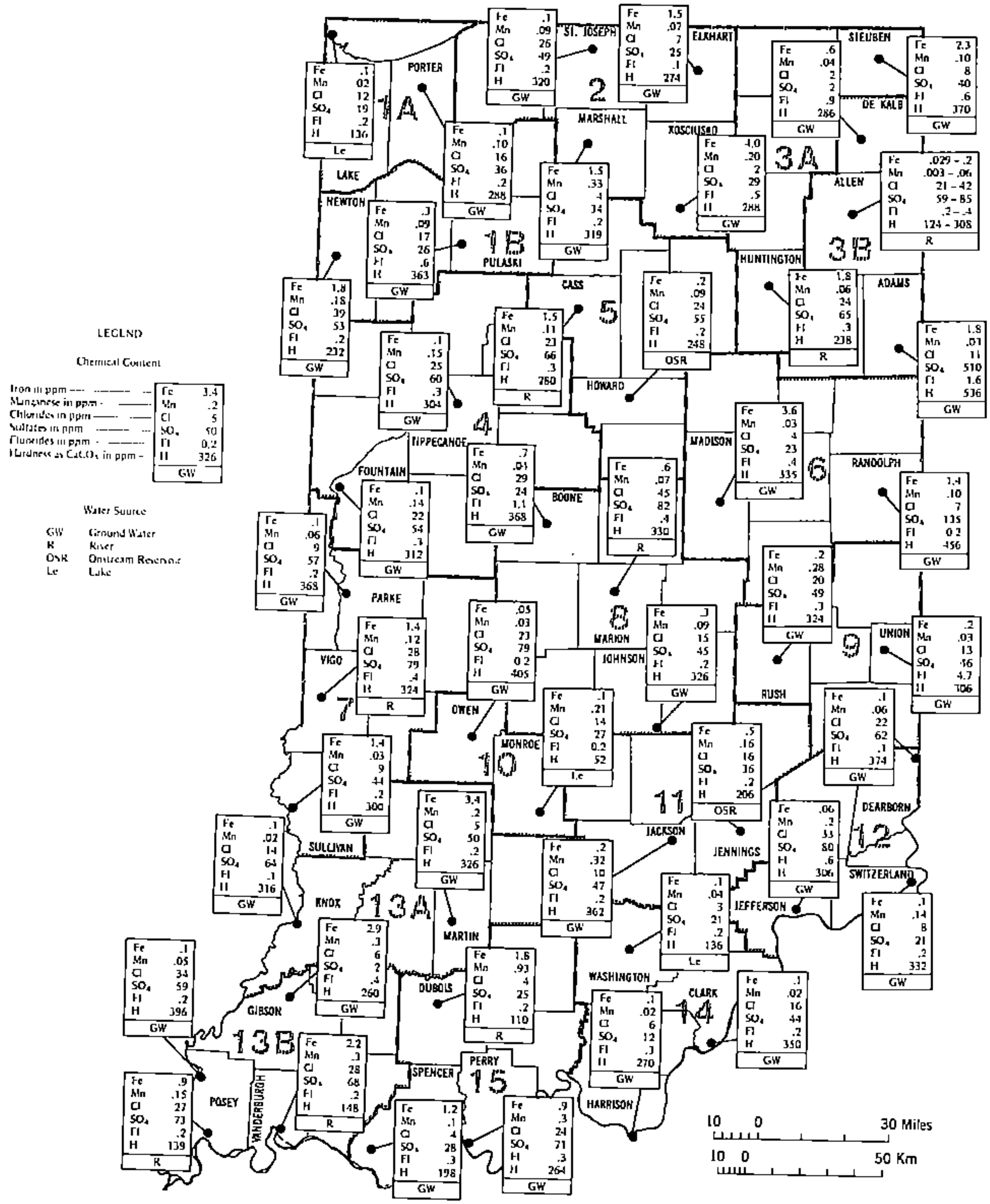


Figure 44
Map of Indiana showing the water quality for a number of municipal water supplies, and the sources of the supplies.

In general, the chemical content of ground water in Indiana is considered satisfactory for most household, municipal, commercial, and irrigation purposes, without significant treatment. Although the water from most aquifer systems is hard, exceeding the 180 parts-per-million classification for very hard waters, few municipal water supplies soften the water. Hardness levels above 300 ppm are present in much of the state, and portions of northeastern Indiana have hardness levels exceeding 600 ppm as indicated in Figure 45. Localized areas of high hardness are also found in extreme south-central Indiana in Harrison and Washington Counties and in northeastern Indiana in Lake County. A region of potentially softer water is present in the southwestern portion of the state where localized geologic conditions may be present in some of the aquifers where natural softening processes have reduced hardness levels below 100 ppm. This region corresponds to that underlain by the Pennsylvanian age bedrock. Other constituents of particular importance when viewing the state-wide chemical composition of ground water are iron, manganese, sulfate, fluoride, and hydrogen-sulfide.

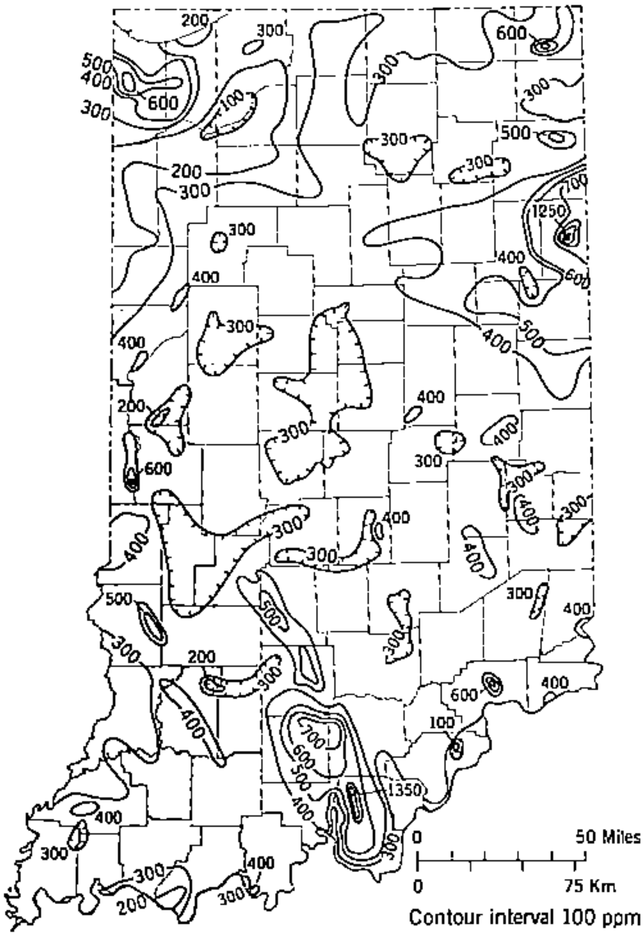
The iron content of ground water is of concern primarily because of staining of plumbing fixtures and laundry. Figure 46 shows areas of low, moderate and high iron content within the state. For the most part ground water in Indiana contains more than 0.3 ppm of iron.

Manganese, often associated with high iron content is a nuisance when present in concentrations of over 0.05 ppm. The areas having the lowest manganese content in Indiana, as shown in Figure 47, are along the Wabash River, the Whitewater River in the southeastern part of the state and in areas underlain by Mississippian age limestone aquifers.

Sulfate levels vary in response to the type of geologic deposits present in an area. In northeastern Indiana sulfate levels in excess of 600 ppm are present, as shown in Figure 48. Elevated sulfate levels are also found in Harrison, Orange, Vermillion and Lake Counties.

Fluoride concentrations above 1 ppm, the recommended level for cavity prevention, are present in much of central and northeastern Indiana and in scattered parts of southwestern, west-central and northwestern Indiana, as indicated in Figure 49. Localized high fluoride concentrations in the western sectors of the state are attributed to geologic factors which have substantially changed the water chemistry of ground water in these areas.

Hydrogen-sulfide ("sulfur water") in even very small concentrations is particularly objectionable to domestic water users. Sizeable areas in northwestern Indiana are underlain by limestone bedrock containing water with a high level of hydrogen sulfide, as indicated on Figure 50. A shale bedrock capstone is present above the limestone in many places, and when the shale occurs at a shallow depth, it virtually eliminates all other alternative water supply possibilities.



EXPLANATION

Outcrop area of Pennsylvanian rocks. In this area hardness levels may vary substantially depending upon depth and aquifer sampled.

Figure 45

Map of Indiana showing the distribution of water hardness of ground water in parts-per-million.

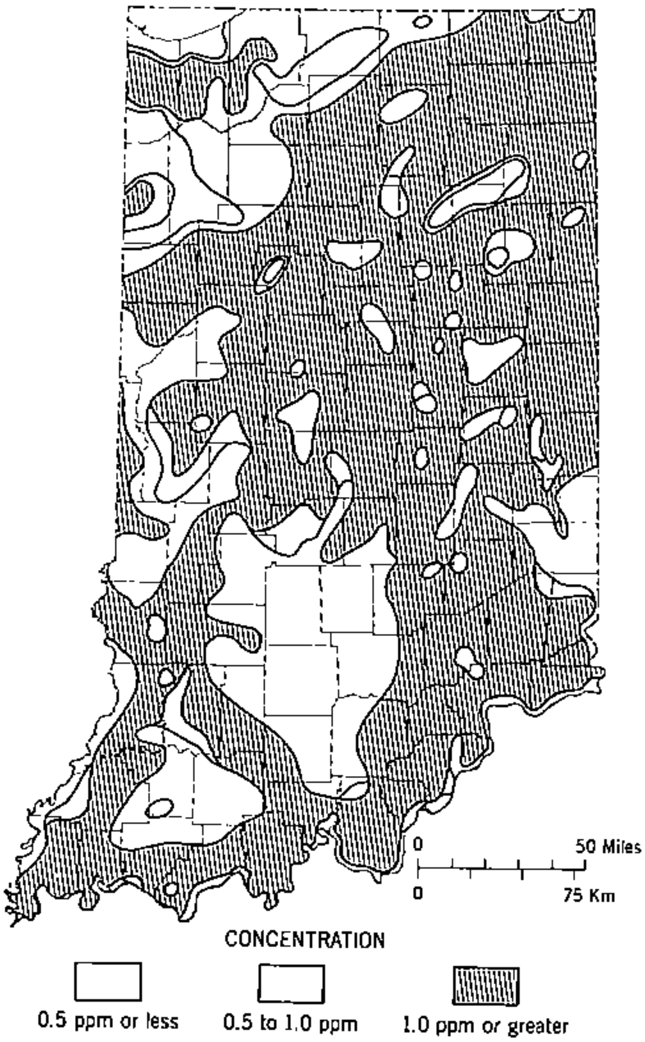


Figure 46
Map of Indiana showing the general concentration of iron in ground water in parts-per-million.

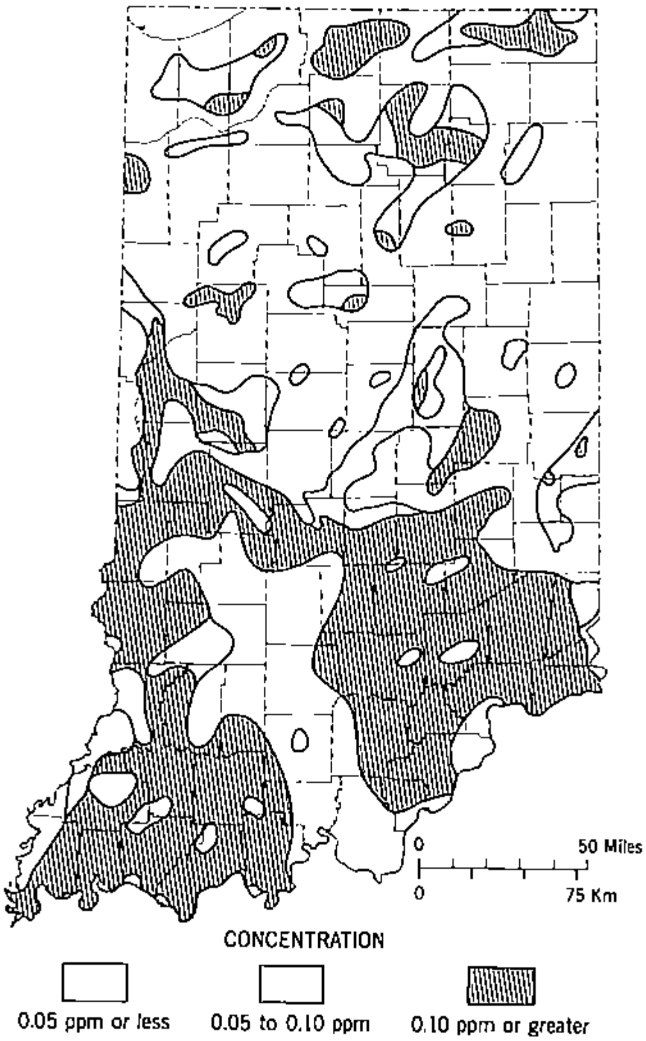


Figure 47
Map of Indiana showing the general concentration of manganese in ground water in parts-per-million.

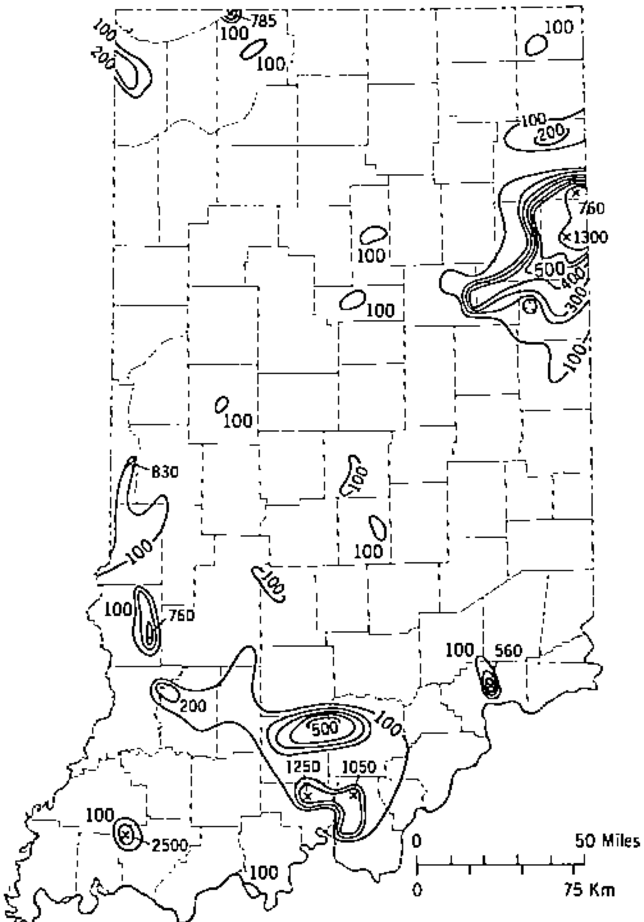


Figure 48
Map of Indiana showing the concentration of sulfate in ground water in parts-per-million.

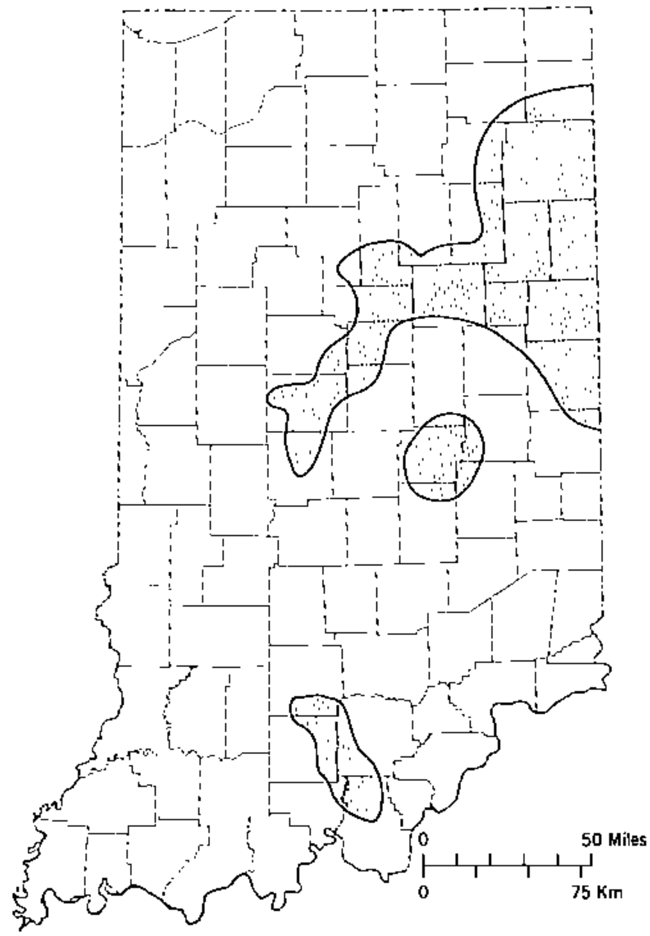


Figure 49
Map of Indiana showing the general distribution of fluoride in ground water.

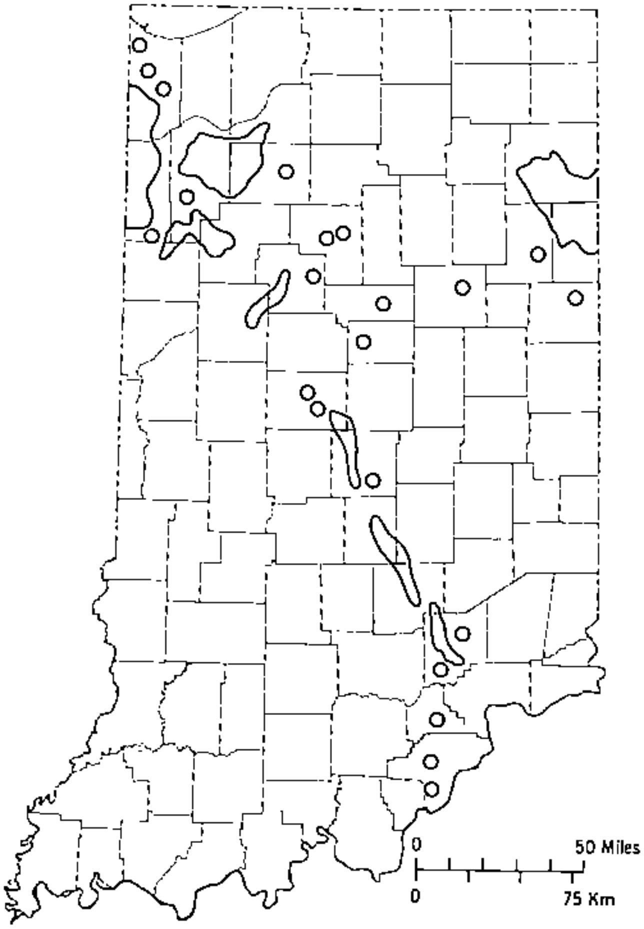


Figure 50
Map of Indiana showing the general distribution of hydrogen sulfide in ground water.

SURFACE WATER

The Stream Pollution Control Board was established in 1943 to abate or prevent pollution of Indiana waters. This board has established water quality standards for all Indiana streams and lakes. These standards are basically designed to protect both instream uses and withdrawal uses of the water resource.

Generally speaking, the standards established by the Stream Pollution Control Board are designed to mitigate the impact caused from the major sources of pollution. These sources are: municipal, industrial, land use, shipping, dredging activities, and miscellaneous spills of toxic substances.

Pollution From Municipal Sources The responsibility for control of pollution from municipal sources is legally vested in the Indiana Stream Pollution Control Board. All plans and specifications for abatement or correction of any polluted condition must be approved by this board, as required by law. All plans and specifications submitted to this board or the State Board of Health must be prepared by or under the supervision of a professional engineer legally registered in the State of Indiana, and must generally meet the minimum requirements as recommended in the *Ten States Standards for Sewage Works.*

A Wastewater Treatment Plant Operator Certification Law requires that the operation of all municipal wastewater treatment facilities be under the direct supervision of an operator certified under State Board of Health Regulation HSE 30-R. The regulation provides for the classification of wastewater treatment plants and sets the experience and educational requirements for operators. All licenses must be obtained by examination. There are provisions for revocation of licenses and fines for noncompliance.

Construction of all new wastewater treatment facilities within the state is generally required to provide average biological oxygen demand and suspended solids removal of at least eighty-five percent. In cases where the receiving stream lacks the capacity to assimilate secondary sewage treatment plant effluent discharges, a higher degree of treatment is to be provided so that the water quality standards of the receiving stream will be met.

The state requires each sewage treatment facility to submit monthly operation reports no later than the twenty-eighth day of the following month. A recommended schedule of laboratory tests is provided for each facility. The schedule indicates the type and frequency of tests depending on the size of the facility and its treatment processes.

The state established a schedule for correction of combined sewer overflows for several municipalities, and it will eventually require such control at all municipalities with combined sewers. A few projects have been completed and several others are progressing according to plan.

The selection of control methods is made on the basic engineering evaluation after investigating alternate methods. The state does not stipulate any one method for control. Any method selected must be capable of producing an effluent that will meet stream water quality standards after dilution.

Pollution from Industrial Sources The responsibility for control of pollution from industrial sources is legally vested in the Indiana Stream Pollution Control Board. All plans and specifications for abatement or correction of any polluted condition must be approved by this board.

The degree of treatment and control for industrial sources is determined by the amount of waste flow, type of waste, size of receiving stream, and downstream water uses. In all cases the degree of treatment must be at least equivalent to best practicable treatment, as defined by the U.S. Environmental Protection Agency, for various industrial categories or secondary treatment. The applicable water quality standards are used to evaluate whether or not a proposed treatment system with its expected removal efficiencies is acceptable.

A Wastewater Treatment Plant Operator Certification Law requires that persons in responsible charge of the plant must be certified. Certification involves the passing of a written examination and the meeting of the educational and experience requirements established in Regulation HSE-30R. The law provides that a license may be revoked or a fine levied if it is determined that the operator has engaged in actions of fraud or has failed to perform his duties.

Regulation SPC-2 requires that all users and handlers of cyanide and cyanogen compounds provide facilities to isolate these compounds from any drain connected to a water course. The general isolation requirements are for the construction of curbed areas around or pits beneath the tanks or handling areas that will contain any leakage or spillage. There has been a significant reduction in cyanide-related fish kills and pollution incidents since full implementation of the regulation.

Radioactive materials have been monitored as part of regular survey work. Industrial inspections have revealed that radioactive materials are used mainly in insignificant quantities for analytical instruments.

Regulation SPC-11 requires all dischargers in the state to submit monthly reports to the Board of Health including flow measurements and effluent characteristics. Monitoring and the frequency of sampling are set individually for each plant. Surveillance of industries is accomplished by routine inspections, grab samples, and by periodic 24-hour surveys which monitor both the plants' discharges and the receiving waters.

Pollution from Land Use Activities In 1971, the Indiana General Assembly enacted a law regulating the distribution, sale, and use of pesticides and providing for the appointment of a Pesticide Review Board. The law specifies that all pesticides offered for sale in the state or transported within the state are to be registered in the office of the State Chemist. The Indiana Stream Pollution Control Board works with the State Chemist and the Pesticide Review Board to insure that pesticides are used in a manner that will not result in pollution of streams. The results of a pesticide monitoring program carried out by the state from the fall of 1969 to September 1971 indicate that there is not a significant pesticide problem in the Indiana portion of the Great Lakes Basin.

In 1971, a Confined Feeding Control Law became effective. This law defines confined feeding operations and requires that all operations exceeding 300 cattle, 600 swine or sheep, and 30,000 fowl, and those smaller operations causing violations of the Stream Pollution Control Law or Stream Pollution Control Board Regulations must receive approval of waste handling facilities from the board. The law further provides that all existing confined feeding operations over the numbers listed above must have submitted information of waste disposal practices to the board by July 1, 1973 for consideration. This provided an inventory of all operations above the indicated numbers.

Nutrient and sediment pollution contributed by agricultural runoff is a problem in portions of the Lake Michigan and Lake Erie Basins. However, sedimentation can be reduced by proper land and water management on the farms. The state works closely with the local Soil and Water Conservation Districts and encourages the development of Small Watershed Protection and Flood Prevention Projects under Public Law 566. In addition, the state encourages the use of agricultural practices that will minimize sediment and nutrient transport to tributaries of the Great Lakes.

Pollution from Shipping Activities In 1969, the Indiana General Assembly enacted an amendment to the 1957 Boating Law making it unlawful to operate any boat furnished with a toilet unless the toilet is equipped with a holding tank of sufficient capacity to store wastes for subsequent disposal at approved shoreside facilities or an incinerator or treatment system approved by the Stream Pollution Control Board. This amendment brought Lake Michigan under the same restriction as had previously been applied for all other waters of the state.

Pollution from Dredging Activities Indiana Harbor and other federal harbors on Lake Michigan are routinely dredged by the U.S. Army Corps of Engineers. Some of the material dredged is classified as polluted.

In 1969, disposal of these materials from Indiana Harbor by dumping in Lake Michigan was discontinued and all dredgings since that time have been placed behind the Inland Steel Company bulkhead-and-fill operation. Further concerns and restrictions on the disposal of polluted dredge spoil materials have raised substantial questions as to whether this site can continue to be used or another site made available. Current polluted dredge spoil from operations at Michigan City Harbor is disposed of at an approved inland site.

Pollution from Toxic Material Spills The Stream Pollution Control Board Regulation 16 requires the immediate reporting of all spills and unauthorized discharges, of hazardous or objectionable substances to the stream board. It further specifies that the responsible person(s) for the spill or discharge take immediate action to contain and recover the toxic material. Failure to comply with these requirements may result in enforcement action by the board and civil penalties.

Spills of oil and hazardous material frequently pose threats to the environment either by fouling a lake or stream causing a fish kill, endangering livestock, or polluting a public water supply. In such events an "Emergency Response Team" is dispatched to the scene from the Water Pollution Control Division to evaluate and take appropriate action to clean up the spilled material. Citizen participation is also encouraged. Local industry, farmers, and residents living contiguous to the affected body of water are advised to consult local health departments for taking appropriate precautionary measures.

During 1977, two hundred and five spills were investigated. These investigations do not include discharges of partially treated sewage from treatment plants, other bypasses, sewer line breaks, or similar events. Spills which were reported and investigated often include instances of pipeline leaks and breaks, rail and truck accidents, storage tank leaks, ruptures, and various other incidents. With a high incidence of spillage, a correlation may exist between the type of spill with seasonal changes through the year. For example, slippery highways and poor visibility appear to be a significant contributing factor in transportation accidents during the winter and early spring. This may also account for the amount of agricultural spills resulting from the transportation of pesticides and fertilizers during the same period. Secondly, the thawing cycle in early spring may cause increased stress to underground pipelines. Hence, pipeline breaks and leaks appear to be a more common occurrence in the winter-spring cycle.

As indicated in Table 24, petroleum products were involved in sixty-four percent of the total spills investigated, representing thirty-two percent (158,320 gallons) of the total volume of spilled material, ranking second only to miscellaneous chemicals (255,135 gallons). It should be noted that a significant percentage of truck and pipeline incidents, twenty-three and sixteen percent respectively, and ship and barge accidents also involved petroleum products as indicated In Table 25.

Table 24
Type, number, and magnitude of toxic material spills.

Product	*Number of Spills*	*Percent of Spills*	*Amount of Product Spilled in Gallons*	*Percent of Total Spilled Material*
Petroleum Products	13	64	158,320	32
Acids and Bases	11	5	20,300	4
Miscellaneous Chemicals	18	9	251,135	50
Food Products	7	3	4,500	1
Agricultural Materials	22	11	61,305	12
Miscellaneous Materials	17	8	1,715	1

Table 25
Summary of the 1977 toxic spill investigation.

Source of Spill	*Percent of Sources*
Transportation Spills	
Trucks	23
Railroads	11
Ships and Barges	2
Industrial Spills	30
Pipeline Spills	16
Agricultural Spills	6
Miscellaneous and Unknown Sources	12

Fish Kills The aquatic habitat is the first to be impacted by pollution. Fish kills may result when a pollution event occurs. However, fish kills need not be expected in chronically polluted areas, since such areas do not usually support a significant fish population.

Fish kills generally result from unusual circumstances, such as an equipment failure, or a spill of toxic substances, or oxygen-demanding materials. Effects of such events are most severe when they occur during low-flow conditions in the summer and early fall. Fish kills usually occur during dry periods and during dry years. Table 26 indicates the source of pollution causing the known fish kills which were investigated by the Stream Pollution Control Board during 1977.

Table 26
Summary of fish kill causes, 1960 to 1977.

Source and Number of Kills	*Percent of Total Kills*
Sewage Sources (102)	23.3
General (53)	12.1
Industrial Waste (17)	3.9
Combined Sewer Overflow and Bypassing (32)	7.3
Industrial Sources (143)	32.7
General (53)	12.1
Cyanide (9)	2.1
Canneries (24)	5.5
Oil (23)	5.3
Packing Plants (2)	0.5
Agriculture Plants (32)	7.3
Agriculture Sources (69)	15.8
Animal Wastes (42)	9.6
Silage (6)	1.4
Pesticides (10)	2.3
Ammonia (7)	1.6
Others (4)	0.9
Water Treatment Plants Sources (4)	0.9
Individual (7)	1.6
Natural Causes (19)	4.1
Undetermined Sources (94)	21.5

Lake Classification Program

Lakes, like living organisms, may be considered to undergo an aging process. Young lakes typically contain very low nutrient levels and consequently support very small populations of aquatic plants. As a lake matures, nutrients are generally introduced from direct surface runoff. As the nutrient level increases the population of aquatic plants increases. As the seasons pass, aquatic vegetation grows, dies, and settles on the lake bottom where it decomposes and releases its nutrients. With time, the nutrient levels increase, the density of aquatic vegetation increases, and the depth of the lake decreases. Eventually a lake may become a wetland and finally may revert back to land capable of supporting terrestrial vegetation.

The aging process of lakes is referred to as *eutrophication*. This aging process may be accelerated by the influence of man through the addition of nutrients. Lechates from septic fields not only decrease water quality but may cause massive growths of aquatic vegetation due to the increased nutrients available. This process of "cultural eutrophication" is common with lakes located near large population centers.

The Stream Pollution Control Board is completing the trophic or age classification of many fresh water lakes. As of February 1978, 404 natural lakes and 150 man-made impoundments totalling more than 87,500 acres were classified. These lakes are classified by age and quality in four "classes."

Class I is the least eutrophic (youngest) and has the highest quality of water. These lakes rarely support extensive populations of weeds or algae, an indicator of excessive nutrient levels. Lake uses are not normally impaired by the overall quality of water.

Class II lakes are of medium quality. These lakes frequently support extensive populations of weeds or algae. However, this plant growth seldom impairs existing lake uses.

Class III lakes always support extensive populations of weeds or algae which frequently impair existing lake uses.

Class IV lakes include remnant lakes which have become very shallow and always support extensive populations of weeds or algae. These remnant lakes are often transformed into wetlands. Tables 27 and 28 indicate the classification, number, and acreage of natural and man-made lakes classified as of 1978. The trophic levels of the lakes surveyed are indicated within the regional reports.

Table 27
Classification of natural lakes.

Class	*Number*	*Acres*
Class I	75	16,023
Class II	144	13,867
Class III	67	6,377
Class IV	118	2,448
Total	404	38,715

Table 28
Classification of man-made lakes.

Class	*Number*	*Acres*
Class I	44	31,157
Class II	62	14,748
Class III	44	2,813
Total	150	48,718

Summary

The Stream Pollution Control Board establishes and enforces water quality standards for streams and lakes within the state. The levels of wastewater treatment required of the various dischargers, such as municipal and industrial sources, are based upon these water quality standards. Any long-term change in the quantity of water resources may require changes in the type and level of pollutant discharges. Some treatment changes will also occur due to increasingly stringent federal wastewater treatment requirements.

The reader who is interested in detailed information as to water quality standards, water quality management, programs, and the quality of ground or surface waters, including the various parameters of quality, should consult the Indiana Stream Pollution Control Board.