ablation—the melting of a glacier and associated depositional processes. An **ablation complex** is a heterogeneous assemblage of till-like sediment, sand and gravel, and lake deposits formed during the disintegration of a glacier; an **ablation hummock** is an irregular to donut-shaped mound, usually of low relief (less than 10 feet) that results from the deposition of ablation sediment in a depression or low area on the ice surface

acetanilide—A white, crystalline organic powder ($CH_3CONHC_6H_5$) used chiefly in organic synthesis and in medicine for the treatment of headache, fever and rheumatism

action level—the Food and Drug Administration's recommended limit for a toxic substance in the edible portion of a fish, above which fish are not safe to consume and interstate sales are not allowed

acute aquatic criterion—"AAC", the highest concentration of a chemical that, if met instream will protect the aquatic life present from mortality or other irreversible effects due to short-term exposure (327 IAC 2-1-9); the AAC is equal to one-half (1/2) the final acute value (FAV)

air mass—a large portion of the atmosphere that is fairly uniform in temperature and humidity

alluvium—fine- to coarse-grained sediment deposited in or adjacent to modern streams and derived from erosion of surface sediments elsewhere in the watershed or from valley walls

anhydrite—a mineral consisting of anhydrous calcium sulfate: $CaSO_4$; it represents gypsum without its water of crystallization, and it alters readily to gypsum. It usually occurs in white or slightly colored, granular to compact masses

anion—an atom or molecule that has gained one or more electrons and possess a negative electrical charge

anthropogenic—relating to the impact or influence of humans or human activities on nature

apron—wedge-shaped or sheet-like body composed of sand and/or gravel. Aprons associated with end moraines sometimes consist of several adjacent, coalesced fans. Aprons are often characterized by a gently sloping, low-relief surface that slopes away from end moraines or other ice-marginal positions

aquifer—a saturated geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients

aquifer system—a heterogeneous body of permeable and poorly permeable materials that functions regionally as a water-yielding unit; it consists of two or more aquifers separated at least locally by confining units that impede ground-water movement, but do not affect the overall hydraulic continuity of the system

aquitard—a confining layer that retards but does not prevent the flow of water to or from an adjacent aquifer

arcuate—bent or curved like a bow

argillaceous—pertaining to, largely composed of, or containing clay-sized particles or clay minerals

artesian—see confined

backwater—water held or forced back, as by a dam, flood, tide, etc.

bank storage—the water absorbed into the banks of a stream channel when the stage rises above the water table, then returns to the channel as effluent seepage when the stage falls below the water table

base flow—the portion of stream flow derived largely or entirely from ground-water discharge

beach ridge—wave-swept or wave-deposited ridge running parallel to a shoreline- commonly composed of sand as well as sediment reworked from underlying material; height of is usually proportional to wave size and energy; may be capped by or associated with sand dunes

bench—a small terrace or steplike ledge breaking the continuity of a slope

benthic—describes organisms, sediment, and other material at the bottom of an aquatic system

best management practices—an entire body of land practices aimed at treating the watershed as a whole; used to control four primary, interactive processes: erosion control, runoff control, nutrient control, and pesticide or toxic control

bioaccumulating—a process by which there is an increase in the concentration of a chemical over time in a biological organism compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted

biochemical oxygen demand (BOD)—the amount of dissolved oxygen needed for the decomposition of organic matter in water

bioclastic vuggy dolomite—a calcium magnesium carbonate rock which consists primarily of fragments or broken remains of organisms (such as shells) and which contains small cavities usually lined with crystals of a different mineral composition from the enclosing rock

bog—a poorly drained wetland, usually found in a glacial depression, which is characterized by the presence of saturated organic soil (peat) and acidic ground water; plant decomposition is very slow in this environment

calcareous—describes a rock or sediment that contains calcium carbonate

carbonate—in this usage, a rock consisting chiefly of carbonate minerals which were formed by the organic or inorganic precipitation from aqueous solution of carbonates of calcium, magnesium, or iron; e.g. limestone and dolomite

cation—an atom or molecule that has lost one or more electrons and possesses a positive charge

catostomids—an individual that is a member of the sucker family; the sucker family includes buffalo fishes, carp suckers, red horse, and chub suckers

centrarchid—an individual that is a member of the sunfish family; the sunfish family includes the black basses, rock bass, sunfish, and bluegill

channel slope—the difference in elevation between points 10 percent and 85 percent of the distance along the channel from a gaging station (or discharge point) upstream to the watershed boundary, divided by the distance between the two points; expressed in feet per mile

channelization—in this usage, any excavation and construction activities intended to widen, deepen, straighten or relocate a natural river channel; the term does not include maintenance activities on existing channels, such as the clearing of debris or dredging of accumulated sediments

chronic aquatic criterion—"CAC", the highest concentration of chemical that, if met instream, will protect the aquatic life present from toxic effects due to long term exposure, e.g., adverse effects on growth and reproduction (327 IAC 2-1-9)

clastic—pertaining to a rock or sediment composed principally of broken fragments that are derived from preexisting rocks or minerals and that have been transported some distance from their places of origin; also said of the texture of such a rock

combined sewer overflow—a discharge composed of untreated

or partially treated sewage mixed with stormwater
cone of depression—a depression in the ground water table or potentiometric surface that has the shape of an inverted cone and develops around a well from which water is being withdrawn. It defines the area of influence of a well
confined—describes an aquifer which lies between impermeable formations; confined ground-water is generally under pressure greater than atmospheric; also referred to as artesian
conformable—describes strata or groups of strata lying one above another in parallel order
contact—a plane or irregular surface between two types or ages of rock
contaminant (drinking water)—as defined by the U.S. Environmental Protection Agency, any physical, chemical, biological, or radiological substance in water, including constituents which may not be harmful
continuous-record station—a site on a stream or lake where continuous, systematic observations of stage and/or discharge are obtained by recording or nonrecording instruments and periodic measurements of flow
convection—in this usage, the vertical transport of atmospheric properties, esp. upward (distinguished from advection)
crest-stage station—a site on a stream or lake where peak stage and/or discharge data are collected systematically over a period of years
cyprinids—an individual that is a member of the minnow family; the minnow family includes shiners, minnows, chubs, and carp
dead storage—the volume of water in a reservoir which is not useful under ordinary operating conditions
debris-flow—body of sediment that has moved downslope under the influence of gravity; may be derived from a wide variety of pre-existing sediments that are generally saturated and may be deposited on or against unstable substrates, such as glacial ice; flowage occurs when the sediments lose their cohesive strength and liquify. **Mud flows** are a variety of debris flow composed primarily of fine-grained sediment such as silt and clay. Historically, debris flows formed by flowage of soft till have been referred to as **flow till**. Because ancient mudflows frequently resemble glacial till they are sometimes referred to as **till-like sediment**
detection limit—is the amount of constituent that produces a signal sufficiently large that 99 percent of the trials with the amount will produce a detectable signal 5 X the instrumental detection limit
diatom—any of numerous microscopic, unicellular, marine or fresh-water algae having siliceous cell walls
dicamba—a member of the benzoic acid and analogue herbicides ($C_8H_6Cl_2O_3$). These mimic plant growth-regulating hormones that interfere with plants' normal functions
direct runoff—see runoff, direct
disconformably—pertaining to a disconformity; term used to refer to rock formations that exhibit parallel bedding but have between them a time break in deposition
divalent—having a valence of two, the capacity to unite chemically with two atoms of hydrogen or it equivalent
dolomitic—dolomite-bearing, or containing dolomite; esp. said of a rock that contains 5 to 50 percent of the mineral dolomite in the form of cement and/or grains or crystals; containing magnesium
down-dip—a direction that is downwards and parallel to the dip (angle from the horizontal) of a structure or surface
drainage basin—the land area drained by a river and its tributaries; also called watershed or drainage area
drawdown (ground water)—the difference between the water level in a well before and during pumping
ecoregion—an area or region of relative homogeneity in ecological systems. It is defined by map overlays of soil, geology, geomorphology, potential natural vegetation, and land use. Six ecoregions are recognized in Indiana: Interior River Lowland, Interior Plateau, Eastern Corn Belt Plain, Central Corn Belt Plain, Southern Michigan-Northern Indiana Till Plain, and Huron-Erie Lake Plain
end moraine—see moraine, end
enplanement—passenger entering an airplane
escarpment—a long, more or less continuous cliff or relatively steep slope facing in one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces, and produced by erosion or by faulting
esker—narrow, elongate ridge of ice-contact stratified drift believed to form in channels under a glacier
estimated—in this usage, (population) number based on events that have already occurred
eutrophic—in this usage, streams or lakes characterized by an abundant accumulation of nutrients that support a dense growth of plant and animal life, the decay of which depletes the shallow waters of oxygen in summer
eutrophication—in this usage, a general term describing the process by which lakes and streams become enriched by high concentrations of nutrients such as nitrogen and phosphorus
eutrophy—the state of being eutrophic; see above
evapotranspiration—a collective term that includes water discharged to the atmosphere as a result of evaporation from the soil and surface-water bodies and by plant transpiration
evaporite—see evaporitic deposits
evaporitic deposits—of or pertaining to sedimentary salts precipitated from aqueous solutions and concentrated by evaporation
exposure—in this usage, (geology) an area of a rock formation or geologic structure that is visible, either naturally or artificially, i.e. is unobscured by soil, vegetation, water, or the works of man; also, the condition of being exposed to view at the earth's surface
fabric—the manner of arrangement of individual particles, such as rock fragments, in a body of sediment, such as till; till units which have strongly aligned particles are considered to have a well-developed fabric
facies—features, such as bedding characteristics or fossil content, which characterize a sediment as having been deposited in a unique environment; a facies tract is an area characterized by two or more closely related facies
facies tracts—a system of different but genetically interconnected sedimentary facies of the same age
facultative— able to survive under a variety of water-quality conditions, including moderately polluted or eutrophic waters
fan—body of outwash having a fan shape and an overall semiconical profile; generally deposited where a constricted meltwater channel emerges from an ice margin into a large valley or open plain. The **fan head** represents the highest and most ice-proximal part of the fan and commonly emanates from an end moraine or similar ice marginal feature. **Ice-contact fans** were deposited up against or atop ice and are commonly collapsed and pitted. Meltwater along the toe of the fan commonly occupies **fan-marginal channels**
fan-delta—body of meltwater sediment which commonly formed where an outwash fan built outward into a glacial lake; consists of sediment deposited partly in or under water (delta) and partly in open air, on or adjacent to land surface (fan)
fault—(structural geology) a fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture
fen—a saturated wetland characterized by the presence of basic or calcareous ground water (as contrasted to a bog); often found as seepage areas on gentle slopes comprised of glacial deposits
finished water—water that has been treated and is ready for distribution

flatwoods—a forest on level upland terrain characterized by a mosaic of wet depressions and slightly elevated soils. Soils are typically poorly drained, and standing water is generally ephemeral and the result of direct precipitation rather than flooding
flood, 100-year—a statistically-derived flood discharge having an average frequency of occurrence of once in 100 years, or a one percent chance of being equaled or exceeded in any given year
flow till—see debris flow
flowing well—a well completed in a confined aquifer in which the hydrostatic pressure is greater than atmospheric pressure, and the water rises naturally to an elevation above land surface
fluvial—of or pertaining to rivers
fossiliferous—containing fossils, which are preserved plant or animal imprints or remains
gamma-ray logs—the radioactivity log curve of the intensity of natural gamma radiation emitted from rocks in a cased or uncased borehole. It is used for correlation, and for distinguishing shales and till (which are usually richer in naturally radioactive elements) from sand, gravel, sandstone, carbonates, and evaporites
geomorphic—describes physical characteristics of the land surface that are the result of geologic processes
glacial lobe—segment of a continental ice sheet having a distinctive flow path and lobate shape that formed in response to the development of regional-scale basins (e.g., Lake Erie) on the surface that the ice flowed across. The shapes and flow paths of most of the individual glacial lobes in this part of the upper Midwest were largely related to the forms of the Great Lake basins. Each lobe was tens of thousands of square miles in size and had flow patterns and histories that were distinct from one another
glacial terrain—geographic region or landscape characterized by a genetic relationship between landforms and the underlying sequences of sediments
glaciolacustrine— pertaining to, produced by, or formed in a lake or lakes associated with glaciers
grab sample—water collected at a single location and at a single time as opposed to a sample composited over space or time
ground-water discharge—in this usage, the part of total runoff which has passed into the ground and has subsequently been discharged into a stream channel
gypsiferous—containing gypsum, a mineral consisting of hydrous calcium sulfate
gypsum—a widely distributed mineral consisting of hydrous calcium sulfate
health advisories (HAs)—provide the level of a contaminant in drinking water at which adverse non-carcinogenic health effect would not be anticipated with a margin of safety
herbaceous—with the characteristics of a herb; a plant with no persistent woody stem above ground
horizon (soils)—a layer of soil, approximately parallel to the land surface, having distinct characteristics produced by soil-forming processes
hummocky—describes glacial deposits arranged in mounds with intervening depressions
hydraulic conductivity—a parameter that describes the conductive properties of a porous medium; often expressed in gallons per day per square foot; more specifically, rate of flow in gallons per day through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature
hydraulic gradient—the rate of change in total head per unit of distance of flow in a given direction
hydraulic head—the height of the free surface of a body of water above a given subsurface point
hydraulic residence time—the average time required to completely renew a lake's water volume
hydric soil—soil that in its undrained condition is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation
hydrophyte—plants typically found in wet habitats; any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content
hydrostatic pressure—the pressure exerted by the water at any given point in a body of water at rest. The hydrostatic pressure of ground water is generally due to the weight of water at higher levels in the zone of saturation
hypolimnion—the lowermost layer of water in a lake, characterized by an essentially uniform temperature (except during a turnover) that is generally colder than elsewhere in the lake, and often by relatively stagnant or oxygen-poor water
ice-contact fans—see fan
ice-contact stratified drift—glacial sediment composed primarily of sand and gravel that was deposited on, against, or within glacier ice. These deposits typically have highly irregular surface form due to the collapse of the adjacent ice
ice-marginal channel—valley segment or stream channel cut by meltwater flowing along the margin of a glacier. Depending on its relationship to modern drainage patterns, a particular ice-marginal channel may or may not contain a modern steam
igneous—describes rocks that solidified from molten or partly molten material
immunoassay—is a quantitative or qualitative method of analysis for a substance which relies on an antibody or mixture of antibodies as the analytical reagent. Antibodies are produced in animals in response to a foreign substance called an antigen. The highly sensitive and specific reaction between antigens and antibodies is the basis for immunoassay technology
incised—describes the result of the process whereby a downward-eroding stream deepens its channel or produces a narrow, steep-walled valley
industry—in this usage, a general term encompassing all major employment categories
infiltration—the process (rate) by which water enters the soil surface and which is controlled by surface conditions
interflow—the part of precipitation which infiltrates the surface soil, and moves laterally toward streams as perched ground water
interlobate—refers to the general line of contact or zone of overlap between two glaciers or ice lobes. These areas are often broader and more irregular in dimension than other types of glacial terrains and typically contain a predominance of hummocky deposits such as ice-contact stratified drift
interpolate—to estimate intermediate values of a function between two known points
ion exchange—the process of reciprocal transfer of ions
jet stream—strong, generally westerly winds concentrated in a relatively narrow and shallow stream in the upper troposphere
kame—irregular ridge or roughly conical mound of sand and gravel with a hummocky surface; usually formed in contact with disintegrating ice
karst—topography characterized by closed depressions or sinkholes, caves, and underground drainage formed by dissolution of limestone, dolomite or gypsum
karstic—of karst, see above
kettle lake—small to large body of water that occupies a depression created by the melting of one or more blocks of buried ice; often round in outline and extending below the modern water table
lacustrine—pertaining to, produced by, or formed in a lake or lakes
lacustrine sediment—sediment deposited in lakes; usually composed of fine sand, silt, and clay in various combinations

Lake Maumee—formal name given by early workers to the most recent phase of ancestral Lake Erie, which formed in front of the Erie Lobe during its final retreat at the close of the Ice Age and covered all of the lowlands that now surround the valley of the Maumee River; also referred to by some as glacial Lake Maumee
lithofacies—a lateral, mappable subdivision of a designated stratigraphic unit, distinguished from adjacent subdivisions on the basis of lithology
lithologic—describes the physical character of a rock; includes features such as composition, grain size, color and type of bedding
lithology—the description of rocks, esp. in hand specimen and in outcrop, on the basis of such characteristics as color, mineralogic composition, and grain size
loam—describes a soil composed of a mixture of clay, silt, sand, and organic matter
lobate—having the form of a roundish projection or lobe
macroinvertebrate—an invertebrate species large enough to be readily visible without the aid of optical magnification
macrophyte—a plant large enough either as an individual or in communities to be readily visible without the aid of optical magnification
marsh—a wet, level, treeless area covered mostly with grasses, sedges or cattails and usually underlain by a mucky or mineral soil; sometimes referred to as a wet meadow
mass movement—a unit movement of a portion of the land surface; gravitative transfer of material down a slope
Maumee Lacustrine Plain—the formal name given by Malott (1922) to the flat tract in eastern Allen County and northwester Ohio that formerly lay below ancestral Lake Erie (glacial Lake Maumee)
Maumee Torrent—name historically used for the catastrophic outburst of water from Lake Maumee that drained through the Wabash-Erie Channel and down the Wabash River
maximum contaminant level—the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the user of a public water system
mean—arithmetic average of a set of observations
median—middle value of a set of observations arranged in order of magnitude
meltwater—water resulting from the melting of snow or glacial ice
mesotrophic—subject to moderate eutrophication
metabolite—a product of metabolic action
metrics—in this usage, a mathematical function developed to obtain scores for the various integrity classes used in the Index of Biotic Integrity
methemoglobinemia—a disease, primarily in infants, caused by the conversion of nitrate to nitrite in the intestines, and which limits the blood's ability to transport oxygen
monovalent—having a valence of one, the capacity to unite chemically with one atom of hydrogen or its equivalent
moraine—unsorted, unstratified glacial drift deposited chiefly by the direct action of glacial ice
moraine, end—a ridgelike accumulation of drift built along any part of the outer margin of an active glacier; often arcuate in shape, end moraines mark places along which the terminus of a glacier remained for relatively long periods. **Terminal moraines** mark the ultimate extent of a particular glacier, whereas **recessional moraines** are deposited where the ice-margin stabilized for a period of time during the retreat of the glacier
moraine, ground—material (primarily till) deposited from a glacier on the ground surface over which the glacier moved, and generally forming a region of low relief
morphometric—in this usage, of or pertaining to the structure and form of a lake
morphometry—in this usage, the structure and form of a lake
muck—a highly organic dark or black soil less than 50 percent combustible
mud flow—see debris flow
nested—in this usage, refers to multiple closely spaced observations wells each set at a different depth for the purpose of determining the hydrostatic pressure on different aquifers at the same location
nonsoil—any substrate which is not capable of supporting plant life such as marl beaches and sandbars (the substrate in deep water habitats is also considered nonsoil because the water is too deep to support emergent vegetation)
non-point sources—see point sources
normal (climate)—the average (or mean) value for a particular parameter over a designated period, usually the most recent 30-year period ending every decade
oligotrophic—subject to very mild eutrophication; low in nutrient inputs with low organic production
organic (soils)—containing partially decomposed plant remains; formal designation depends on relative percentage of organic material and clay
organic sediment—peat and muck, formed by the deposition of plant matter in kettle lakes, bogs, and other wetlands
outwash—sediment deposited by meltwater out in front of an ice margin; usually composed of sand and/or gravel. An **outwash plain** is a broad tract of low relief covered by outwash deposits, whereas an **outwash terrace** is a relatively small flat or gently sloping tract that lies above the valley of a modern stream
outwash fan—a fan-shaped accumulation of primarily sand and gravel deposited by meltwater streams flowing in front of or beyond a glacier
outwash plain—see outwash
outwash terrace—see outwash
overbank—describes water or sediment carried out of a stream channel onto the surrounding land surface during a flood
overland flow—the part of runoff which passes over the land surface to the nearest stream channel
overconsolidated—refers to the consistency of unconsolidated sediment that is much harder than would be expected from its present depth of burial; fine-grained glacial sediments such as till are commonly overconsolidated due to such processes as burial by ice or younger sediments, frequent wetting and drying, and freezing and thawing
oxbow—a sharp bend in a river forming a distinct crescent or U-shape
palimpsest—refers to a landscape in which some or all of the topographic features are not directly related to the form of the materials at the land surface but are inherited from the structure of a buried surface at depth
palustrine—includes wetlands dominated by vegetation such as trees, shrubs and persistent emergents; or an area less than 20 acres lacking such vegetation and having a water depth less than 6.6 feet at low water
parent material (soils)—the horizon of weathered rock or partly weathered soil material from which soil is formed
partial-record station—a site where limited stream-flow and/or water-quality data are collected systematically over a period of years
peat—a highly organic soil more than 50 percent combustible, composed of partially decayed vegetable matter found in marshes or damp regions, which is cut and then dried for use as fuel
per capita income—the total money income of the residents of a given area divided by the resident population of that area; as defined by the U.S. Bureau of the Census, total money income is the sum of all sources of cash income, excluding transfer payments, the imputed value of non-monetary income, and other income included under the Bureau of Economic Analysis' definition of personal income

percolate (geology)—to seep downward from an unsaturated zone to a saturated zone
permeability—the capacity of a porous medium to transmit a fluid; highly dependent upon the size and shape of the pores and their interconnections
physiographic region—an area of characteristic soils, landforms and drainage that have been developed on geologically similar materials
physiography—in this usage, a description of the physical nature (form, substance, arrangement, changes) of objects, esp. of natural features
piezometric surface—an imaginary surface representing the level to which water from a given aquifer will rise under the hydrostatic pressure of the aquifer
plankton—an assemblage of suspended or floating microscopic plants and animals that drift passively with water currents
Pleistocene—geologic epoch corresponding to the most recent ice age; beginning about 2 million years ago and ending approximately 10,000 years ago
point sources—discharges from specific sources such as a wastewater treatment plant or industry are point (end of the pipe) sources of pollution, whereas human uses of drainage basins such as urban development, agriculture, and silviculture can cause **nonpoint source** pollution
polychlorinated biphenyls (PCBs)—a family of chlorinated hydrocarbons potentially toxic to animals and humans and that persists in the environment
polynuclear aromatic hydrocarbons—polyunsaturated cyclic compounds that are composed of fused benzene rings where each benzene ring has at least two carbon atoms in common with another benzene ring; present in coal tar, high-boiling petroleum fractions, cigarette tar, and even the surface of charcoal broiled steak (major component of soot)
porosity—the amount of pore space; specifically, the ratio of the total volume of voids to the total volume of a porous medium
postdate—to follow in time
postdepositional—occurring after materials had been deposited
post glacial—occurring or been deposited after glaciation
potable—water which is palatable and safe to drink: ie fit for human consumption
potentiometric surface—an imaginary surface representing the total head of ground water in a confined aquifer that is defined by the level to which water will rise in a well
pre Wisconsin—general term that refers to the part of the Ice Age prior to about 75,000 years ago, during which many other glacial episodes at least as extensive as those of the Wisconsin Age took place
pro glacial—occurring or being deposited directly in front of a glacier
progradation—a seaward advance of the shoreline resulting from the nearshore deposition of sediments brought to the sea by rivers
projected—describes a number based on trends and patterns of the past
provenance—a place of origin; specifically the area from which the constituent materials of a sedimentary rock or facies are derived; also, the rocks of which this area is composed
public water systems—any system "for the provision of piped water for human consumption" so long as it has "at least fifteen service connections or regularly serves at least twenty-five individuals" (SDWA sec. 1401(4))
pumping test—a test conducted by pumping a well at a constant rate for a period of time, and monitoring the change in hydraulic head in the aquifer
raw water—water direct from the source, prior to any treatment
real payroll—the amount of money to be paid out by an employer to employees, adjusted for inflation
recessional moraine—see moraine, end
recurrence interval—the average number of years within which a stream-flow event is expected to occur once
recharge (ground water)—the process by which water is absorbed and added to the zone of saturation
reducing—describes the process of removing oxygen from a compound
reef—a ridgelike or moundlike structure, layered or massive, built by sedentary calcareous organisms, esp. corals, and consisting mostly of their remains
return period—see recurrence interval
riparian—relating to, or living or located on the bank of a natural watercourse, or sometimes of a lake or tidewater
runoff coefficient—the ratio of the peak rate of direct runoff to the average intensity of rainfall in a storm
runoff, direct—water entering a stream channel promptly after a precipitation event; it is presumed to consist of surface runoff and a substantial portion of the interflow
runoff, surface—water which passes over the land surface to the nearest stream channel (overland flow) plus precipitation falling directly onto the stream
runoff, (total)—the part of precipitation that appears in surface-water bodies; it is the same as stream flow unaffected by artificial manipulation
sandstone—a medium-grained clastic sedimentary rock composed of abundant rounded or angular fragments of sand size set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material
secci disk—a small disk, painted with an alternating black and white pattern, which is lowered into the water to obtain rough measures of transparency
secondary maximum contaminant level—recommended, nonenforceable standards established to protect aesthetic properties of drinking water, such as taste and odor
sedimentary rock—formed by the deposition of sediment
seep—a spot where groundwater oozes slowly to the surface and often forms a pool
seismic—pertaining to an earthquake or earth vibration, including those that are artificially induced
senescence (lakes)—approaching the end stages of eutrophication when the lake is being filled in by organic sediments and aquatic weeds
sessile—permanently attached, not free moving
shale—a fine-grained detrital sedimentary rock, formed by the consolidation (esp. by compression) of clay, silt, or mud
skewed—describes the state of asymmetry of a statistical frequency distribution, which results from a lack of coincidence of the mode, median, and arithmetic mean of the distribution
sluiceway—valley or channel that conducted large amounts of glacial meltwater through and/or away from a glacier; may or may not be occupied by a modern stream; commonly associated with one or more former ice margins
slough—a backwater area or remnant of a former river channel which contains standing water and serves as the main river channel only during high water
solution—(geology) a process of chemical weathering by which mineral and rock materials passes into solution; e.g. removal of the calcium carbonate in limestone by carbonic acid derived from rain-water containing carbon dioxide acquired during its passage through the atmosphere
source area—general geographic region that furnished the sediment supply for a particular deposit. Sediments deposited by different rivers or glaciers can often be distinguished because

their respective source areas differ in terms of the composition of bedrock and other sediments they contain; see provenance

specific conductance—The ability of a body of unit length and unit cross- sectional area to conduct an electrical current at a specific temperature. In general, the specific conductance of water is proportional to the total amount of dissolved solids

standard industrial classification code—a four-digit code established by the Office of Management and Budget, and used in the classification of establishments by type of activity

stage—the height of a water surface above an arbitrarily established datum plane, same as gage height

static water level—the level of water in a well that is not being affected by withdrawal of ground water

stratigraphy—the geologic study of the formation, composition, sequence and correlation of unconsolidated or rock layers

stream piracy—the capture by one stream of the drainage of another; results from headward erosion of the capturing stream, drainage reversals, or diversion by glacial processes

storage coefficient—the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head

subcrop—a "subsurface outcrop" that describes the areal limits of a truncated rock unit at the buried surface of an unconformity

subglacial—taking place beneath a glacier

subjacent—being lower, but not necessarily lying directly below

superposed—a shortened form of superimposed; said of rocks that are layered or stratified

surface runoff—see runoff, surface

swamp—a forested wetland that usually is seasonally flooded and that is dominated by either trees or shrubs; the interior of swamps may contain open-water areas such as ponds

swale—a slight depression, sometimes swampy, in the midst of generally level land

taxonomic—see taxonomy

taxonomy—orderly classification of plants and animals according to their presumed natural relationships

terminal moraine—see moraine, end

till—unsorted sediment deposited directly from glacier ice with little or no reworking by meltwater or mass movement; usually contains particles ranging in size from clay to boulders

till-like sediment—see till and debris flow

till plain—an extensive area with a flat to undulating surface, underlain by till and commonly covered by ground moraines and subordinate end moraines

topography—the relief and contour of a surface, especially land surface

total runoff—see runoff, total

toxic—describes materials which are or may become harmful to plants or animals when present in sufficient concentrations

transgression—the spread or extension of the sea over the land areas

transmissivity—the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient

transmission (soils)—process by which water moves through the soil and which is controlled by the soil horizons

transpiration—process by which water is evaporated from plants, primarily through microscopic air spaces in their leaves

triazine—Any of a group of chemicals containing three nitrogen and three carbon atoms arranged in a six member ring and having the formula $C_3H_3N_3$; also any of various derivative of these compounds including several used as herbicides

trophic—concerned with nutritive processes

tunnel valley—wide, linear channel oriented perpendicular to an ice margin and eroded into the substrate below the ice sheet. A tunnel valley typically represents a major route for meltwater draining part of an ice sheet, and exiting the front of that ice sheet

turbidity current—a current flowing downslope along the bottom of a body of water; such currents are driven by their high density, which is in turn caused by large amounts of suspended sediment

unconfined—describes an aquifer whose upper surface is the water table which is free to fluctuate under atmospheric pressure

unconformably—not succeeding the underlying rocks in immediate order of age or not fitting together with them as parts of a continuous whole

unconformity—a substantial break or gap in the geologic record where a rock unit is overlain by another that is not next in stratigraphic succession

unit (discharge)—a general term describing a stream-flow parameter calculated on a unit-area basis, usually per square mile, during a specified period of time

valley train—large, elongated body of outwash localized within the confines of a topographic valley

Wabash-Erie Channel—formal name given to the wide, flat-bottomed valley that runs between Fort Wayne and Huntington, and which most recently formed the outlet of Lake Maumee

water table—the upper surface of the zone of saturation below which all voids in rock and soil are saturated with water

watershed—see drainage basin

wet prairie—herbaceous wetland that occurs in deep swales; substrates range from very black mineral soils to muck

Wisconsin Age—the most recent period of major glacial activity during the ongoing ice age, perhaps beginning as long as 75,000 years ago and continuing until about 10,000 years ago

zonal stagnation—process in which a sizable part of an ice sheet or ice lobe becomes stagnant; commonly accompanied by general downwasting and deposition of widespread ablation complex

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APPENDICES

Appendix 1. Historic and projected county population

Upper figures: Division of Water estimates, in-basin portions only.
Lower figures: U.S. Census Bureau 1993, total county (1940-1990); Indiana State Board of Health (1993), total county (2000-2030).

County	1940	1950	1960	1970	1980	1990	2000	2010	2020	2030
Adams	17852	19051	21622	23459	25714	26920	29085	31769	34885	37915
	21254	22393	24643	26871	29619	31095	33600	36700	40300	43800
Allen	146282	171694	216110	257213	266680	272409	285395	296441	305677	308303
	155084	183722	232196	280455	294335	300836	315200	327400	337600	340500
DeKalb	24380	25627	27832	30369	33150	34874	36628	38504	39886	40478
	24756	26023	28271	30837	33606	35324	37100	39000	40400	41000
Noble	2602	2843	2820	3227	3752	3999	4245	4467	4657	4773
	22776	25075	28162	31382	35443	37877	40200	42300	44100	45200
Steuben	2544	2881	2985	3610	4610	5189	5466	5560	5541	5409
	13740	17087	17184	20159	24694	27446	28900	29400	29300	28600
Wells	999	985	1094	1133	1219	1236	1276	1328	1366	1385
	19099	19564	21220	23821	25401	25948	26800	27900	28700	29100
Total In-basin	194659	223081	272463	319011	335125	344627	362095	378069	392012	398263
Total county	256709	293864	351676	413525	443098	458526	481800	502700	520400	528200

Appendix 2. Recent and projected population of selected cities and towns

{Tabulation includes only cities and towns having at least 2,500 residents in 1990. Population values for 1960-1990 are from U.S. Bureau of the Census (1993). Values for 2000 through 2030 are Division of Water projections.}

City or Town	County	1960	1970	1980	1990	2000	2010	2020	2030
Auburn	DeKalb	6350	7388	8122	9379	9869	10374	10746	10906
Berne[1]	Adams	2644	2988	3300	3559	3830	4184	4594	4993
Butler	DeKalb	2176	2394	2509	2601	2745	2886	2990	3034
Decatur	Adams	8327	8445	8649	8644	9341	10203	11203	12176
Ft. Wayne[1]	Allen	161776	178269	172391	173072	181240	188255	194120	195788
Garrett	DeKalb	4364	4715	4751	5349	5602	5889	6100	6191
New Haven	Allen	3396	5346	6714	9320	9771	10149	10466	10556

[1] Corporate limit lies partially outside of the basin boundary.

Appendix 3. Land Use for the Maumee River Basin

Land Use	Acreage	Sq. Miles	Percent
URBAN OR BUILT-UP LAND	61,186	95.60	7.45
Residential	36,220	56.59	4.41
Commercial	13,480	21.06	1.64
Industrial	2,334	3.65	0.28
Trans., Comm. & Util.	3,299	5.15	0.40
Indust. and Comm. Complexes	416	0.65	0.05
Mixed Urban/Built-up	821	1.28	0.10
Other Urban/Built-up	4,617	7.21	0.56
AGRICULTURAL LAND	723,818	1,130.96	88.09
Cropland and Pasture	723,230	1,130.05	88.02
Orchards, etc.	222	0.35	0.03
Confined feeding	101	0.16	0.01
Other Agricultural land	264	0.41	0.03
FOREST LAND	31,655	49.46	3.85
Deciduous Forest	28,956	45.24	3.52
Evergreen Forest	70	0.11	0.01
Mixed Forest	2,629	4.11	0.32
LAKES AND WETLANDS	3,369	5.26	0.41
Lakes	2,281	3.56	0.28
Reservoirs	1,026	1.60	0.12
Nonforested Wetland	62	0.10	0.01
BARREN LAND	1,610	2.52	0.20
Str. Mines, Quarries, Gravel Pits	1,319	2.06	0.16
Transitional Areas	291	0.45	0.04
NOT SPECIFIED	5	0.01	0.00
TOTAL	821,642	1,283.82	100.00

Appendix 4. Geotechnical properties of Erie Lobe till units

The bulk properties of a body of rock or sediment that affect its engineering and hydrologic behavior are collectively referred to as geotechnical properties. Two properties of particular interest in the glacial tills of the Maumee Basin include consistency, which is essentially a measure of the unconfined compressive strength or consolidation of the till matrix, and the orientations of discontinuities, such as joints, that separate the matrix into discrete blocks. The development of these properties generally depends on the interaction of several main factors, such as grain size distribution; mineralogy; the type of sequence within which the till occurs; and the stress history of the till during and after deposition. Consistency and discontinuities commonly control the response of the till to a variety of near-surface engineering and hydrologic applications, hence a knowledge of their origin and characteristics is useful in the design of many types of projects.

In-situ bulk consistency is commonly measured in terms of blow counts, which refers to the number of blows required to drive a sampling device a specified distance through the till. This procedure is typically carried out as part of foundation test borings and other exploratory drilling and utilizes a sliding, 140-pound hammer mounted on the drill rod. Glacial tills are commonly found to be substantially harder to penetrate than would be expected from their present shallow depth of burial, and are referred to as overconsolidated. In particular, the sequence of loamy Huron-Erie Lobe tills of the Trafalgar Formation is severely overconsolidated, especially along its buried upper surface. More than 300 blows have been required to penetrate less than 12 inches into the till at some places—an extraordinarily hard consistency for "unconsolidated" sediment. Although the Trafalgar Formation is not the immediate surface till in the basin, its buried surface lies at relatively shallow depths (5-25 feet) in many low-lying places in the metropolitan Fort Wayne area, where it can pose a significant obstacle to excavations and test drilling, particularly where these operations are performed with small equipment. On the other hand, these same qualities typically result in superior bearing strength for supporting large loads such as tall buildings.

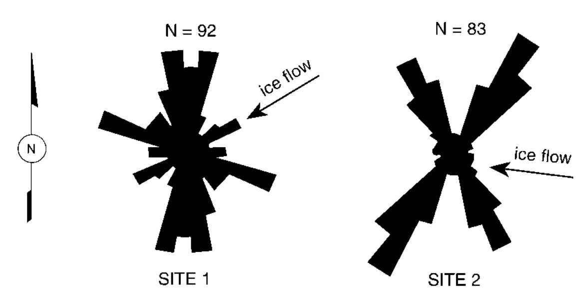
The origin of the extreme overconsolidation in these tills is not clear and probably results from the complex interaction of several factors. Overconsolidation in glacial sediments is commonly perceived to be mostly attributable to the great weight of the overriding glacier during till deposition, but this does not seem likely because the downward force at the sole of most glaciers is commonly offset by extremely high pore pressures attributable to build up of meltwater along the ice-sediment interface. Numerous exposures of the Trafalgar Formation in Allen County provide abundant evidence for formerly high pore pressures, most directly in the form of various dewatering structures, and indirectly by the presence of low-permeability units within and beneath the till that would likely have restricted the flow of meltwater away from the interface. A more plausible explanation is suggested by the abundance of permeable sand and gravel units along the contact with the overlying clayey tills of the Lagro Formation. The granular materials increase the bulk permeability near the top of the Trafalgar Formation, allow drainage of the till matrix to occur more readily, and thereby effect more rapid consolidation when the till is (or was) subject to increased confining pressure. As most of these granular units clearly post-date the deposition of the underlying till and its glacier, a more likely source of the hydrostatic stress required to cause the overconsolidation is the weight of the overlying sediments of the Lagro Formation, and possibly the ice that deposited them. Additional stress changes due to repeated wetting and drying associated with the pro-glacial environment are also likely to have been a major factor, as are post-glacial water-table fluctuations, particularly in the many places where the Trafalgar Formation is close to the land surface.

Discontinuities are planar openings or partings in sediment that separate the matrix into discrete blocks. Related terms include joints- -openings across which there is no evidence of displacement; shear planes and faults—discontinuities showing definite evidence of movement of opposing walls; and fractures—which generally refer to any planar discontinuity without regard to displacement or origin. All of these features are commonly described in fine-grained glacial tills having relatively high cohesion, and they can cause the bulk engineering and hydrogeologic properties of the till to be very different from those of the matrix alone. The development of discontinuities at any given site in a particular unit can be complex and it appears that a variety of mechanisms are involved in their genesis and propogation.

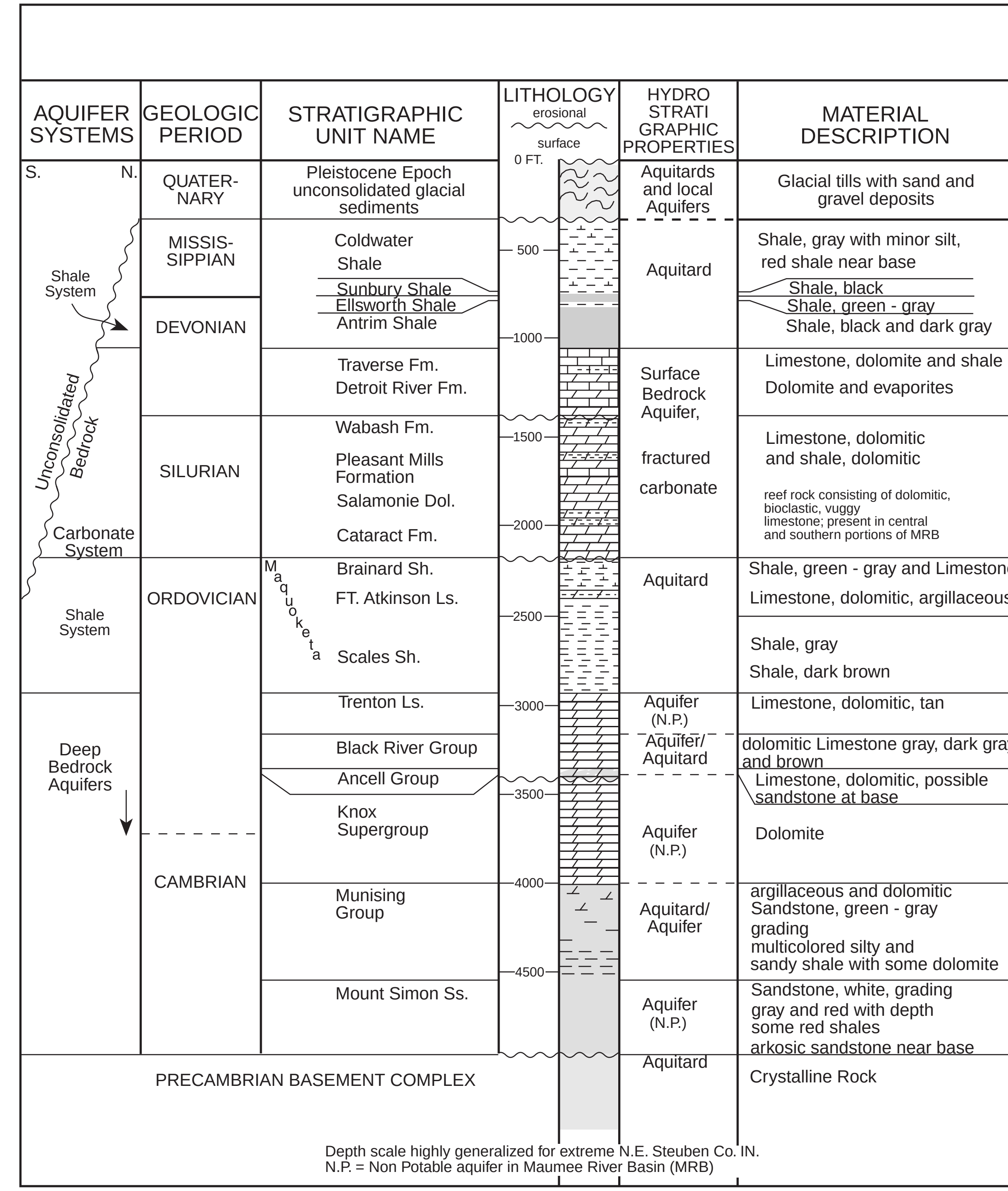
Evidence from numerous exposures and boreholes indicates that discontinuities are widely present in the Lagro Formation, which encompasses the clay-rich surface tills of the basin. The discontinuities appear to primarily be of two types—moderately inclined shear planes and near-vertical joints. The shear planes commonly comprise groups of closely spaced, curvilinear fractures that are generally inclined at angles between 20 and 50 degrees. At any given locality, they typically dip up-ice, opposite to the former direction of ice flow. Some of these features are associated with nebulous inclusions of highly folded lake sediment and virtually all bear slickensides and flutes that show that the top block was thrust over the bottom block. They are interpreted to result from shearing of debris-rich ice and subglacial sediment in areas of strongly compressive flow.

In contrast, the joints appear to be oriented in distinct sets that exhibit a strong conjugate pattern about local ice-flow direction (figure below). Joint spacing ranges from two inches to tens of feet and generally increases with depth. Joint lengths are typically in the range of one to 10 feet, although a few individual joints as long as 23 feet were observed. All of the observed joints were concentrated in the upper 25 feet of the till. There is abundant evidence of water movement through the joints, and seepage of water from large open joints was directly observed during wet periods. The till matrix adjacent to joints shows oxidation haloes as much as 2 feet wide, but is typically reduced (gleyed) along the joint planes. Joint faces commonly show abundant deposits of calcite or gypsum. Hydraulic and geochemical data from wells in the till (Fleming, 1994; Ferguson, 1992) suggest that the secondary hydraulic conductivity attributable to the joints is substantially greater than the primary hydraulic conductivity of the unfractured till matrix.

The joints in the Lagro tills have experienced a complex history. It is clear that they originated as shear joints in response to the stress field imposed by the overriding ice. However, most of the opening and propogation of the joints to their present depths probably did not occur until post-glacial time, in response to unloading caused by removal of overlying ice, and subsequent dessication caused by lowering of the water table during warmer and drier climatic episodes. Post- glacial modification of the joints is strongly suggested by the relationship between the broad oxidation haloes, which probably formed above or within the zone of fluctuation of a formerly lower water table, and the apparently younger gleying of the joint surfaces, which has presumably formed in response to the high water table characteristic of the modern, wetter climate.



Rose diagrams showing relationship of azimuths of near-vertical joints in silty-clay till of the Lagro Formation to flow direction of the Erie Lobe at two sites in southern Allen County. Locations of sites 1 and 2 are shown on figure 17.



Adapted from Shaver and Others, 1986 ; Rupp, 1991, and Rupp, oral communications

Appendix 6. Description of wetland protection programs

Administrative agency: IDNR, Indiana Department of Natural Resources - Divisions of Water (DOW), Nature Preserves (DNP), Fish and Wildlife (DFW) and Soil Conservation (DSC); IDEM, Indiana Department of Environmental Management; USACE, U.S. Army Corps of Engineers; USEPA, U.S. Environmental Protection Agency; USDA, U.S. Department of Agriculture, TNC, The Nature Conservancy, USFWS, U.S. Fish and Wildlife Service, USFS, U.S. Forest Service, BLM, Bureau of Land Management, NPS, National Park Service, CZM, Office of Coastal Zone Management-Department of Commerce. Slash denotes cooperative program.

		Program	Administrative Agency	Relevance or Benefit to Wetlands
REGULATORY	STATE	Flood Control Act (IC 14-28-1)	IDNR-DOW	Requires permit from Natural Resources Commission for construction, excavation or filing within a stream's floodway and its encompassed wetlands.
REGULATORY	STATE	Lake Preservation Act (IC 14-26-2)	IDNR-DOW	Requires permit from Natural Resources Commission to alter the bed or shoreline of a public freshwater lake of natural origin.
REGULATORY	STATE	Nature Preserves Act (IC 14-4-5)	IDNR-DNP	Protects wetlands contained within a dedicated Nature Preserve[1].
REGULATORY	STATE	Water quality regulations	IDEM	Authority to protect most wetland types is inherent in the Indiana Stream Pollution Control Law (IC 1971, 13-1-13) and portions of 330 IAC 1-1, which establishes water quality standards for designated water use categories. Anti- degradation provisions typically are applied to wetlands.
REGULATORY	FEDERAL	Section 404/401 permit program	USACE/IDEM/USEPA	Regulates discharge of dredge or fill into wetlands and waterways; Section 401 of Federal Clean Water Act requires a water quality certification or waiver by IDEM prior to issuance of a Section 404 dredge-and-fill permit from USACE; USEPA may evaluate suitability of sites for fill placement.
REGULATORY	FEDERAL	1986 Emergency Wetlands Resources Act		Requires that statewide outdoor recreation plans include a wetland priority conservation plan. It also requires the USFWS to update its report on the status and trends of wetlands every 10 years.

[1] Nature Preserves, which may be publicly or privately owned, possess significant natural communities, geologic features, or rare plant and animal species.

Appendix 6. Description of wetland protection programs – Continued

		Program	Administrative Agency	Relevance or Benefit to Wetlands
REGULATORY	FEDERAL	Executive Order 11990, Protection of Wetlands. (1977)	All Federal Agencies	Minimizes impact on wetlands from Federal activities.
REGULATORY	FEDERAL	Executive Order 11988	All Federal Agencies	Requires Federal agencies to avoid direct or indirect support of flood plain development wherever there is a practical alternative. Many wetlands are located in floodplains.
REGULATORY	FEDERAL	Fish and Wildlife Coordination Act (1967)	USFWS	Requires that wildlife conservation be given equal consideration when planning water resource development.
REGULATORY	FEDERAL	Water Resources Development Act (1976)(1990)	USACE	Requires that USACE achieve the wetland no-net loss goal based on both acreage and function for new water projects, to enhance existing environmental values of projects, and to carry out wetland restoration and creation demonstration projects.

Appendix 6. Description of wetland protection programs – Continued

		Program	Administrative Agency	Relevance or Benefit to Wetlands
NON REGULATORY	STATE	Wetland conservation program	IDNR-DFW	Funds land acquisition for wetland protection and waterfowl management.
		Natural areas registry	IDNR-DNP/TNC	Encourages voluntary conservation efforts on private land containing significant natural communities or rare plant or animal species.
		Natural heritage protection campaign (IC 14-4-5.1)	IDNR-DNP/TNC	Identifies and ranks significant natural areas according to the need for protection; funds acquisition and protection of these areas.
		Non-game and endangered wildlife program	IDNR-DFW	Prohibits the taking of state endangered wildlife species; program includes monitoring surveys of wetland wildlife.
		Federal Endangered Species Act	USFWS	Prohibits the taking of Federal endangered species. Provides for the conservation of wetland species habitat.
		Wildlife habitat cost-share project	IDNR-DFW	Reimburses landowners for developing or improving wildlife habitat, including wetlands.
		Classified wildlife habitat and riparian lands program	IDNR-DFW	Provides technical assistance and reduced property tax assessment for land and wetlands placed in the program.
	FEDERAL	Food Security Act (1985 Farm Bill)	USDA	"Swampbuster" provision revokes certain federal farm. program benefits if wetlands are converted into farmland.
				Conservation Reserve Program (CRP) promotes financial incentives for removing wetlands from production for at least 10 years.
				Conservation Easements Program grants easements on wetlands to aid in farm debt reduction.
		1990 Farm Act Agricultural Wetland Reserve Program (AWRP)	USDA	States that of the remaining cropland eligible for the CRP, up to one million acres may be wetlands for inclusion in the AWRP over the next five years. Easements have terms of 30 years or more.

Appendix 6. Description of wetland protection programs – Continued

		Program	Administrative Agency	Relevance or Benefit to Wetlands
NON REGULATORY	FEDERAL	Federal Aid to Wildlife Restoration Act (1937)(1974)	USFWS	Provides grants to States for acquisition, restoration, and maintenance of wildlife areas, including wetland areas.
		Migratory Bird Hunting and Conservation Stamps (1934)	USFWS	Acquires or purchases easements on wetlands with revenue from fees paid by hunters for duck stamps.
		Wetlands Loan Act (1961)	USFWS	Provides interest-free Federal loans for wetland acquisitions and easements.
		Land and Water Conservation Fund Act (1968)	USFWS, BLM, FS, NPS	Acquires wildlife areas, including areas containing wetlands.
		Coastal Zone Management Act (1972)	CZM	Provides up to 80% in matching-funds grants to states to develop coastal management plans that give wetland protection high priority.
		North American Wetlands Conservation Act (1989)	USFWS	Provides public-private partnerships with matching federal grant monies to conserve wetland ecosystems and the species that they support, primarily waterfowl. This act also provides funds for the implementation of the North American Waterfowl Management Plan which strives to increase continental waterfowl populations by restoring and protecting waterfowl habitat.
		"No Net Loss" Policy (1988)	All Federal Agencies	Formulated by the National Wetland Policy Forum in 1988 and echoed by President Bush in his 1990 budget address, the no-net loss concept for wetlands has become a cornerstone for wetland conservation in the United States.

Appendix 7. Waterfowl, game, and furbearers, found in Indiana wetlands

(Information from state game managers)

Migratory Game Birds	Shovelers	*Other:*	**Furbearers**
	Blue-winged Teal	Sandhill Crane (P)	
Ducks:	Green-winged Teal	Swan (P)	Beaver
Black ducks	Widgeons		Bobcat (P)
Buffleheads	Wood ducks	**Small Game**	Coyote
Canvasbacks			Fox (red)
Gadwalls	Geese:	Pheasant	Mink
Goldeneyes	Canada Goose	Rabbit, swamp* (P)	Muskrat
Mallards	Snow Goose		Opossum
Mergansers	White-fronted Goose	**Big Game**	Otter* (P)
Old-squaws (R)			Raccoons
Pintails	*Webless:*	Black bear (E)	Weasel
Redheads	Coots	Elk (E)	
Ring-necked ducks	Gallinules	White-tailed deer	
Ruddy ducks	Rail		
Scaups	Snipe		
Scoters (R)	Woodcock		

* Not found in the Maumee River basin
(E) Extirpated in Indiana
(P) Protected
(R) Rare

Appendix 8. Wastewater discharges for selected facilities permitted under the National Pollutant Discharge Elimination System (NPDES)

Facility type: RSD - Regional Sewer District, MSTP - Municipal Sewage Treatment Plant, CD - Conservation District, IN - Industry.
Site locations for facilities discharging approximately 1MGD or more are shown in figure 31.
Data compiled by IDNR, Division of Water staff and from unpublished files of the Indiana Department of Environmental Management.
Numbers given below are based on 1994 or 1995 data unless otherwise indicated.

Facility type and name		Receiving Stream	Average flow (MGD)	Design flow (MGD)
RSD	Allen County	Houk Ditch to St. Marys River	0.052(a)	0.052(a)
MSTP	Auburn	Cedar Creek	2.9	3.35(b)
MSTP	Avilla	Little Cedar Creek to Cedar Creek	0.192	0.225
MSTP	Berne	Habegger Ditch to Wabash River	0.6	0.638
MSTP	Butler	Big Run Creek to St. Joseph River	0.349(c)	0.4(c)
MSTP	Corunna	Maumee River	0.019(d)	0.024
MSTP	Decatur	St. Marys River	1.83	2.8
MSTP	Fort Wayne	Maumee River	43	60
MSTP	Garrett	Garrett Ditch to Cedar Creek	0.576	0.88
CD	Hamilton Lake	Fish Creek to St. Joseph River	0.202	0.3
MSTP	Monroeville	A-S-0B Ditch to Flat Rock Creek to Maumee River	0.149(a)	0.144(a)
MSTP	Waterloo	Cedar Creek	0.273	0.24(e)
MSTP	Woodburn	Edgerton Carson Ditch to Maumee River	0.177	0.4
IN	Auburn Foundry, Inc. Plant #1	Peckherd Ditch to Cedar Creek	0.065	N/A
IN	Auburn Foundry, Inc. Plant #2	Wetland to tributary to Cedar Creek	0.0(f)	"
IN	Auburn Gear, Inc.	Cedar Creek	0.187	"
IN	B & B Custom Plating	St. Marys River via unnamed tributary	neg.	"
IN	Bohn Aluminum Corporation	Teutsch Ditch to Big Run	0.086	"
IN	Central Soya Co., Inc.	St. Marys River	.703(g)	"
IN	Chemical Waste Mgt. of Indiana	Trier Ditch to Maumee River	0.72	"
IN	Cooper Tire & Rubber Co.	Grandstaff Ditch to Cedar Creek	0.21(h)	"
IN	Dana Corp. Spicer Axle Div.	Newhause Ditch to Spy Run	1.18	"
IN	Dana Corp. Spicer Clutch Div.	Cedar Creek	0.17	"
IN	DeKalb Molded Plastics Company	Teutsch Ditch to Big Run	0.0015	"
IN	Deli Depot Marathon Station	Lincolndale Drain to Spy Run	0.021	"
IN	Eagle-Picher Plastic Division	Haifley Ditch to St. Joseph River	0.31	"
IN	Fort Wayne Metals	Bradbury Ditch to St. Marys River	0.04	"
IN	Fort Wayne wire Die, Inc.	Harbor Dofairfield Ditch to St. Marys River	.016(i)	"
IN	France Stone, Midwest Quarry	Edgerton—Carson Ditch to Maumee River	0	"
IN	France Stone, Woodburn Quarry	Maumee River	4.1	"
IN	General Electric Co., Fort Wayne	St Marys River	0.18	"
IN	ITT Aerospace / Optical Division	Harvester Ditch to Maumee River	0.033	"
IN	Magnavow Gov't and Ind'l Electrn	Spy run to St. Marys River	—	"
IN	Mechanics Laundry	St. Marys River	0.1	"

Appendix 8. Wastewater discharges for selected facilities permitted under the National Pollutant Discharge Elimination System (NPDES) — Continued

Facility type and name		Receiving Stream	Average flow (MGD)	Design flow (MGD)
IN	Meshberger Bros. Stone Plt. #2	Unnamed Ditch to Blue Creek to St. Marys River	0.8	N/A
IN	Norfolk and Western Railway Co.	Trier Ditch to Maumee River	0.017	"
IN	Northcrest Shopping Center	St. Joseph via Stoney Run Creek Sewer	0.028	"
IN	Nucor Fastener Plant	St. Joseph River	0.432	"
IN	Phelps Dodge Magnet Wire Co.	Harvester Ditch to Maumee River	0.00(k)	"
IN	Philips Technologies	Grandstaff Ditch to Cedar Creek	0.0311	"
IN	R.J. Tower Corporation	Grandstaff Ditch to Cedar Creek	—	"
IN	Ralph Sechler & Sons, Inc.	Hindman Ditch to St. Joseph River	0.036	"
IN	Rea Magnet Wire Co., Inc.	Harvester Ditch to Maumee River	0.015(i)	"
IN	Rieke Corporation	Cedar Creek	0.33	"
IN	Sealed Power Tech., Contech	Grandstaff Ditch to Cedar Creek	0.648	"
IN	Stafford Gravel	St. Joseph River	—	"
IN	Stone-Street Quarries, Inc.	Unnamed Tributary to St. Marys River	0.6	"
IN	Uniroyal Goodrich Tire Company	Maumee River	.938(m)	"
IN	United Technologies Automotive	Blue Creek to St. Marys River	0.022(n)	"
IN	Universal Tool and Stamping Co.	Teutsch Ditch to Big Run	—	"
IN	Volcraft Div., Nucor Corp.	St. Joe wastewater treatment facility	0.0007(p)	"

N/A - not applicable
neg. - Amount of discharge is negligible.
a) 1992 data.
b) Plant capacity will be expanded to 4.5 MGD in April of 1996.
c) Numbers are based on 1992 data. New facility presently under construction.
d) 1992 estimate, facility has no flow meter.
e) Funds are being obtained to increase plant capacity to approximately 0.5 MGD.
f) New plant presently under construction.
g) Based on a 6 month average, June-November, 1995.
h) Plant discharges an additional .12 MGD to the Auburn MSTP.
i) Discharge is exclusively non-contact cooling water.
k) Due to plant design changes, the facility disharges less than one gallon per minute and expects to reduce this to zero in the near future.
m) Discharge is for the entire facility and includes stormwater runoff and some agricultural drainage.
n) Incorporates all discharges including sewer.
p) Until Dec. 1st, 1995, plant discharged to the St. Joseph River. Discharge is an average of 88 batches of approx. 3000 Gal.

Appendix 9. Standards and suggested limits for selected inorganic constituents

(All values except pH and are in milligrams per liter. If multiple uses have been designated, the most protective standard applies. Dash indicates no available criterion).

Aquatic life: Values for all constituents except iron, pH, selenium, and silver are 4-day average concentrations; selenium value is the 24-hour average; silver criterion is not to be exceeded at any time. All values are chronic aquatic criteria which apply outside the mixing zone, except for silver which is the acute aquatic criterion. Where applicable, trace metal standards were calculated using a hardness value of 325 milligrams per liter. Except where indicated, all values are from trhe Indiana Water Pollution Control Board, 1992, IAC 327 2-1-6.

Public supply: Unless otherwise noted, values represent maximum permissible level of contaminant in water at the tap. National secondary regulations (denoted sec) are not enforceable. All values are from the U.S. Environmental Protection Agency, 1994.

Irrigation and livestock: All values are from the U.S. Environmental Protection Agency, 1973.

Constituent	Aquatic life	Public supply	Irrigation	Livestock
Arsenic (trivalent)	0.190	0.05	0.10	0.2
Barium	-	2.0	-	-
Cadmium	0.003	0.005	0.01	0.05
Chloride	230	250 sec	-	-
Chlorine	0.011	-	-	-
Chromium (total)	0.05[a]	0.1	0.1	1.0
Copper	0.032	1.0 sec	0.20	0.5
Cyanide	0.005	0.2	-	-
Fluoride	-	4.0	1.0	2.0
	-	2.0 sec		
Iron	1.00[b]	0.3 sec	5.0	-
Lead	0.014	-	5.0	0.1
Manganese	-	0.05 sec	0.20	-
Mercury (inorganic)	0.012*	0.002	-	0.01
Nickel	0.427	0.1	0.20	-
Nitrate (asnitrogen)	-	10.0	-	-
pH (standard unit)	6.0-9.0	6.5-8.5 sec	4.5-9.0	-
Selenium	0.035	0.05	0.02	0.05
Silver	0.015	0.1 sec	-	-
Sulfate	-	250 sec	-	-
Total dissolved solids	-	500 sec	500-1000	3000
Zinc	0.288	5 sec	2.0	25.0

* Value is in micrograms per liter
[a] U.S. Environmental Protection Agency, 1973
[b] _____1976

Appendix 10. Summary of fishery surveys on selected streams and lakes.

{Indiana Department of Natural Resources, Fish and Wildlife Division}

Fishery surveys conducted by the Indiana Department of Natural Resources, Division of Fish and Wildlife may provide additional information about fish populations and water-quality of streams and lakes. Fish sampled are classified by species, size, and weight, and water-quality samples are often taken concurrently. In the Maumee River basin, IDNR fish sampling studies have been performed on the major river systems as well as some smaller streams and several lakes.

In July of 1977, a survey was completed to evaluate the present and future sport fishing potential of **rivers in the Maumee basin**. Four sample stations on the St. Marys River, four on the St. Joseph River, and 2 on the Maumee River were evaluated. Thirty-six species of fish were collected with gamefish comprising 56 percent of the sample by number, but only 17 percent by weight. The St. Marys River offered poor quality sport fishing. Upstream sections were overwhelmingly dominated by carp and white sucker with few game species. Downstream sections were similar except for limited channel catfish fishing. The Maumee River offered poor quality fishing as well. The fish population was dominated by carp and white suckers with very few catchable-size gamefish. The St. Joseph River offered the highest quality fishing of the three for several reasons: diversity was greatest, there were higher numbers and a greater biomass of sunfish and catfish species, and some larger gamefish were present.

The **St. Marys River** was re-evaluated in 1992. Five sampling stations were used, four of which were near those used in 1977. It was determined that the water-quality and habitat of the river was severely degraded. High turbidity and silt loads limited sight feeding game fish populations such as smallmouth bass and rock bass. Game species accounted for only 15.2 percent of the total number and only 8.1 percent by weight. Snagging and clearing operations and stream bank alterations have removed most stream habitat. Unless major changes are made in land use practices throughout the watershed, there is little chance of gamefish populations recovering and providing a substantial and sustainable fishery.

A program is underway to improve **walleye fishing in the Maumee River basin.** Fifty thousand fingerlings will be released in June, 1996 at 10 locations on the St. Joseph and St. Marys Rivers. In 1995, pre-stocking surveys were completed to obtain background information on current walleye populations in the Maumee watershed. Four locations on the Maumee, one on the St. Joseph, and one on the St. Marys were evaluated. Angler catch information was also collected. All species were sampled at the Maumee River stations, but only walleye were sampled on the St. Joseph and St. Marys Rivers. On the Maumee River, 26 species were found. Gizzard shad accounted for 45 percent of the fish population, followed by common shiners (19 percent), and steelcolor shiners (10 percent). Only seven walleyes were collected, six of these were captured above Hosey Dam. Popular sportfish included drum, channel catfish, smallmouth bass, and a few rock bass. Only three walleye (4/hr) were collected on the St. Joseph, and only one was captured (1/hr) on the St. Marys River. The total combined catch rate for walleye was 1.8/hr.

A survey of **Cedar Creek** was completed in 1978. At that time there was a general low abundance of popular game fish which was probably the result of habitat inadequacies and not a lack of adult spawners. The presence of adult species indicates that some factors other than the lack of brood fish are limiting the fishery.

Cedarville Reservoir in Allen county was last surveyed in 1986. Previous fish management activities included fish surveys in 1966 and 1977, and the stocking of white bass in 1975. It was determined in 1986 that the lake supported poor quality sport fish populations. Winter fish kills occur quite regularly due to low oxygen content, and conditions are not stable enough to allow older game fish populations to develop.

The first fishery survey of **Indian Lake** occurred in 1963. In response to the surveys recommendations, the lake was treated in 1964 with 20.5 gal of rotenone to remove a large number of gizzard shad. The lake was subsequently restocked with 21,000 largemouth bass fingerlings. On August 8, 1994, another survey was conducted on the fish population. Gamefish accounted for 81 percent of the catch and 62 percent by weight. Indian lake presently supports a mediocre bluegill population, but ample numbers of largemouth bass and crappies are available. Bull heads, perch, and sunfish add diversity to the fishing opportunity.

Cedar Lake was first surveyed in 1962. The lake was treated with a low concentration of rotenone to kill a large number of gizzard shad, and restocked with 5,600 largemouth bass fingerlings. In August of 1994 another survey was conducted. Gizzard shad dominated the catch by number (47 percent) and weight (30 percent). Sportfish made up only 39 percent of the catch and 26 percent by weight. Adequate oxygen was available only in the top 5 to 10 feet. Cedar Lake has a poor quality bluegill fishery and few other gamefish are available. Management problems include: excessive siltation from the surrounding area, low visibility, lack of diverse aquatic plant community, over-abundant gizzard shad, excessive immigration of riverine species, low bluegill density, and a lack of large predator fish.

Built in 1969, public access to the **Hurshtown Reservoir** was denied until 1986. Entree fees are charged, and no outboard motors are allowed. Enough oxygen was available in the top 20 feet, so following the recommendations of a 1987 survey, smallmouth bass were stocked in 1989. Additional surveys were conducted in 1990 and 1992 to monitor the survival rates of stocked bass. Despite the establishment of a smallmouth bass fishery, the reservoir continues to provide poor quality fishing opportunities. Few other sportfish are present, and small carp and yellow bullheads tie up much of the reservoirs production. Biennial stocking of 26,000 smallmouth bass continue, but no additional species are stocked at this time.

Long Lake is bisected by the Indiana-Michigan state line. A reciprocal fishing agreement exists between the two states. Long Lake was hydrogeographically surveyed in 1962, and the fish population was surveyed in 1985 by the Michigan Department of Natural Resources. The latest survey was conducted by the IDNR in May of 1992. Dominant species by number were largemouth bass (23.9 percent), redear (20 percent), and yellow perch (18.2 percent), and by weight were largemouth bass (20.7 percent), redear (16.3 percent), carp (12.1 percent),and yellow perch (10.5 percent). As is evident by these numbers, Long Lake supports a good population of sportfish. Excellent fishing opportunities are available, although few largemouth bass are within the legal limit.

Round Lake was hydrologically surveyed in 1956, and a fish survey was conducted in June of 1992. Dominant species by number were largemouth bass (26 percent) and bluegill (22.3 percent). Largemouth bass (22.2 percent) longnose gar (20.4 percent) and carp (16.9 percent) were the dominant species collected by weight. Round Lake supports a good sport fish population and should provide good fishing opportunities. Species composition, growth rates and length frequencies are satisfactory.

A large diameter culvert passes under a road and connects **Clear Lake** with Round Lake. Clear Lake has been stocked numerous times with walleye. In April - October, 1988, creel surveys were done to determine types of fish being harvested. In order of numbers caught, the fish harvest included: Yellow perch, rock bass, bluegill, rainbow trout, walleye, largemouth bass, and smallmouth bass. At that time, Clear Lake supported a popular and diverse fishery.

Ball Lake was hydrographically surveyed in 1960. It was originally surveyed by fisheries biologists from the IDNR in 1967. Due to abundance of rough fish and 3-5 inch bluegill, a total fish eradication project was completed in 1968. The lake was subsequently restocked with smallmouth bass, rock bass, and rainbow trout. Although total eradication of rough fish was not achieved, a much improved fishery developed. Additional surveys were accomplished in 1968, 1972, 1978, 1983, and 1988. These surveys indicated a decline in the fishery. In 1983 it was recommended that tiger muskies be stocked to provide additional sport fishing opportunities. The original stocking of tiger muskies took place in 1985, and additional stockings were done in 1986, 1987, 1989, and 1990. Early stockings consisted of pellet-reared tiger muskies and were unsuccessful. Pellet reared-forage finished fish were stocked starting in 1987. The present survey, conducted in April of 1990, indicates that the 1987 fish stocking program was the most successful. According to this 1990 survey, Ball Lake is dominated by black crappie, largemouth bass, and tiger muskies. Gizzard shad however, are abundant and can be detrimental to sport fish populations by competing with their young for food.

Hydrogeographically surveyed in 1957, **Hamilton Lake** was first surveyed by IDNR fisheries biologists in 1977 at the request of Hamilton Lake property owners. The sport fishery was considered satisfactory at that time with the dominant species by weight being bluegill (19.4 percent) bowfin (15.8 percent) and northern pike (10.4 percent). The latest survey took place in September of 1985. At that time, Hamilton Lake supported a good population of sport fish that was dominated numerically by bluegill, yellow perch, black crappie, and largemouth bass. Bluegill dominate, but weights are low and harvestable numbers have declined significantly. The fishery is best suited for black crappie, largemouth bass, and northern pike. The most significant change since 1977 was the development of a large gizzard shad population.

Additional fishery information in the Fort Wayne area can be found in an unpublished report by the IDNR Division of Fish and Wildlife titled Current Fish Resources and Fishing Opportunities in Fort Wayne, Indiana by Jed Pearson, Fisheries Biologist.

Appendix 11. Morphometric and trophic characteristics of Maumee River basin lakes

Lake Name	Trophic Class	Surface Area (acres)	Maximum Depth (ft)	Mean Depth (ft)	Total Phosphorus (mg/l)	Secchi Disc (ft)	Eutrophication Index	Lake Management Group
Adams Co.								
Saddle	two	24	10	10.0	0.04	2.0	41	VII C
Allen Co.								
Cedarville Res.	two	245	20	4.0	0.12	0.9	24	VI A
Hurshtown Res.	–	265	35	–	–	–	–	–
St. Joseph Res.	–	30	–	–	–	–	–	–
DeKalb Co.								
Cedar	three	28	30	8.2	0.08	2.5	40	VII C
Indian	two	56	38	15.0	0.10	9.5	34	VII C
Steuben Co.								
Ball	one	87	66	40.5	0.18	4.6	24	II C
Clear	one	800	107	31.2	0.09	7.6	19	II B
Hamilton	two	802	70	20.0	0.12	4.3	26	VI C
Long	two	154	36	11.9	0.13	4.3	40	VII C
Round	one	30	25	11.3	0.03	17.1	20	VII A

Indiana Lake Classification System and Management Plan, Indiana Department of Environmental Management, 1986a.
Indiana 305 (b) Report, 1992-1993, Indiana Department of Environmental Management, [1995].

Appendix 12. Yield and costs of various tillage systems in Indiana for corn and soybeans

The information below represents four-year average yield, and chemical and field operational costs of various tillage systems in Indiana. Costs and yield are based on acres. Production costs per bushel are calculated solely on average expenditures for agricultural related chemicals and standard field operations.

The numbers are based on the Indiana T-by-2000 Educational Program study conducted through the Farming for Maximum Efficiency Program by Purdue soil and water conservation specialists.

This table is adapted from information given in the Fish Creek Watershed Newsletter, Issue 4, August 1994

	Number of fields	Chemical costs	Field operations	Total cost	Number of fields	Four year avg. yield (bushels)	Prod. cost per bushel
Corn							
No-till	**285**	**$24.31**	**$48.43**	**$72.74**	**377**	**149.3**	**$ 0.49**
Ridge-till	46	$19.54	$58.99	$78.53	53	148.3	$ 0.53
Reduced-till	161	$23.55	$59.97	$83.52	205	146.6	$ 0.57
Plow	52	$19.51	$67.88	$87.39	57	150	$ 0.58
Soybeans							
No-till	**276**	**$32.77**	**$44.79**	**$77.56**	**377**	**48.4**	**$ 1.60**
Ridge-till	25	$20.79	$56.26	$77.05	30	46.9	$ 1.64
Reduced-till	126	$25.77	$58.10	$83.87	161	46.9	$ 1.79
Plow	48	$24.43	$61.62	$86.05	51	50	$ 1.72

Appendix 13. Results of chemical analysis from selected wells

{All values in milligrams per liter except as indicated.}

{Well locations displayed in figure 55.}

NA, Analysis not available or not conducted; *, Indiana Department of Environmental Management volatile organic and pesticide sampling site; ^, Questionable data value.

Aquifer systems: HC, Hessen Cassel aquifer system; KEN, Kendallville aquifer system; NH, New Haven aquifer system; SD, Silurian and Devonian bedrock aquifer system; SH, Devonian shale; TVT, Teays Valley and Tributary aquifer system.

Date sampled: month/year.

Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
ADAMS COUNTY																					
1	87741	28N	14E	6	112	TVT	9/88	7.6	699	121.6	96.4	127.4	4.2	1.5	0.1	122.3	< 1.0	837.0	1.3	< 1.0	1348
2	87696	26N	15E	31	88	TVT	9/88	^6.3	975	234.4	94.9	77.0	2.2	5.8	0.1	156.9	7.4	828.0	1.6	< 1.0	1454
3	87746	28N	14E	4	149	SD	9/88	7.6	654	122.3	84.9	69.1	1.6	1.1	< 0.1	144.5	4.5	631.0	1.6	< 1.0	1104
4	103827	28N	14E	34	395	SD	8/83	7.6	522	137.0	44.0	36.0	2.0	1.0	< 0.1	236.0	9.0	350.0	1.1	< 1.0	N.A.
5	87802	28N	15E	35	170	SD	9/88	7.8	299	81.9	22.9	76.8	1.1	0.9	< 0.1	106.2	7.8	328.0	2.0	< 1.0	657
6	103812	28N	14E	34	400	SD	8/83	7.5	700	184.0	58.0	36.0	3.3	0.6	< 0.1	358.0	31.0	380.0	0.8	< 1.0	N.A.
*7	86590	27N	15E	17	88	SD	9/88	7.2	953	204.4	107.9	64.0	2.0	3.2	< 0.1	183.7	5.5	850.0	1.5	< 1.0	1475
8	103767	28N	14E	34	439	SD	6/81	7.2	608	155.0	53.0	35.0	2.2	4.4	< 0.1	276.0	11.0	390.0	1.2	< 1.0	N.A.
*9	87756	28N	13E	21	122	SD	9/88	7.7	1250	317.9	111.0	104.7	2.9	1.1	0.1	58.1	3.5	1320.0	1.0	< 1.0	1944
10	110608	27N	14E	32	115	TVT	3/79	7.1	1060	301.0	74.0	101.0	N.A.	1.4	< 0.1	124.0	8.0	1100.0	1.4	< 1.0	1730
*11	87751	28N	13E	25	207	SD	9/88	7.5	833	190.7	86.8	74.5	1.9	2.0	< 0.1	135.9	8.4	833.0	1.4	< 1.0	1376
12	120123	25N	14E	2	150	TVT	8/83	7.3	544	133.0	52.0	64.0	2.9	1.6	< 0.1	170.0	12.0	480.0	1.6	< 1.0	N.A.
13	87691	27N	13E	2	100	HC	9/88	7.2	858	228.2	70.1	81.6	2.0	9.1	0.3	114.9	60.0	890.0	1.6	< 1.0	1496
*14	87761	28N	13E	3	142	SD	10/88	7.1	650	130.5	79.0	57.3	2.2	1.9	< 0.1	227.3	12.1	553.0	1.4	< 1.0	1129
*15	87686	27N	13E	3	195	SD	9/88	7.5	689	182.2	57.1	73.7	1.7	1.8	< 0.1	137.1	< 1.0	664.0	2.0	< 1.0	1163
16	87716	26N	14E	17	127	SD	10/88	6.9	1291	406.6	67.0	80.6	2.2	4.0	0.2	110.5	4.5	1233.0	1.9	< 1.0	1944
17	87681	27N	13E	26	120	SD	9/88	7.4	747	168.1	79.6	76.9	1.7	2.3	< 0.1	176.7	< 1.0	681.0	2.2	< 1.0	1239
18	86580	28N	15E	9	107	SD	10/88	7.5	593	140.1	59.3	72.4	1.4	1.0	< 0.1	133.6	5.8	567.0	1.2	< 1.0	1019
*19	86595	27N	14E	23	117	SD	9/88	7.4	1048	272.2	89.6	75.9	2.2	3.5	< 0.1	143.3	< 1.0	993.0	1.8	< 1.0	1625

Appendix 13. Results of chemical analysis from selected wells – Continued

Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
ADAMS COUNTY - continued																					
20	103822	28N	14E	34	25	SD	8/83	7.5	628	169.0	50.0	30.0	2.3	1.0	< 0.1	312.0	14.0	370.0	0.9	< 1.0	N.A.
*21	87721	26N	13E	23	170	SD	9/88	7.3	622	163.2	52.2	79.4	1.7	2.3	0.1	185.3	5.9	564.0	1.6	6.7	1113
22	110953	28N	14E	35	396	SD	8/83	7.7	590	142.0	57.0	73.0	2.8	1.1	< 0.1	166.0	9.0	490.0	1.5	< 1.0	N.A.
23	87711	26N	14E	17	112	HC	9/88	7.4	813	248.4	46.8	79.2	1.8	2.8	0.1	138.4	8.7	922.0	2.0	< 1.0	1490
24	186291	28N	14E	35	400	SD	8/83	7.7	614	146.0	60.0	73.0	2.8	0.7	< 0.1	166.0	9.0	570.0	1.5	< 1.0	N.A.
25	87706	26N	15E	5	90	SD	9/88	7.2	1034	242.8	104.2	72.3	2.4	3.9	< 0.1	190.3	11.4	1050.0	1.6	< 1.0	1732
26	87766	28N	14E	14	320	SD	10/88	7.4	790	171.4	88.3	71.6	1.7	2.0	< 0.1	139.1	7.9	776.0	1.5	< 1.0	1302
*27	87701	26N	15E	21	156	SD	9/88	5.8	931	232.1	85.4	83.5	2.3	2.6	< 0.1	135.9	11.1	929.0	1.6	< 1.0	1526
28	103802	28N	14E	34	400	SD	8/83	7.4	786	198.0	71.0	53.0	4.5	1.7	< 0.1	350.0	52.0	440.0	0.8	< 1.0	N.A.
*29	87731	25N	15E	10	140	SD	9/88	6.1	583	138.2	57.9	56.6	1.5	2.1	0.1	207.6	7.6	476.0	1.8	< 1.0	1005
30	87726	26N	13E	23	134	HC	10/88	7.0	578	144.6	52.9	67.9	1.5	2.4	0.1	199.3	5.7	519.0	1.8	< 1.0	1047
31	120128	25N	14E	2	151	TVT	8/83	7.5	678	165.0	65.0	74.0	3.0	2.1	< 0.1	162.0	11.0	620.0	1.5	< 1.0	N.A.
32	110623	27N	14E	33	130	SD	4/79	7.1	1172	344.0	75.0	60.0	N.A.	2.1	< 0.1	132.0	10.0	1110.0	2.0	< 1.0	1810
33	87736	25N	15E	7	90	SD	9/88	6.3	862	185.5	97.1	50.5	2.0	2.4	< 0.1	404.0	7.9	539.0	1.8	< 1.0	1387
ALLEN COUNTY																					
34	87828	32N	13E	5	122	KEN	10/88	7.2	356	79.9	38.1	20.3	1.0	2.5	< 0.1	380.1	1.6	46.2	1.1	< 1.0	659
*35	87823	32N	14E	8	81	KEN	9/88	7.1	392	105.3	31.5	7.1	0.7	3.4	< 0.1	349.1	1.6	39.2	0.9	< 1.0	618
36	111791	31N	12E	15	180	SD	10/88	7.3	266	57.3	29.9	21.0	1.2	0.3	< 0.1	288.0	1.3	27.8	1.4	< 1.0	496
37	114210	31N	14E	21	48	NH	4/92	7.3	854	N.A.	N.A.	37.7	1.9	4.3	< 0.1	420.0	< 1.0	470.0	1.1	N.A.	1150
38	87888	30N	12E	2	180	SD	10/88	^9.4	82	19.8	7.9	26.3	1.5	< 0.1	< 0.1	20.8	30.6	67.9	1.0	2.0	183
39	107127	32N	14E	34	89	KEN	4/92	7.4	476	N.A.	N.A.	28.8	2.1	1.7	< 0.1	343.0	< 1.0	180.0	1.0	N.A.	586
*40	87883	30N	12E	34	74	HC	10/88	6.6	470	95.7	56.2	28.6	1.3	2.3	< 0.1	363.3	4.1	162.0	1.4	< 1.0	800
41	103028	32N	11E	13	238	SD	4/92	7.4	388	N.A.	N.A.	14.4	1.5	5.2	0.1	343.0	< 1.0	55.0	0.7	N.A.	438
42	87908	29N	13E	5	52	HC	10/88	7.1	715	142.5	87.5	27.2	1.8	3.9	< 0.1	493.3	7.5	288.0	1.1	< 1.0	1169
43	114649	31N	14E	4	305	SD	3/92	7.0	744	N.A.	N.A.	35.0	5.5	< 0.1	< 0.1	382.0	15.0	490.0	1.0	N.A.	1040
44	87288	30N	13E	16	180	SD	10/88	7.2	532	98.8	69.4	31.7	1.7	0.8	< 0.1	379.1	10.1	240.0	1.3	< 1.0	925
45	114669	31N	14E	3	53	KEN	4/92	7.2	516	N.A.	N.A.	25.5	2.9	12.3	< 0.1	372.0	17.0	175.0	0.7	N.A.	652

Appendix 13. Results of chemical analysis from selected wells – Continued

Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
ALLEN COUNTY - continued																					
46	87293	30N	13E	13	82	NH	10/88	7.4	738	129.0	101.4	42.3	2.3	9.6	0.1	447.3	4.9	344.0	1.0	< 1.0	1191
47	106800	32N	13E	34	230	SD	4/92	7.1	1690	N.A.	N.A.	30.7	4.4	6.6	0.4	510.0	11.0	1270.0	0.8	N.A.	2362
48	87878	30N	13E	9	60	NH	10/88	7.3	376	92.6	35.1	10.6	0.8	2.5	< 0.1	317.2	13.5	86.1	0.7	< 1.0	632
49	105545	32N	12E	2	93	KEN	3/92	7.0	396	N.A.	N.A.	4.0	0.9	2.3	0.1	276.0	6.0	120.0	0.3	N.A.	475
50	87807	31N	13E	17	48	HC	9/88	7.3	534	145.4	41.5	25.0	1.5	1.5	0.3	372.0	46.6	129.0	0.3	< 1.0	845
51	186311	31N	13E	4	148	KEN	5/80	7.5	380	80.0	43.0	17.0	N.A.	2.3	N.A.	352.0	2.0	7.0	1.0	10.0	424
52	186321	32N	13E	11	271	SD	10/88	7.3	421	106.5	37.7	15.9	0.8	3.2	< 0.1	407.3	2.0	80.9	0.7	< 1.0	747
53	114375	31N	13E	30	344	SD	5/83	7.4	791	N.A.	N.A.	N.A.	N.A.	0.1	< 0.1	332.0	65.0	< 1.0	N.A.	N.A.	N.A.
*54	87918	29N	12E	11	79	HC	10/88	7.2	465	87.3	60.1	47.7	1.7	1.7	0.1	321.7	3.2	188.0	1.5	< 1.0	793
55	114365	31N	13E	30	324	SD	5/83	7.5	655	N.A.	N.A.	N.A.	N.A.	0.1	< 0.1	244.0	48.0	< 1.0	N.A.	N.A.	N.A.
56	87913	29N	12E	26	340	SD	10/88	7.3	470	104.7	50.9	61.4	2.0	1.0	< 0.1	150.4	4.5	425.0	1.5	< 1.0	843
57	112242	31N	13E	3	325	SD	6/80	7.4	352	98.0	61.0	< 2.0	N.A.	0.5	0.1	339.0	2.0	43.0	0.9	5.0	567
*58	87903	29N	13E	29	100	SD	10/88	7.1	407	80.2	50.3	26.9	1.3	1.7	< 0.1	331.1	4.0	133.0	1.2	< 1.0	708
*59	87833	32N	12E	4	260	KEN	9/88	7.6	328	71.1	36.7	19.2	1.0	0.8	< 0.1	351.3	1.0	10.3	1.2	< 1.0	576
60	87898	29N	14E	7	110	SD	10/88	7.1	361	88.8	33.9	62.2	1.2	0.8	< 0.1	151.4	6.0	330.0	1.7	< 1.0	717
61	106645	32N	14E	31	80	KEN	4/92	7.3	608	N.A.	N.A.	51.6	2.9	3.2	< 0.1	408.0	< 1.0	245.0	1.1	N.A.	762
62	87848	31N	14E	1	137	SH	9/88	7.3	471	84.6	63.3	28.0	1.2	1.5	< 0.1	385.1	2.1	148.0	1.5	< 1.0	806
63	103008	32N	11E	13	73	KEN	3/92	7.0	468	N.A.	N.A.	13.7	1.8	0.2	0.1	331.0	17.0	125.0	0.6	N.A.	553
64	87813	32N	15E	18	110	NH	10/88	7.4	478	81.1	67.2	43.2	1.5	0.6	< 0.1	269.5	5.3	320.0	1.3	< 1.0	858
65	106580	32N	14E	15	106	KEN	4/92	7.4	896	N.A.	N.A.	69.5	3.3	13.7	< 0.1	357.0	6.0	625.0	1.2	N.A.	1280
*66	87843	31N	15E	17	81	SD	10/88	7.5	386	73.5	49.4	45.7	1.2	0.3	< 0.1	195.3	29.7	253.0	1.2	< 1.0	704
67	186306	31N	13E	3	146	KEN	5/80	7.4	336	86.0	29.0	15.0	N.A.	2.6	N.A.	360.0	2.0	6.0	1.0	7.0	322
68	87812	31N	14E	14	85	NH	10/88	7.2	590	104.2	80.5	33.8	1.5	1.3	< 0.1	358.4	3.2	319.0	1.1	< 1.0	991
69	112257	31N	13E	3	140	SD	10/80	7.9	360	94.0	30.0	13.0	1.0	3.0	< 0.1	370.0	< 5.0	25.0	0.6	1.1	N.A.
*70	87817	31N	14E	23	66	SD	10/88	7.2	424	99.8	42.5	11.4	0.9	0.7	< 0.1	347.9	14.7	83.2	1.3	< 1.0	683
71	111449	31N	12E	10	83	KEN	3/86	7.1	384	N.A.	N.A.	N.A.	N.A.	0.5	0.1	504.0	15.0	80.0	N.A.	N.A.	N.A.
*72	87278	30N	14E	6	68	NH	10/88	7.6	263	70.2	21.5	12.0	0.6	1.0	0.1	248.5	3.9	45.7	0.7	< 1.0	464
73	106096	32N	12E	19	89	KEN	3/92	6.8	638	N.A.	N.A.	111.5	1.8	6.3	< 0.1	307.0	9.0	330.0	0.8	N.A.	802
*74	87273	30N	14E	11	46	HC	10/88	7.5	345	70.7	41.0	50.6	1.3	1.0	< 0.1	208.3	3.6	261.0	1.1	< 1.0	695

Appendix 13. Results of chemical analysis from selected wells – Continued

Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
ALLEN COUNTY - continued																					
75	106773	32N	13E	29	131	KEN	4/92	7.4	332	N.A.	N.A.	21.6	1.8	2.7	< 0.1	343.0	< 1.0	13.0	0.8	N.A.	355
*76	87263	30N	15E	10	74	SD	10/88	7.5	306	71.0	31.3	36.6	1.1	0.1	< 0.1	152.1	28.2	223.0	1.9	< 1.0	584
77	87818	32N	14E	21	93	KEN	9/88	7.6	713	107.8	108.2	44.5	1.9	2.8	< 0.1	378.1	4.4	400.0	1.5	< 1.0	1143
*78	87258	30N	15E	30	75	HC	10/88	7.5	443	88.9	54.0	59.5	1.5	1.3	< 0.1	185.1	6.9	379.0	1.2	< 1.0	829
79	114644	31N	14E	4	57	KEN	3/92	6.8	586	N.A.	N.A.	55.3	2.7	2.9	0.2	374.0	5.0	270.0	1.0	N.A.	776
80	87893	29N	15E	23	80	SD	10/88	7.5	694	170.2	65.5	72.6	1.9	1.0	0.1	97.2	10.5	714.0	1.1	< 1.0	1168
81	87283	30N	12E	17	140	SD	9/88	7.4	457	124.1	35.9	14.1	0.7	2.0	< 0.1	285.3	50.8	113.0	0.6	< 1.0	691
82	87268	30N	14E	27	68	HC	10/88	7.4	481	90.9	61.9	64.9	1.8	1.1	< 0.1	189.8	6.2	426.0	1.4	< 1.0	897
DEKALB COUNTY																					
*83	87832	34N	13E	16	80	KEN	9/88	7.3	264	58.5	28.7	20.7	0.7	1.4	< 0.1	299.0	5.0	10.2	1.6	< 1.0	501
*84	87852	34N	15E	8	42	KEN	9/88	6.8	580	169.6	38.1	4.8	0.7	4.6	0.2	377.9	20.4	113.0	0.2	< 1.0	813
85	87837	34N	12E	15	53	KEN	9/88	7.2	357	83.6	36.1	17.4	0.8	2.0	< 0.1	294.9	3.9	95.3	1.2	< 1.0	607
86	87899	33N	12E	5	65	KEN	9/88	7.4	309	73.8	30.4	13.6	0.7	1.7	< 0.1	307.0	1.5	23.6	1.2	< 1.0	526
87	87912	33N	15E	5	124	KEN	9/88	7.2	299	73.1	28.3	12.6	0.7	0.6	< 0.1	307.7	1.2	10.7	1.3	< 1.0	508
88	87822	34N	14E	22	190	KEN	9/88	7.1	302	75.6	27.6	15.5	0.7	2.4	< 0.1	330.2	3.8	< 1.0	0.9	< 1.0	533
89	87907	33N	15E	29	199	KEN	10/88	7.5	243	47.4	30.2	28.8	0.8	0.9	< 0.1	306.9	1.8	13.4	1.2	< 1.0	504
90	87892	35N	14E	33	101	KEN	9/88	7.4	289	74.3	25.1	14.3	0.7	3.2	< 0.1	308.7	1.8	5.4	0.9	< 1.0	506
*91	87917	33N	14E	22	60	KEN	9/88	7.2	349	80.6	35.9	21.1	1.0	2.0	< 0.1	314.7	3.6	69.1	1.2	< 1.0	603
92	87873	35N	13E	7	150	KEN	9/88	7.4	308	82.7	24.6	7.4	0.5	4.0	0.2	308.2	1.3	11.3	0.9	< 1.0	511
*93	186316	33N	13E	10	52	KEN	10/88	7.7	267	60.6	28.1	20.3	0.8	2.9	< 0.1	337.2	1.5	< 1.0	1.1	< 1.0	531
94	87872	34N	12E	1	118	KEN	9/88	7.4	315	74.2	31.6	14.9	0.7	2.2	< 0.1	330.8	1.4	30.9	1.2	< 1.0	568
*95	87902	35N	14E	11	99	KEN	9/88	6.9	674	160.0	66.9	18.0	1.3	11.1	0.1	442.6	14.8	244.0	0.6	< 1.0	1057
*96	87853	35N	13E	33	40	KEN	9/88	7.3	290	84.4	19.3	2.1	0.6	0.3	< 0.1	245.0	5.4	50.7	0.2	< 1.0	462
97	87868	35N	13E	11	220	KEN	9/88	7.4	308	77.0	28.2	10.1	0.6	1.7	< 0.1	327.8	< 1.0	6.9	1.1	< 1.0	532
98	87827	34N	13E	24	94	KEN	9/88	7.4	267	59.7	28.6	19.8	0.7	1.1	< 0.1	297.1	2.6	8.3	1.2	< 1.0	490
99	87889	33N	13E	20	192	KEN	9/88	7.3	271	59.9	29.4	21.5	0.8	0.9	0.1	303.5	2.5	8.2	1.4	< 1.0	499
100	108296	34N	13E	31	131	KEN	1/86	6.6	360	N.A.	N.A.	N.A.	N.A.	2.8	< 0.1	304.0	31.0	62.0	0.9	< 1.0	N.A.

Appendix 13. Results of chemical analysis from selected wells – Continued

Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
DEKALB COUNTY - continued																					
101	87882	35N	15E	18	109	KEN	9/88	7.1	345	92.3	27.8	9.6	0.6	2.7	< 0.1	320.8	3.0	31.9	0.8	< 1.0	562
102	108301	34N	13E	31	85	KEN	2/86	6.9	336	N.A.	N.A.	N.A.	N.A.	1.7	0.1	264.0	22.0	48.0	N A	N.A.	N.A.
103	87857	34N	14E	34	225	KEN	9/88	7.5	264	61.8	26.6	21.7	0.8	1.8	< 0.1	303.0	2.7	< 1.0	1.2	< 1.0	491
104	186281	34N	13E	30	93	KEN	5/82	8.0	278	78.0	20.0	17.0	1.8	2.3	< 0.1	291.0	< 5.0	16.0	1.0	< 1.0	N.A.
105	87863	35N	13E	21	182	KEN	10/88	7.7	299	75.3	27.0	14.0	0.6	5.1	< 0.1	329.7	1.6	6.2	0.9	< 1.0	536
106	186286	34N	13E	30	88	KEN	4/82	7.9	286	81.0	20.0	17.0	1.8	1.7	0.1	296.0	< 5.0	20.0	0.9	< 1.0	N.A.
*107	87887	35N	15E	5	96	KEN	9/88	7.2	356	79.5	38.4	23.5	1.0	1.8	< 0.1	348.7	5.6	48.3	1.2	< 1.0	630
108	87847	35N	12E	8	93	KEN	9/88	6.9	459	127.2	34.5	4.0	0.5	2.6	< 0.1	351.7	8.3	79.7	0.2	< 1.0	686
109	87894	33N	12E	15	184	KEN	9/88	7.3	302	68.7	31.8	18.8	1.1	1.2	< 0.1	313.4	1.6	6.9	1.2	< 1.0	519
110	87877	35N	12E	28	253	KEN	9/88	7.2	285	71.7	25.9	14.0	0.6	1.3	< 0.1	319.8	1.5	< 1.0	0.9	< 1.0	509
111	87842	33N	14E	1	102	KEN	10/88	7.6	307	66.4	34.4	21.8	0.9	1.4	< 0.1	350.4	4.5	19.0	1.1	< 1.0	582
112	87697	35N	12E	32	310	KEN	9/88	7.4	281	69.4	26.1	13.0	0.6	1.7	< 0.1	309.2	1.3	5.0	1.1	< 1.0	499
*113	87879	33N	13E	31	47	KEN	9/88	6.8	658	135.0	78.1	20.0	1.7	4.4	0.1	534.6	2.4	170.0	1.1	< 1.0	1068
114	87858	35N	13E	24	95	KEN	9/88	7.5	289	67.7	29.2	19.8	0.7	1.8	< 0.1	314.7	1.8	5.0	1.3	< 1.0	518
115	87884	33N	13E	24	82	KEN	10/88	7.3	368	89.8	35.0	16.0	0.8	1.8	< 0.1	379.6	1.3	29.2	1.0	< 1.0	641
116	87897	34N	12E	19	84	KEN	9/88	7.2	272	63.7	27.6	19.6	0.8	1.4	< 0.1	294.6	1.7	15.1	1.3	< 1.0	497
NOBLE COUNTY																					
117	87919	33N	11E	6	234	KEN	9/88	7.2	331	86.7	27.7	9.4	0.5	2.1	0.1	317.1	1.3	21.0	1.2	< 1.0	540
118	87904	33N	11E	33	150	KEN	9/88	7.4	362	86.8	35.4	13.4	0.9	2.3	< 0.1	361.5	1.2	24.5	1.1	< 1.0	610
119	87914	33N	11E	16	75	KEN	9/88	6.9	617	159.7	53.2	9.1	0.9	3.3	0.1	442.9	7.3	170.0	0.5	< 1.0	945
120	80837	34N	11E	16	215	KEN	8/87	7.5	220	53.0	21.0	32.0	1.6	0.6	< 0.1	278.0	< 5.0	7.0	1.6	< 1.0	297
121	87803	33N	10E	24	102	KEN	9/88	7.4	338	92.6	26.1	6.7	0.6	2.3	< 0.1	322.4	4.0	17.3	0.9	< 1.0	544
*122	87702	34N	11E	20	56	KEN	9/88	6.9	419	113.8	32.8	7.5	0.5	2.8	< 0.1	357.6	13.9	55.5	1.0	< 1.0	666
123	121629	34N	11E	16	145	KEN	8/87	7.4	272	69.0	24.0	15.0	3.0	1.4	< 0.1	296.0	< 5.0	10.0	1.0	< 1.0	313
*124	87909	33N	11E	25	190	KEN	9/88	7.7	304	70.4	31.3	20.2	0.8	1.4	< 0.1	337.0	1.0	6.9	1.2	< 1.0	549

Appendix 13. Results of chemical analysis from selected wells – Continued

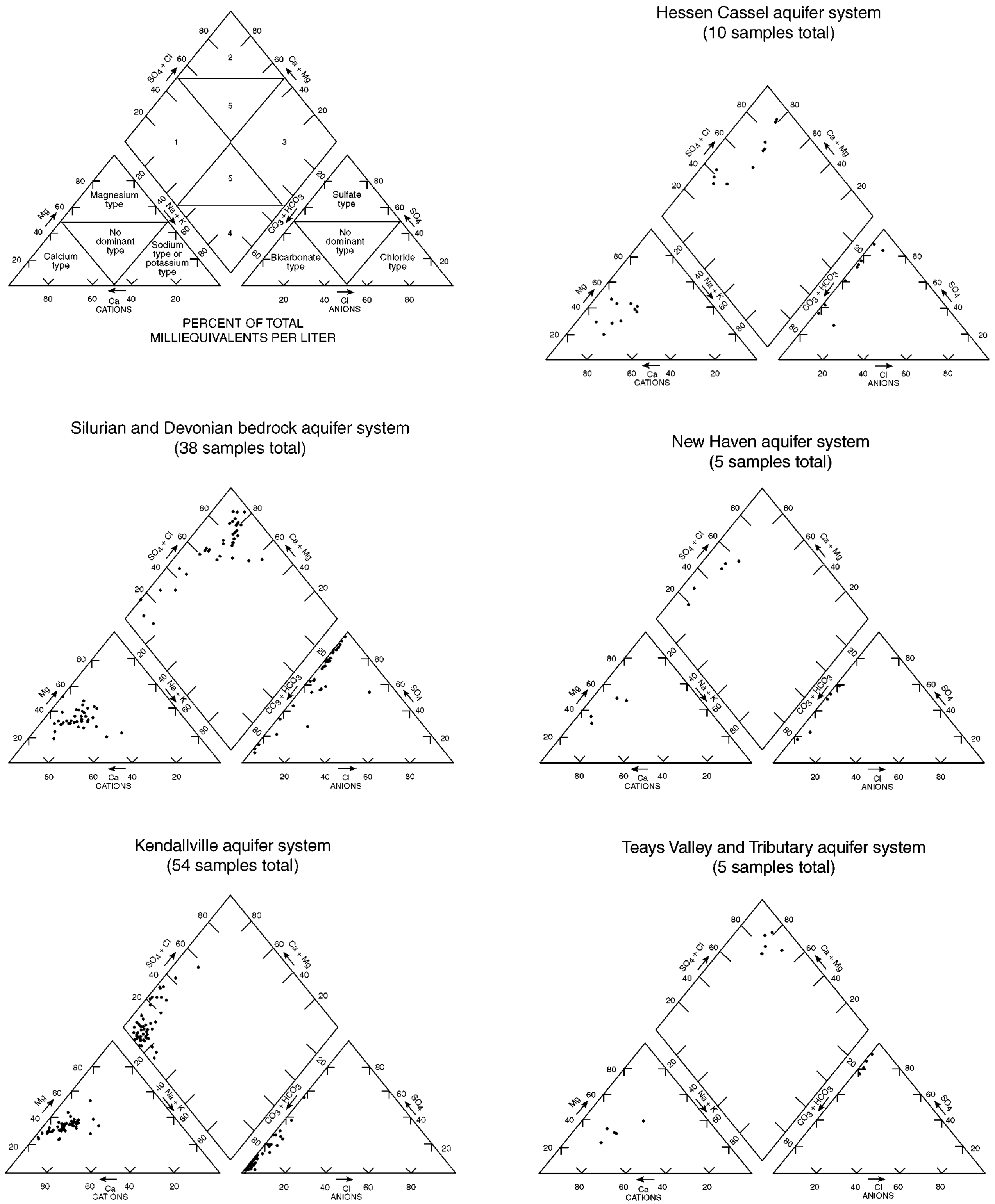
Location number	IDNR/DOW Well ID Number	Township	Range	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium	Magnesium	Sodium	Potassium	Iron	Manganese	Alkalinity as $CaCO_3$[2]	Chloride	Sulfate	Fluoride	Nitrate as Nitrogen	Total Dissolved Solids[3]
STEUBEN COUNTY																					
125	87781	37N	15E	19	170	KEN	9/88	7.2	305	77.5	27.1	15.8	0.6	1.7	< 0.1	297.6	4.2	17.4	1.0	< 1.0	512
126	87786	36N	15E	29	107	KEN	9/88	7.4	314	67.0	35.7	22.9	1.0	2.2	0.1	325.3	4.4	31.2	1.3	< 1.0	570
127	87791	36N	15E	18	96	KEN	9/88	7.0	302	70.4	30.6	17.4	0.8	1.8	< 0.1	321.1	3.5	7.2	1.2	< 1.0	530
128	87692	37N	15E	4	130	KEN	9/88	7.5	188	39.0	22.0	29.3	0.7	0.8	< 0.1	258.3	1.3	3.8	1.8	< 1.0	442
*129	87771	38N	15E	16	42	KEN	9/88	7.2	313	92.1	20.2	3.6	0.3	1.8	0.1	213.1	8.3	67.5	0.2	< 1.0	454
*130	87682	36N	14E	22	75	KEN	9/88	7.4	314	76.3	30.2	14.7	0.7	2.5	< 0.1	333.5	2.6	16.9	1.2	< 1.0	556
*131	87796	36N	15E	6	40	KEN	9/88	7.0	511	136.3	41.6	9.9	0.7	3.4	< 0.1	363.1	17.9	81.0	0.5	< 1.0	735
*132	87776	37N	15E	28	101	KEN	9/88	7.6	276	65.8	27.1	23.5	0.8	1.2	< 0.1	285.7	8.9	6.2	1.2	< 1.0	489

1 Results in standard pH units.
2 Laboratory analysis.
3 TDS values are the sum of major constituents expected in an anhydrous residue of a ground-water sample with bicarbonate converted to carbonate in the solid phase.

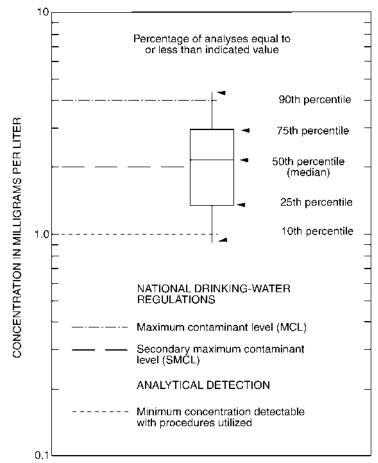
Appendix 14. Results of chemical analysis for strontium, zinc, and copper from selected wells

Location number	Zinc	Copper	Strontium
ADAMS COUNTY			
1	<0.05	<0.05	9.32
2	<0.05	<0.05	10.73
3	<0.05	<0.05	10.92
5	<0.05	<0.05	3.22
7	<0.05	<0.05	11.89
9	<0.05	<0.05	10.42
11	<0.05	<0.05	11.65
12	0.06	<0.05	12.41
14	<0.05	<0.05	14.00
15	<0.05	<0.05	13.09
16	0.10	<0.05	9.24
17	<0.05	<0.05	11.30
18	0.06	<0.05	7.75
19	<0.05	<0.05	11.54
21	<0.05	<0.05	9.67
23	<0.05	<0.05	9.06
25	<0.05	<0.05	7.75
26	0.05	<0.05	11.46
27	<0.05	<0.05	12.53
29	<0.05	<0.05	9.90
30	<0.05	<0.05	8.26
ALLEN COUNTY			
33	<0.05	<0.05	10.96
34	<0.05	<0.05	4.28
35	0.48	<0.05	1.91
36	<0.05	<0.05	4.60
38	<0.05	<0.05	0.56
40	<0.05	<0.05	5.08
42	<0.05	<0.05	7.15
44	0.13	<0.05	8.02
46	<0.05	<0.05	10.39
48	0.28	<0.05	3.21
50	<0.05	<0.05	0.30
52	<0.05	<0.05	2.02
54	0.08	<0.05	9.21
56	<0.05	<0.05	8.33
58	<0.05	<0.05	5.70
59	<0.05	<0.05	5.61
60	<0.05	<0.05	7.80
62	0.05	<0.05	6.04
64	<0.05	<0.05	9.34
66	<0.05	<0.05	11.39
68	<0.05	<0.05	9.27
70	0.14	<0.05	4.10
72	0.10	<0.05	4.42
74	<0.05	<0.05	10.00
76	<0.05	<0.05	5.13
77	<0.05	<0.05	9.64
78	<0.05	<0.05	11.15
80	1.08	<0.05	11.70
81	<0.05	<0.05	1.02
82	<0.05	<0.05	11.33
DEKALB COUNTY			
83	<0.05	<0.05	9.14
84	0.05	<0.05	0.22
85	<0.05	<0.05	6.88
86	0.08	<0.05	4.99
87	0.37	<0.05	3.73
88	0.33	<0.05	3.54
89	0.24	<0.05	4.88
90	0.11	<0.05	3.13
91	<0.05	<0.05	4.48
92	<0.05	<0.05	1.74
93	<0.05	<0.05	4.27
94	0.23	<0.05	6.58
95	<0.05	<0.05	0.45
96	0.27	<0.05	<0.05
97	1.58	<0.05	3.50
98	<0.05	<0.05	5.02
99	<0.05	<0.05	4.39
101	0.22	<0.05	1.50
103	0.53	<0.05	3.79
105	<0.05	<0.05	2.67
107	<0.05	<0.05	5.14
108	0.05	<0.05	0.20
109	<0.05	<0.05	5.04
110	<0.05	<0.05	3.08
111	<0.05	<0.05	5.03
112	0.72	<0.05	3.11
113	0.66	<0.05	2.00
114	<0.05	<0.05	6.29
115	<0.05	<0.05	2.71
116	<0.05	<0.05	6.63
NOBLE COUNTY			
117	<0.05	<0.05	3.00
118	<0.05	<0.05	2.94
119	<0.05	<0.05	0.78
121	<0.05	<0.05	0.70
122	1.17	<0.05	0.28
124	<0.05	<0.05	3.76
STEUBEN COUNTY			
125	<0.05	<0.05	5.79
126	0.18	<0.05	7.14
127	0.20	<0.05	4.59
128	0.19	<0.05	27.82
129	0.09	<0.05	0.26
130	0.09	<0.05	3.99
131	<0.05	<0.05	0.80
132	0.08	<0.05	5.59

For additional data, including location information, see Appendix 13

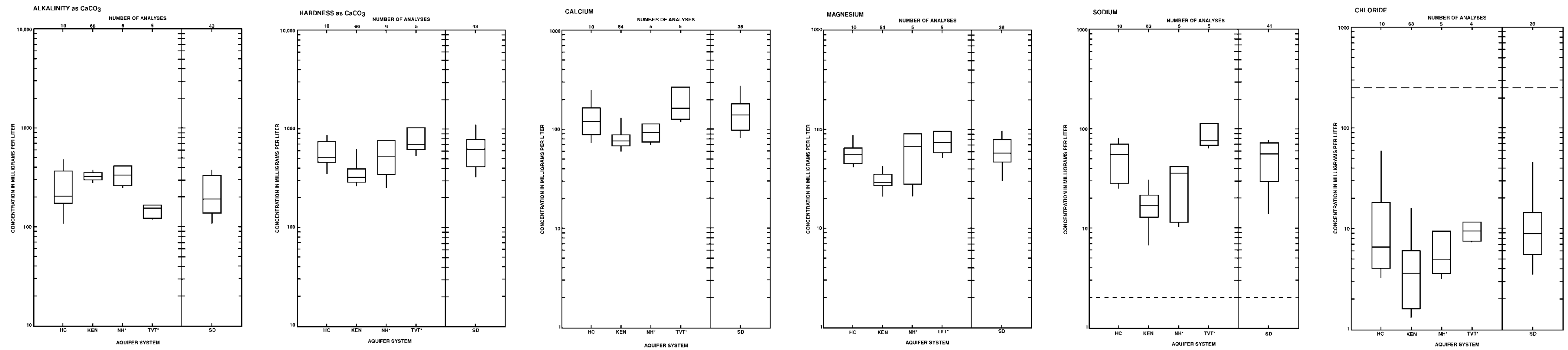


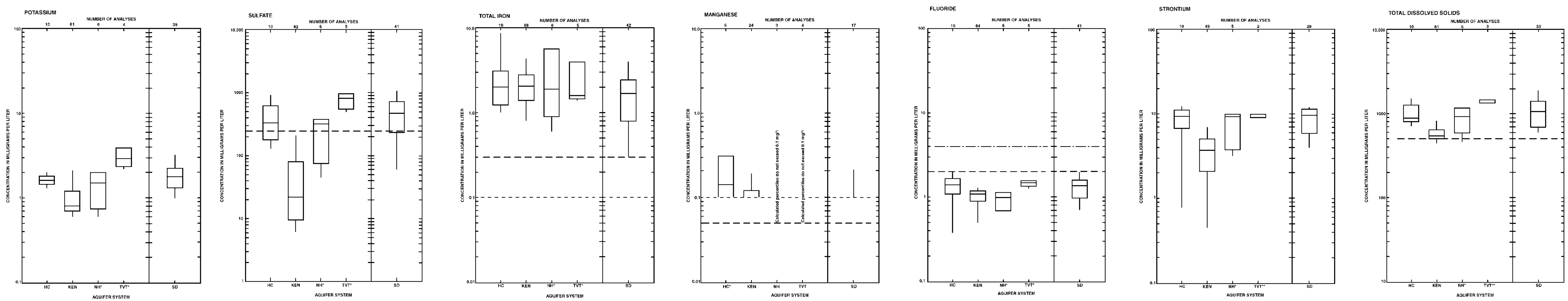
Appendix 16. Piper trilinear diagrams of ground-water quality data for major aquifer systems



Explanation and legend for box plots

HC Hessen Cassel
KEN Kendallville
NH New Haven
TVT Teays Valley Tributaries
SD Silurian/Devonian





Appendix 15. Statistical summary of selected water-quality constituents for aquifer systems

Appendix 17. Registered water-use data by type, county, and source (1993)

{Numbers denote water use in millions of gallons. County data refer to areas within the basin only.}

County	Source	Public Supply	Industrial	Agricultural	Energy Production	Total Water Use
ADAMS	combined	839.16	311.35	43.74	117.96	1312.21
	surface	0.00	302.96	0.00	117.60	420.56
	ground	839.16	8.39	43.74	0.36	891.65
ALLEN	combined	12303.07	2582.00	322.15	109.97	15317.19
	surface	11667.47	2271.60	84.49	0.00	14023.56
	ground	635.60	310.40	237.66	109.97	1293.63
DEKALB	combined	1105.78	765.16	122.22	26.34	2019.50
	surface	0.00	328.00	41.62	0.00	369.62
	ground	1105.78	437.16	80.60	26.34	1649.88
NOBLE	combined	53.07	0.07	0.00	0.00	53.14
	surface	0.00	0.00	0.00	0.00	0.00
	ground	53.07	0.07	0.00	0.00	53.14
STEUBEN	combined	0.00	0.00	0.67	0.00	0.67
	surface	0.00	0.00	0.02	0.00	0.02
	ground	0.00	0.00	0.65	0.00	0.65
WELLS	combined	4.98	0.00	0.00	0.00	4.98
	surface	0.00	0.00	0.00	0.00	0.00
	ground	4.98	0.00	0.00	0.00	4.98
TOTAL	combined	14306.1	3658.6	488.8	254.3	18707.8
	surface	11667.5	2902.6	126.1	117.6	14813.8
	ground	2638.6	756.0	362.7	136.7	3894.0