MCHENRY COUNTY WATER RESOURCES

Approximately 10,000 to 20,000 years ago glaciers from the most recent period of glaciation (Wisconsin glaciation) retreated from McHenry County leaving a water-rich tapestry of lakes, rivers, streams and wetlands. As soon as the landscape became more hospitable, Native Americans became regular visitors to McHenry County. Archaeologists have uncovered artifacts that verify the presence of Native Americans in McHenry County extending back 12,000 years before present (BP). Large and small wetlands likely provided the most productive and easily harvested food resources, including game and vegetation, for the earliest people 10. For thousands of years Native Americans of many tribes and cultures migrated through and occupied McHenry County, relying on its abundant natural resources.

In the 1800's, expanding European settlement forced Native American occupants from McHenry County and many man-made changes were implemented that degraded the health of water resources. Changes included converting prairie, wetland and woodland to agriculture; draining or filling wetlands and channelizing streams to increase agricultural land; and grading or paving over land for residential and commercial development. These changes accelerated as new technologies were introduced and urban development expanded into the countryside.

Historically, the native vegetation in McHenry County consisted predominantly of deep rooted plant species that held soils in place, protected soil from erosion, intercepted and stored rainfall, and sequestered organic carbon in the soil. The canopy and roots of trees in woodlands, another historically dominant plant community in the county, were also capable of intercepting, storing and transpiring rainfall. The canopy and interconnected root systems of the native vegetation acted as a sponge capable of absorbing, storing, and transpiring tremendous volumes of water, thereby reducing the potential for flooding and promoting the infiltration of groundwater. The infiltrated groundwater in turn provided

baseflow of cool, filtered water to surface waters in the watersheds that supported healthy aquatic ecosystems and biodiversity. As agriculture and development expanded, the native vegetation (and its extensive root systems) was removed and replaced with tilled soil that remained uncovered much of the year, turfgrass and other non-native plants with shallow root systems, compacted ground, and paved or hardscape surfaces. Instead of precipitation primarily being stored or infiltrated in soil, the volume and velocity of stormwater runoff flowing overland increased, thereby contributing to greater amounts of flooding, erosion, and pollution draining into surface water bodies. The chemistry, biology, and temperature of surface waters changed as the primary sources of water shifted from groundwater to stormwater. Impacts from these changes include increased flooding, erosion, sedimentation, pollution, and loss of wildlife habitat.

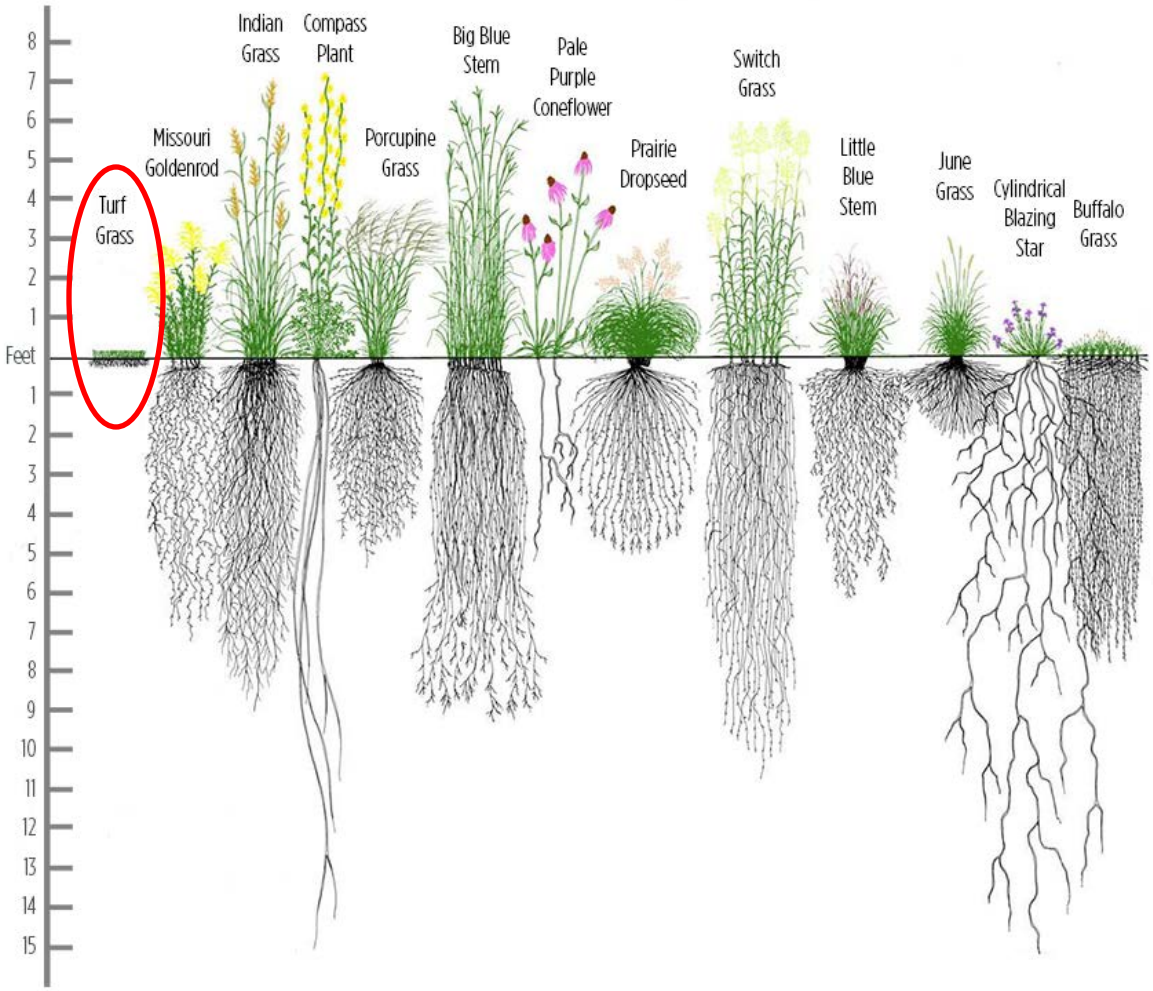

Figure ???: Profile view showing a variety of native plant species and the depth of their roots underground. For comparison, the roots of Kentucky Bluestem which is commonly used for turf only extend down 1 to 2 inches into the soil. The intertwining root systems of native plant species are capable of holding and storing large volumes of water and promoting infiltration of water to groundwater aquifers.

Although the degradation of lakes, rivers, streams and wetlands has occurred over time, many remaining water bodies in McHenry County continue to represent some of the highest quality aquatic resources in the state, maintain a broad diversity of natural ecosystems, support important wildlife habitat, create natural beauty, and provide vital benefits to the county's residents 25. Numerous communities in McHenry County have gathered together to develop and implement lake management plans. Watershed management plans have been prepared by a wide variety of stakeholders to protect and restore water resources in several of the county's watersheds. Federal, state and county regulations have helped to protect water resources and reduce flooding, thereby reducing further damage and helping to improve habitat and water quality. Organizations such as the McHenry County Conservation District, the Land Conservancy of McHenry County, the Environmental Defenders of McHenry County and others are also working to restore water resources and surrounding habitat throughout the county. Because of its rich natural history and the efforts of so many of its residents, McHenry County's water resources remain a vital part of the county's character, health and economy. McHenry County's water resources include:

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McHenry County Watersheds

Main Watersheds, Primary Watersheds, and Sub-Watersheds in McHenry County

McHenry County has two rivers within its boundaries: the Fox River and the Kishwaukee River. Since all water in McHenry County flows to one of these rivers, they define the two main watersheds in the county: the Fox River Watershed (east side of the county) or the Kishwaukee River Watershed (west side of the county). These are generally divided into six primary watersheds: Nippersink Creek, Upper Fox River, Lower Fox River which all drain to the Fox River; and Kishwaukee River, Piscasaw Creek, and Coon Creek which drain to the Kishwaukee River. Some mapping conventions break the Nippersink Creek watershed into three separate watersheds (discussed below). The six primary watersheds can be further separated into a large number of sub-watersheds.

McHenry County Watersheds

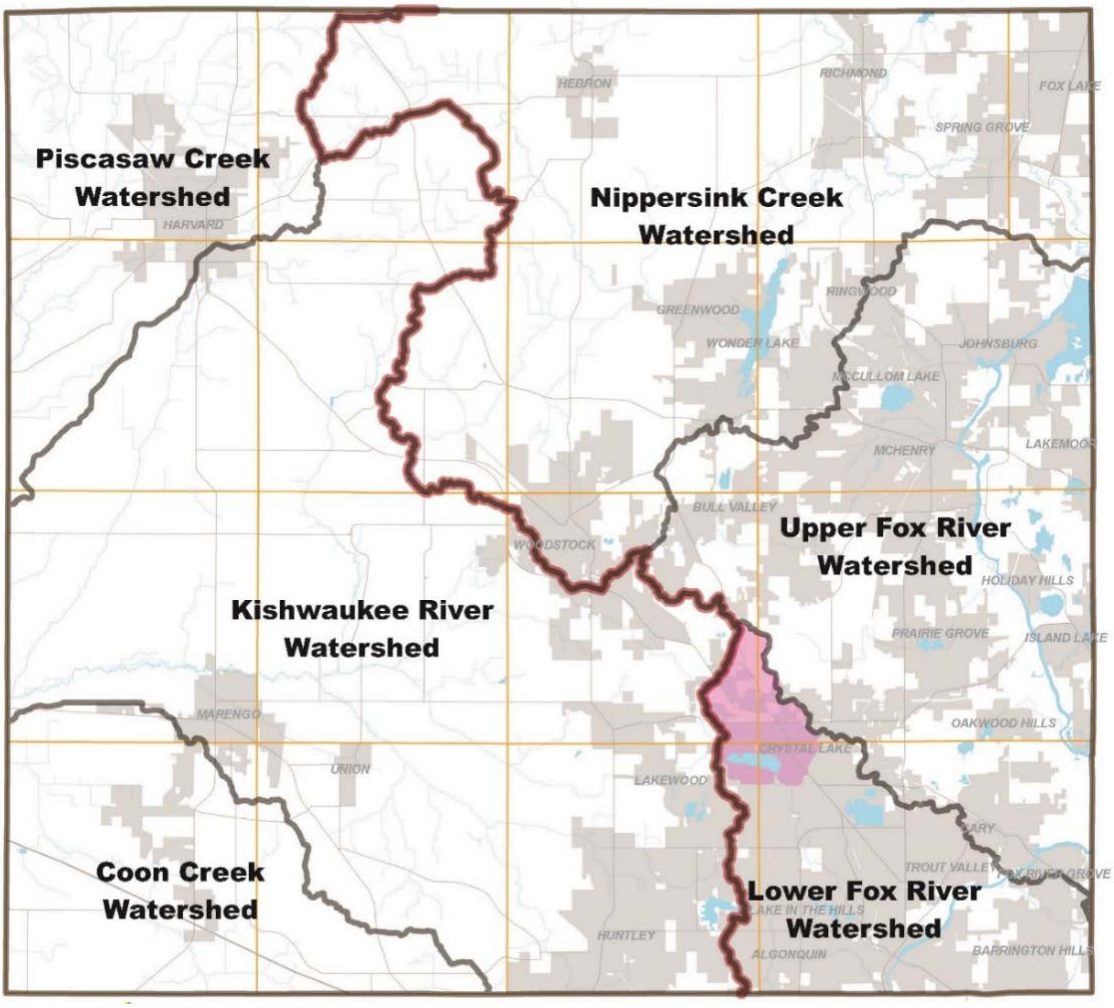

Figure ???: Map of the watersheds in McHenry County. The county has two main watersheds: the Fox River to the east and the Kishwaukee River to the west. The main watersheds are generally divided into six primary watersheds (three flow to the Fox River and three flow to the Kishwaukee River). Each primary watershed can be further divided into smaller sub-watersheds.

It is important to have defined watershed boundaries to aid with planning, understand drainage patterns, calculate stormwater runoff volumes, identify potential sources of pollution, evaluate flood risks, measure costs and benefits of projects, and allocate resources for restoration, enhancement or protection. The United States Geological Survey (USGS) have developed Hydrologic Unit Codes (HUC) that divide and sub-divide the U.S. into successively smaller watershed and sub-watershed units. The HUC boundaries are widely used for watershed planning across the country and were also used to develop the list of McHenry County's watersheds and sub-watersheds provided above. However, alternative methods for determining watersheds can be used for planning purposes. Such alternative methods may be particularly beneficial when identifying sub-watersheds at increasingly small scales because more localized information can be considered when determining watershed boundaries.

McHenry County USGS Sub-Watersheds

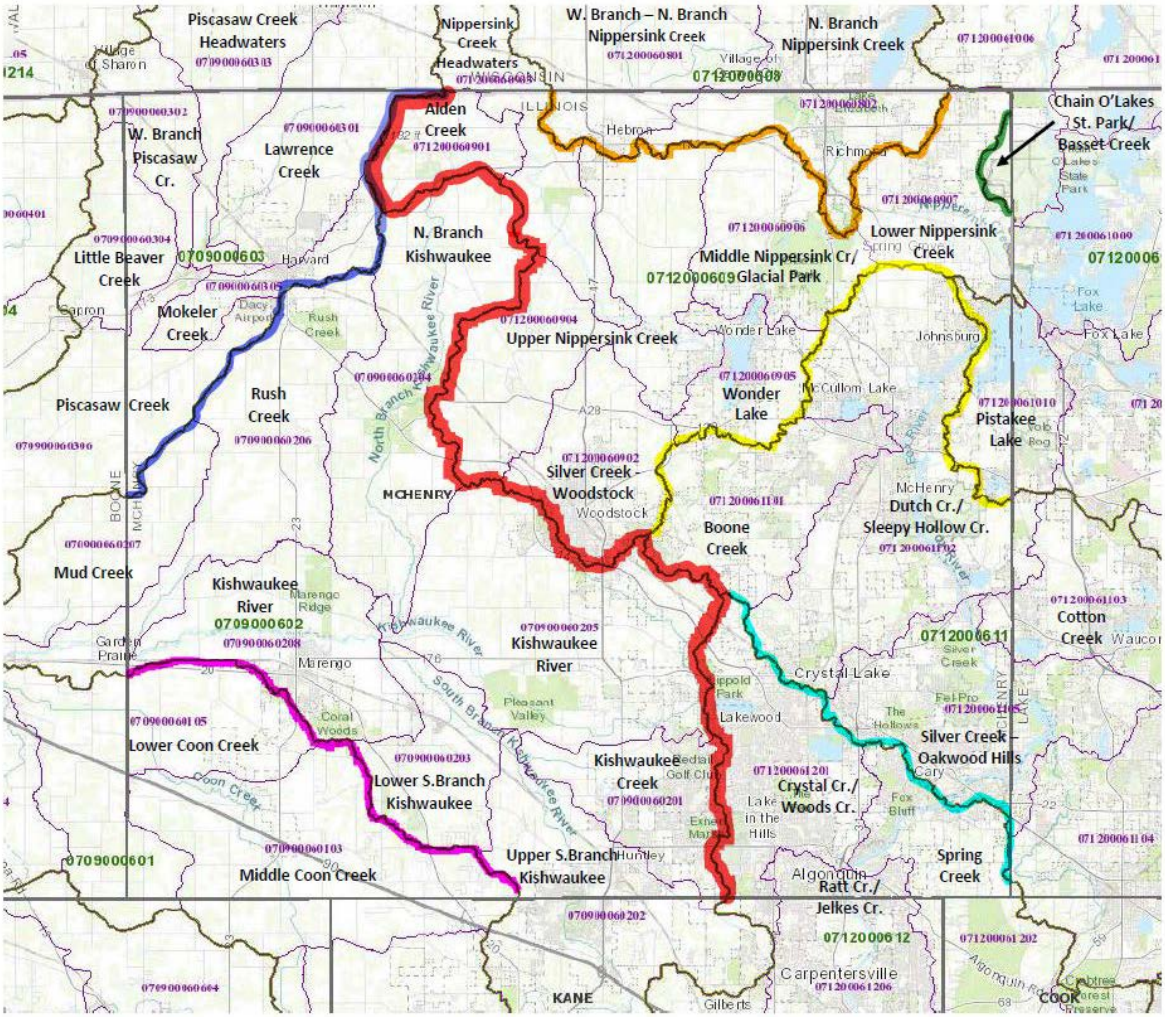

Figure ???: Map showing the USGS Hydrologic Unit Codes and boundaries for the primary watersheds and sub-watersheds in McHenry County. the red line represents the divide between the Fox River and Kishwaukee River watersheds. The other highlighted lines represent the HUC 10 Watersheds. The smaller polygons show the names and boundaries of the HUC 12 Sub-Watersheds.

McHenry County Watersheds

Main Watersheds, Primary Watersheds, and Sub-Watersheds in McHenry County

Main Watersheds (HUC 8)

- Upper Fox River (07120006)
- Kishwaukee River (07090006)

Primary Watersheds (HUC 10)

- Nippersink Creek (0712000609)
  - Parts of N. Branch Nippersink Cr (0712000608)
  - Chain O'Lake/ Fox River (0712000610)
- McHenry County Upper Fox River (0712000611)
- McHenry County Lower Fox River (0712000612)
- Kishwaukee River (0709000602)
- Piscasaw Creek (0709000603)
- Coon Creek (0709000601)

Sub-Watersheds (HUC 12)

- Alden Creek (071200060901)
- Nippersink Creek Headwater (071200060903)
- Upper Nippersink Creek (071200060904)
- Wonder Lake (071200060905)
- Middle Nippersink Creek/Glacial Park (071200060906)
- Lower Nippersink Creek (071200060907)
- W. Branch of N. Branch Nippersink Creek (071200060801)
- N. Branch Nippersink Creek (071200060802)
- Chain O' Lakes St. Park/ Basset Creek (07200061006)
- Silver Creek-Woodstock (071200060902)
- Boone Creek (071200061101)
- Dutch Creek/ Sleepy Hollow Creek (071200061102)
- Pistakee Lake (071200061010)
- Cotton Creek (071200061103)
- Silver Creek-Oakwood Hills (071200061105)
- Crystal Creek/ Woods Creek (071200061201)
- Spring Creek (071200061202)
- Ratt Creek/ Jelkes Creek (071200061206)
- Kishwaukee River Headwaters (070900060205)
- Kishwaukee River (070900060208)
- North Branch Kishwaukee River (070900060204)
- Rush Creek (070900060206)
- Mud Creek (070900060207)
- Lower South Branch Kishwaukee River (070900060203)
- Upper South Branch Kishwaukee River (070900060202)
- Kishwaukee Creek (070900060201)
- Piscasaw Creek Headwaters (070900060303)
- West Branch Piscasaw Creek (070900060302)
- Piscasaw Creek (070900060306)
- Little Beaver Creek (070900060304)
- Lawrence Creek (070900060301)
- Mokeler Creek (070900060305)
- Lower Coon Creek (070900060105)
- Middle Coon Creek (070900060103)

Note: the numbers in parenthesis represent the Hydrologic Unit Code (HUC) that the U.S. Geological Survey has assigned to the watersheds and sub-watersheds.

As McHenry County has been developed, the landscape within its watersheds changed dramatically. Many of these changes have had direct or indirect impacts on water resources. Examples of direct impacts include channelization, damming, and draining of streams that change the hydrology, water quality, and habitat within the watershed. Examples of less direct impacts to water resources in the watershed may include the removal of native vegetation and root systems, compaction of soils, and increase of paved or hardscape surfaces. Each of these changes in land use negatively impacts water resources by reducing the ability of precipitation to infiltrate into the ground, recharge groundwater aquifers, provide baseflow to water bodies, and filter runoff. Instead of infiltrating into the ground, greater volumes of stormwater are produced, thereby contributing to increasing rates of flooding, erosion, and pollution that flow into McHenry County's surface waters.

For instance, sedimentation is a common problem in McHenry County's waterways. The sedimentation is the result of soil erosion and streambank erosion caused by land use changes within a watershed. Soil erosion typically starts when soil disturbed by agricultural or construction activities is not properly stabilized (e.g. planted with a cover crop, erosion control blanket, etc.), thereby allowing stormwater to carry sediments downstream. Stream bank erosion is often the result of disturbances to vegetation along a stream channel, or when increased stormwater flows cut away the edges and bottom of stream banks causing them to collapse. The eroded sediments, primarily loose sand, clay and silt, are then washed downstream as a pollutant that eventually settles out and deposits on the bottom of water bodies. The sedimentation degrades the chemistry and biology of the aquatic ecosystems and can produce shallow areas that impede travel or recreational use of water bodies. This is an increasing problem on the Fox River where shallow water from sediments are affecting recreational opportunities and businesses along the river. Therefore, to continue use of the water body's sediments must be dredged from the water body, stored and dried, and ultimately transported and disposed of. Each of these steps can be expensive and the costs are usually paid by the stakeholders being impacted, not those who caused the erosion. These unnecessary costs and damages can be prevented by recognizing risks, understanding stormwater mechanics, and effectively managing stormwater within a watershed.

*** Photo of eroded shoreline of Kishwaukee River ***

To address these issues on a landscape scale, a number of watershed management plans have been prepared in McHenry County and in partnership with neighboring counties. The plans have been developed by watershed planning groups that consist of diverse stakeholders including municipalities, engineering and environmental consultants, environmental groups, and interested residents. The planning and principal authorship has often been provided by the Chicago Metropolitan Agency for Planning (CMAP) or consulting firms that have been hired specifically to lead development of plans. Many of these Plans included the EPA's nine minimum elements and were effectively used to pursue funding through the EPA Section 319 grant program. To be eligible for EPA funding, watershed plans must be updated every ten years. Therefore, to have coverage for all watersheds in the county existing

watershed management plans will need to be updated while new plans will need to be initiated. Watershed plans that have been completed or initiated include:

- Boone/Dutch Creeks
- Crystal Creek
- Flint Creek
- Jelkes Creek
- Lawrence Creek
- Nine Lakes Area
- Nippersink Creek
- Sleepy Hollow/Silver Creeks
- Spring Creek
- Upper Kishwaukee River
- Woods Creek

*** Side by side images of several watershed plan covers and/or photo of watershed group meeting ***

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McHenry County Surface Waters: Natural Lakes, Man-Made Lakes, and Ponds

McHenry County has a large number of lakes that range in size and quality. Several lakes, such as Crystal Lake, Lake Defiance, and McCullum Lake are natural lakes that were formed by glacial activity. Historically, such lakes were fed primarily by groundwater that provided a steady base flow of cool, clean water. However, expanding impervious surfaces from urban development have increased the amount of stormwater runoff that flows into the lakes. Stormwater runoff tends to be warmer and dirtier than groundwater so increased volumes of stormwater can degrade the lakes aquatic ecosystems. These natural lakes do not have an inlet but do have outlets, such as Crystal Creek that flows out of Crystal Lake and discharges into the Fox River. Lake Defiance in Moraine Hills State Park is one of the few glacial lakes in Illinois that has remained mostly undeveloped and is still in a near natural condition. With its natural shoreline in a protected State Park with little development, Lake Defiance is an excellent example of natural lakes prior to European settlement.

*** Photo of Lake Defiance with cranes and canoe ***

Lakes in McHenry County		
Beh Lake	Lac Louette	South Twin Lake
Bonnie Lake	Lake Atwood	Spruce Lake
Clear Lake	Lake Defiance	Streets Lake
Crystal Lake	Lake in the Hills	Turnberry Lake No. 1
Eddy Lake	Lake Jerilyn	Turnberry Lake No. 2
Elizabeth Lake	Lake Killarney	Turnberry Lake No. 3
Gleneagle Lake	Lily Lake	Thunderbird Lake
Goose Lake	Lily lake	Tomahawk Lake
Griswold Lake	McCullom Lake	Vulcan Lakes
Hidden Lake	Mud Lake	Weston Lake
Highwood Lake	Pistakee Lake	Wold Lake
Island Lake	Silver Lake	Wonder Lake
Kazimier Lake	South Lake	Woods Creek Lake

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Island Lake and Wonder Lake are examples of man-made Lakes that were created by constructing a dam on a stream to impound water. The dam obstructs the flow of water, causing impounded water upstream to rise to the same elevation as the dam (or its spillway). Impounded lakes are typically considered a drainage lake with a stream above the lake that serves as an inlet, and a stream below the dam that serves as an outlet. Since impoundments are dammed streams, they tend to have larger watersheds than natural lakes and receive high nutrient and sediment loads. As a result of the high nutrient loading, impounded lakes also tend to experience larger and more frequent algal blooms as well as sedimentation that reduces the depth of lakes and degrades water quality 11.

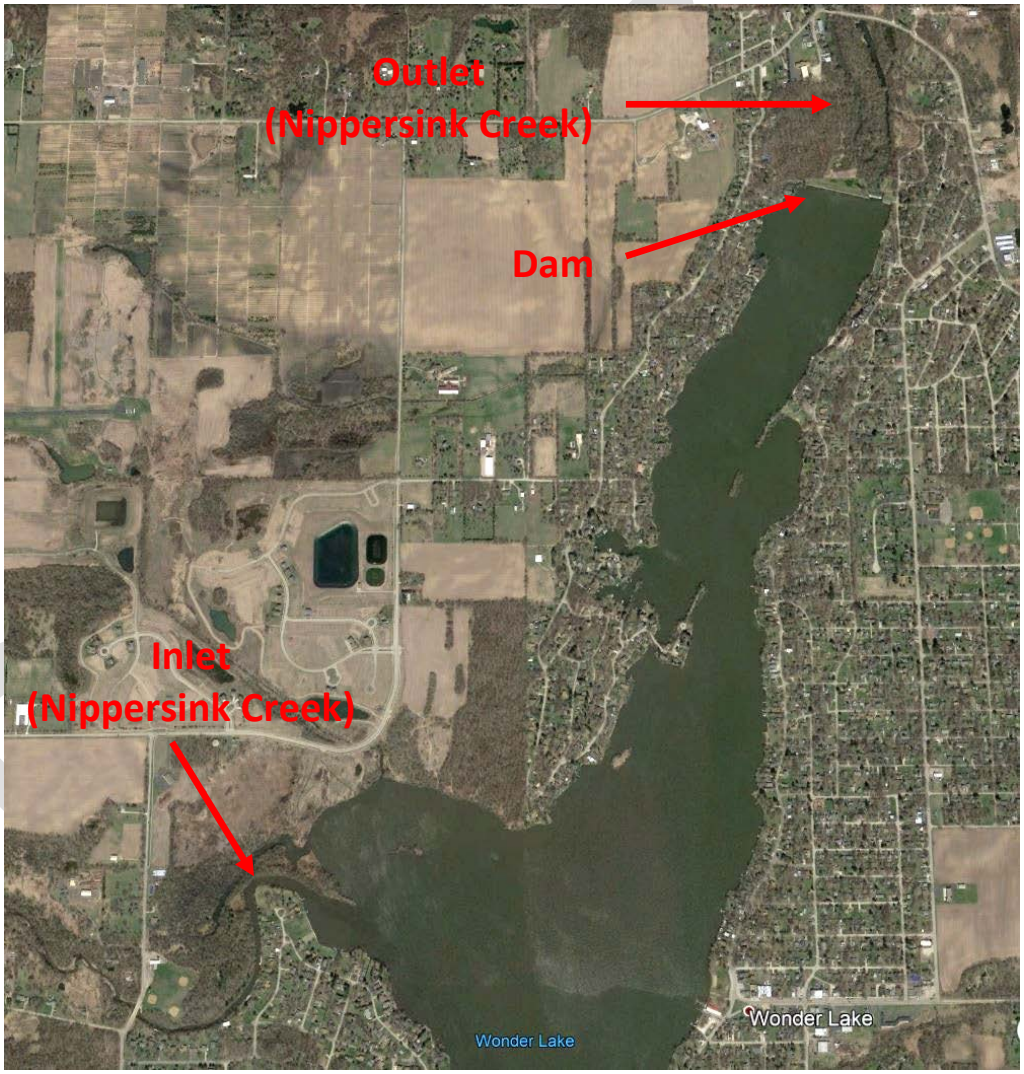


Figure ???: View of north end of Wonder Lake. Wonder Lake is a man-made (impounded) lake that was created by constructing a dam on Nippersink creek and flooding the valley upstream of the dam. Wonder Lake is considered a drainage lake because it has an inlet where Nippersink Creek flows into the lake, and an outlet where Nippersink Creek flows out.

McHenry County also has a large number of lakes that were formed from sand and gravel mining. As part of mining operations, sand and gravel is often excavated from aquifers, leaving the water table exposed and forming lakes. Most of the mined lakes in McHenry County are groundwater fed, and are examples of flow-through lake systems where groundwater flows into the lake, mixes with the open water, and then continues flowing into the aquifer. Because flow-through lakes are an exposed section of the regional aquifer, the lake level will rise and fall with the aquifers water table. As such, the regional water table can also be drawndown if mining operations were to pump out, or drain water from the lake. While mining operations in McHenry County typically do not pump or drain water from the flow-through-lakes, drinking water wells in the vicinity of mining operations could be impacted if such actions were taken. Since the water table is exposed, these flow-through-lakes also increase the risk of aquifer contamination from pollutants released into the lake (either accidentally or intentionally) or from stormwater runoff that flows into the lake. Some of these lakes such as Lake Atwood in the McHenry County Conservation Districts Hollows Conservation Area, Three Oaks in Crystal Lake, and Cary Lake in Cary are being restored and repurposed as parks to provide recreational, fishing and aesthetic benefits.

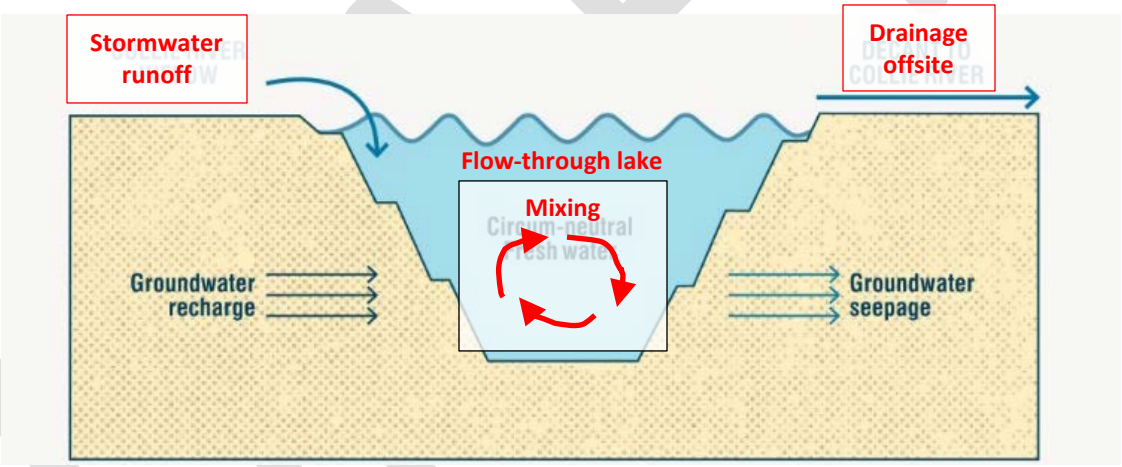


Figure ???: Illustration depicting a flow through lake that characterizes many of the gravel pit lakes in McHenry County

Ponds

McHenry County has a large number of ponds. While some ponds are natural, many were constructed to provide irrigation water, for fishing, stormwater detention, or just as ornamental features. The McHenry County Conservation District (MCCD) estimates that in 2013 there were approximately 2,684 ponds in the county. Only about 75 of these are natural ponds, so the vast majority of ponds in the county are man-made. Historically, most artificial ponds were constructed by excavating in a wetland and exposing the shallow water table to create open water. This practice degrades wetland habitat and exposes the aquifer which could increase the potential for contamination. Ponds constructed in wetlands are prone to sedimentation because the organic soils are not cohesive and easily break apart.

Constructed ponds are also prone to algal blooms because the organic wetland soils are high in nutrients that feed the algae. Wetlands are regulated by the U.S. Army Corps of Engineers and McHenry County so permits would need to be obtained before initiating any excavation or grading. Another historical method periodically used in the county to create ponds is to construct a dam in a stream to impound water. The damming of streams adversely impacts aquatic habitat and wildlife. Since streams carry sediments and nutrients, ponds constructed by damming streams are also prone to sedimentation and algal blooms. Dam construction and work in streams are regulated activities that may require Federal, State or County permits.

Many constructed ponds in McHenry County (and throughout the region) are stormwater detention basins that were excavated to help manage excess runoff generated by newly constructed impervious surfaces such as roads, parking lots, and rooftops. The detention basins temporarily store excess runoff and release it over a period of time in order to reduce peak flows and flooding downstream. McHenry County has required stormwater detention basins on new developments for many decades but older developments and communities may have been constructed without providing detention. Additionally, since precipitation rates and storm intensity have increased, and will likely continue to increase, many detention basins are not adequately sized to handle future rainfall.

Generally, detention facilities in McHenry County only redistribute the rate of runoff over a period of time and do not reduce the volume of runoff produced by the development. Therefore, new impervious surfaces from development typically results in a net increase of stormwater runoff being discharged to surface waters and a decrease in precipitation that infiltrates into the ground and provides baseflow to maintain aquatic resources. Some counties, such as DuPage and Lake, have moved toward requiring volume reduction in their Stormwater Management Ordinances. Volume reduction strategies include the use of Low Impact Development (LID) practices (green infrastructure) that promote infiltration, thereby putting water in the ground instead of increasing the volume of runoff. Examples of LID practices include permeable paving, raingardens, bioswales, landscaping with native vegetation, and converting areas of turfgrass to native vegetation.

McHenry County has considered, but not implemented, such regulations due to an abundance of caution regarding potential water quality concerns. The concerns relate to the potential for chlorides, a highly soluble mineral that moves readily with water, to infiltrate through McHenry County's permeable soils and contaminate drinking water sources. The principle source for such chlorides are parking lots and roadways where large amounts of salt may be used to manage snow and ice. Tools are being developed to identify optimum locations to safely use permeable paving which could then validate requiring volume reduction in future stormwater management ordinances. In the interim, municipalities, homeowner associations, residents and businesses should consider the use of permeable paving in strategic locations and incorporating volume reduction strategies from hardscape surfaces other than parking lots to reduce the potential for flooding on their properties due to the increasing rates of precipitation.

Natural Ponds in 1872

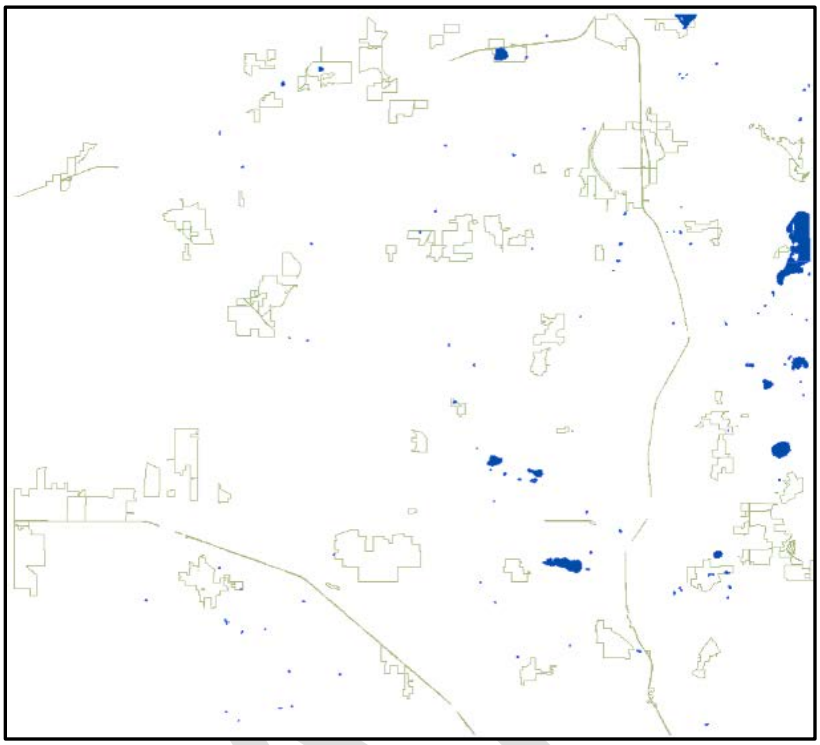


Figure ??? A: 103 Natural Ponds were identified in 1872. 28 of the Natural Ponds were drained by 2013 leaving 75 of the original ponds remaining

Constructed and Natural Ponds in 2013

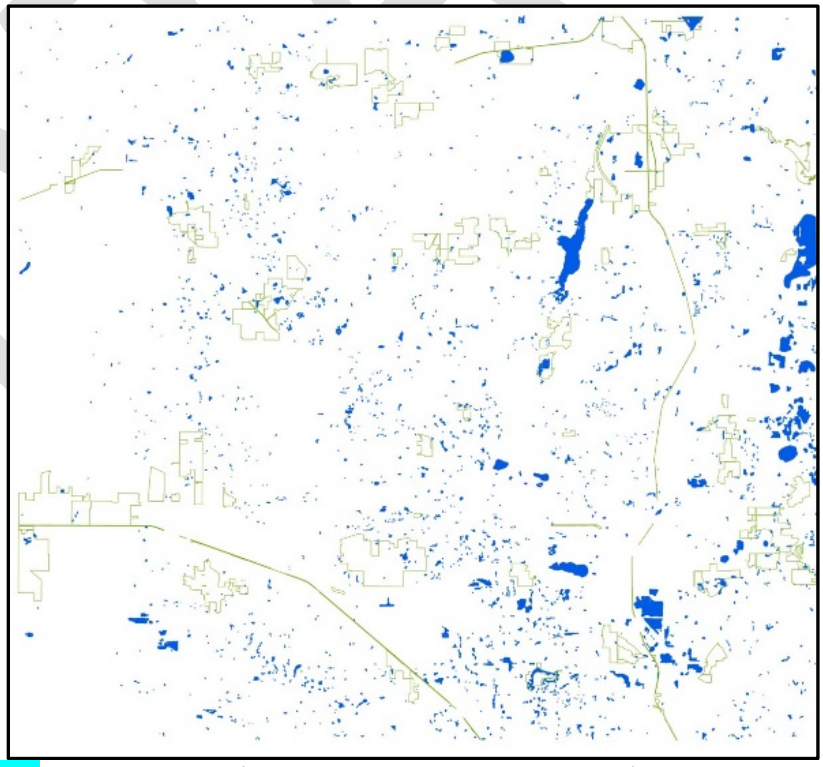


Figure ??? B: 2,609 new ponds (and other impounded water bodies) were constructed by 2013 for a total of 2,684 total ponds in the county

Wetlands

Since the retreat of the glaciers wetlands have been a major landform in McHenry County, creating habitats with abundant wildlife and biodiversity. Due to its diverse geography, geology, and environment McHenry County contains a wide variety of wetland habitat types. Wetland types vary greatly depending on how much water is present, how long the water persists, the source of water, the type of soil, and the kinds of vegetation present. These factors are often influenced by the wetlands location in a landscape (e.g. slope, depression, shoreline, floodplain). There is not a single classification system for wetlands so similar habitats may be called different names. In general terms, some of the wetland types found in McHenry County include:

Ephemeral Wetlands (temporary, seasonal)

- Prairie Vernal Pools (often Farmed Wetlands)
- Wet Woodland Pockets
- Floodplain (Marshes and Forests)

Permanent Wetlands

- Wet or Wet-Mesic Prairies
- Sedge Meadows
- Marshes
- Bogs
- Fens

Open Water with Wetland Components

- Ponds
- Lakes
- Riparian Systems

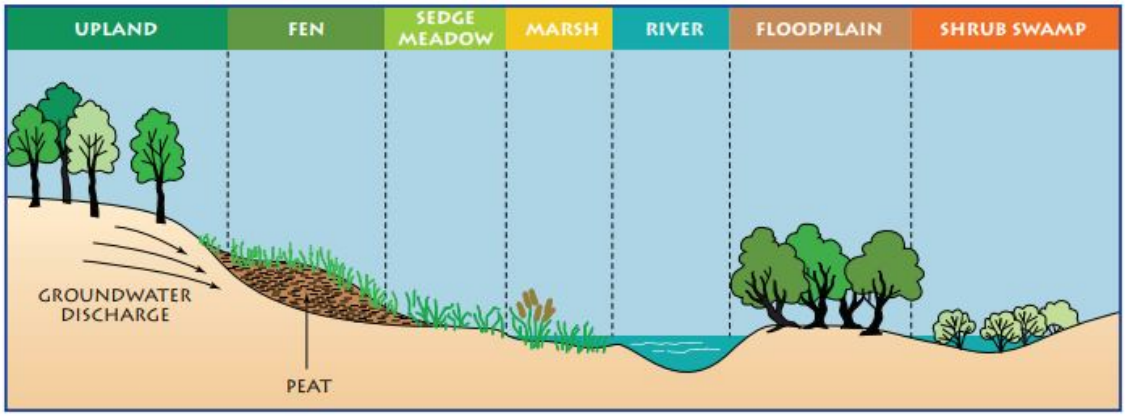
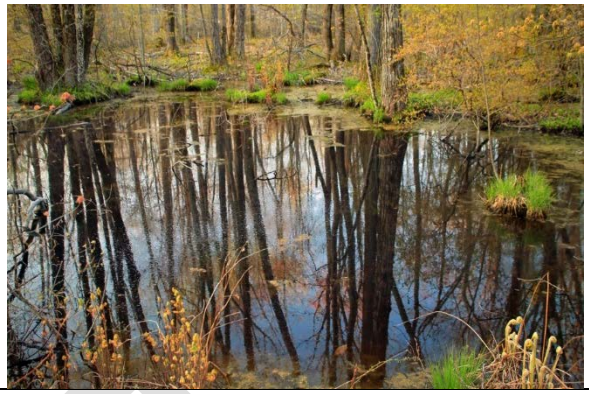


Figure ???: Typical wetland distribution in the Chicago region. Fens occur on hillsides where a consistent flow of mineral rich groundwater keeps ground wet. Sedge meadows (and wet prairie) often grow where soils are consistently saturated but there is little standing water. Marshes need standing water for at least part of the year while shrub swamps are likely to be permanently inundated.

Wetland Habitats in McHenry County

	
Prairie Vernal Pools are seasonal depressional wetlands. They may be covered by shallow water from winter to spring, but dry out in summer, fall or periods of drought. Seasonal wetlands provide important wildlife habitat, particularly for migratory birds.	**Woodland vernal pools** are seasonal depressional wetlands in forested settings that temporarily hold water. Temporary pools do not support fish which makes them vital habitat for amphibians that would otherwise be eaten during the egg or tadpole stages of their lifecycle.
Floodplain (Marsh or Forest) seasonally flooded land adjacent to streams or rivers.	**Wet Prairies and Wet-Mesic** (moderately wet) **Prairies** generally are flat or low land areas of grasses and forbs.
Sedge Meadows are low, flat areas typically flooded with a few inches of water that are dominated by a family of plants called sedges. Almost 150 species of sedges are native to Chicagoland with most found in wet habitats.	Marshes are found in a range of habitats from kettle holes to the edges of lakes and rivers. Water depth is the controlling factor for marsh vegetation ranging from emergent plants with erect stems that rise above the water to plants with floating leaves.

Bogs are glacial depressions with little to no drainage. The unique conditions and acidic water support unique plant species. Bogs in McHenry County are only found at Glacial Park and Volo Bog.	**Fens** grow on slopes fed by mineral-rich groundwater flowing from springs or seeps in sand or gravel deposits. The unique habitat supports plants adapted to alkaline water. Note the vegetation on slope only grows where seep occurs.
	Photo of lake shoreline with wetland vegetation
Ponds are typically small bodies of slow or stagnant water. May have areas of open water with floating plants in deeper water and emergent vegetation along the edges.	**Lakes** are typically larger bodies of open water that may have floating plants in some areas and emergent vegetation along the edges.
Riparian Systems are the wetland habitats along river and streams. Such systems can consist of many habitat types including areas dominated by herbaceous vegetation, shrubs, and forest.	

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As is common across the nation and Illinois, much of the wetland habitat in McHenry County has been lost to agricultural and urban development. Because of their temporary or seasonal hydrology, ephemeral wetlands have been the most vulnerable to destruction. Wet prairies and sedge meadows were also widely drained and converted. Fens are ecologically sensitive wetlands that have become increasingly rare due to development and changes in hydrology. All other types of wetland have also experienced disturbance and destruction to varying degrees. The cumulative losses of wetland habitat can have profound impacts on the natural and built environments. These impacts result in a direct loss of wildlife habitat and biodiversity. When wetlands are lost, flooding can increase since water that had been stored in the depressions, soils and vegetation flows downhill and creates greater volumes of stormwater runoff. Pollution and nutrient loading in surface waters also increase as water that had been filtered by wetland vegetation and soils now flows untreated into waterways.

However, McHenry County still contains a large amount of wetland that provides important benefits for all of its occupants including flood prevention, stormwater management, water quality treatment, wildlife habitat and recreation. In 2005, the Chicago Metropolitan Agency for Planning (CMAP) conducted an Advance Identification (ADID) of wetlands study that sought to locate and map remaining wetland 24. The ADID study characterized wetlands as High Quality Habitat Value, High Functional Value, Farmed Wetland, Wetland, High Quality Lake, and Lakes. The ADID wetland Boundaries are included as a data layer on the McHenry County's online Interactive maps. Based on the ADID study, approximately 9.7% of the total acreage in McHenry County consists of wetland (including High Quality Lakes. https://www.mchenrycountyil.gov/county-government/departments-a-i/geographic-information-system-gis/interactive-maps

In McHenry County, wetlands are currently regulated either by the U.S. Army Corps of Engineers (USACE) and/or the McHenry County Department of Planning and Development, Water Resources Division. The USACE requires permits for impacts to jurisdictional wetland (wetlands connected to a navigable waterway); may require wetland mitigation (replacing impacted wetland) at a ratio of 1.5:1 or greater depending on the quality of the impacted wetland; and may require a buffer of undeveloped land around the wetland with an averaged width of either 50-feet or 100-feet depending on the quality of the impacted wetland. McHenry County requires permits for impacts to isolated wetland (wetland not connected to navigable waterways) that are 0.10-acre or larger in size (wetland impacts less than 0.10 acre are exempt). The County may require wetland mitigation at a ratio of 1:1 to 5:1 depending on the quality of impacted wetland; will require a wetland buffer with an averaged width of 30-feet to 100-feet depending on size, configuration (linear or non-linear), and quality of impacted wetland.

*** Photo of high quality wetland (wetland buffer if possible) ***

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Because the health of wetland habitat is dependent on a specific amount of water, wetlands can be degraded or destroyed by changes in hydrology even if they are not drained or filled directly. For instance, a wetland can be dried out if a neighboring development were to re-direct traditional flows away from the wetland. Conversely, a wetland can be drowned if the development were to redirect significantly greater amounts of water to the adjacent wetland. For this reason, the McHenry County Stormwater Management Ordinance requires regulated development sites to maintain between 80% to 150% of the existing runoff volume that flows to isolated wetlands.

Fens are an important and unique type of wetland that usually occur on slopes fed by mineral rich groundwater flowing from springs or seeps. They are peat-forming (partially decayed plant material) wetlands that rely on groundwater inputs and can take thousands of years to develop. In Illinois, and across the United States, fens are among the rarest plant communities 27. In Illinois, fens are exclusively found in the northern third of the state. To protect the most important remaining fens or other groundwater fed wetlands, the State of Illinois has established groundwater protections under Title 35, Section 620.230 Class III: Special Resource Groundwater 28. Class III groundwaters have been determined to be demonstrably unique (e.g. irreplaceable) sources of groundwater that support particularly sensitive ecological systems or dedicated Illinois Nature Preserves. As unique and vital groundwater sources, they are found to be suitable for more stringent water quality standards than would otherwise be applicable.

Because of its unique hydro-geology, McHenry County is home to a numerous Illinois Nature Preserves and has more designated Class III groundwater recharge areas than any other county in the state. The boundaries of the Class III recharge areas have been mapped by the Illinois Pollution Control Board and IEPA. Unincorporated properties that fall within the Class III groundwater recharge area boundaries are subject to specific requirements under the McHenry County Unified Development Ordinance to protect water quality and maintain groundwater recharge. The mapped boundaries are included as a layer on McHenry County's interactive online mapping application PlanDev Viewer: https://www.mchenrycountygis.org/planning/ The following Class III Special Recharge Groundwater areas are located in McHenry County:

- Lake in the Hills Fen
- Cotton Creek Marsh
- Gladstone Fen
- Boone Creek Fen
- Yonder Prairie
- Spring Grove Fen
- Elizabeth Lake

Because of their value for flood mitigation, water quality treatment and wildlife habitat, wetland restoration tends to be a primary focus in Watershed Management Plans. Wetland protection and restoration is also a primary focus for conservation organizations including MCCD, TLC, EDMC, the McHenry County Soil and Water Conservation District (SWCD), the Friends of Hackmatack National Wildlife Refuge, and Ducks Unlimited. Wetland benefits are also increasingly being recognized by municipalities who are having to contend with increasing rates of precipitation and storm intensity. The ecosystem services wetlands provide benefit all residents of McHenry County and should be appreciated more widely.

*** Vander Karr Farmed Wetland Wildlife ***

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McHenry County Surface Waters: Rivers, Streams, and Creeks

McHenry County contains two rivers: the Fox River, and the Kishwaukee River.

Rivers of McHenry County
Fox River
Kishwaukee River

Fox River - The Fox River is approximately 202 miles long and flows south from Colgate, Wisconsin to Ottawa, Illinois where it discharges into the Illinois River. In Illinois, the Fox River watershed includes portions of Lake, McHenry, Cook, Kane, DuPage, Will, Kendall, LaSalle, and Grundy Counties. The Illinois segment of the Fox River Watershed is divided into two portions: the Upper Fox River and Lower Fox River Watersheds. The Upper Fox River Watershed, which includes McHenry County, covers a total of 391,680 acres (612 square miles). Several major streams which comprise the Upper Fox River Watershed flow through McHenry County including: the Fox River, Boone Creek, Dutch Creek, and Nippersink Creek. Crystal Lake, Crystal Creek, and Woods Creek are located in the Lower Fox River Watershed. The primary land use in these two Fox River watersheds is agricultural but urban development is expanding and large areas along the river are developed for residential and commercial use.

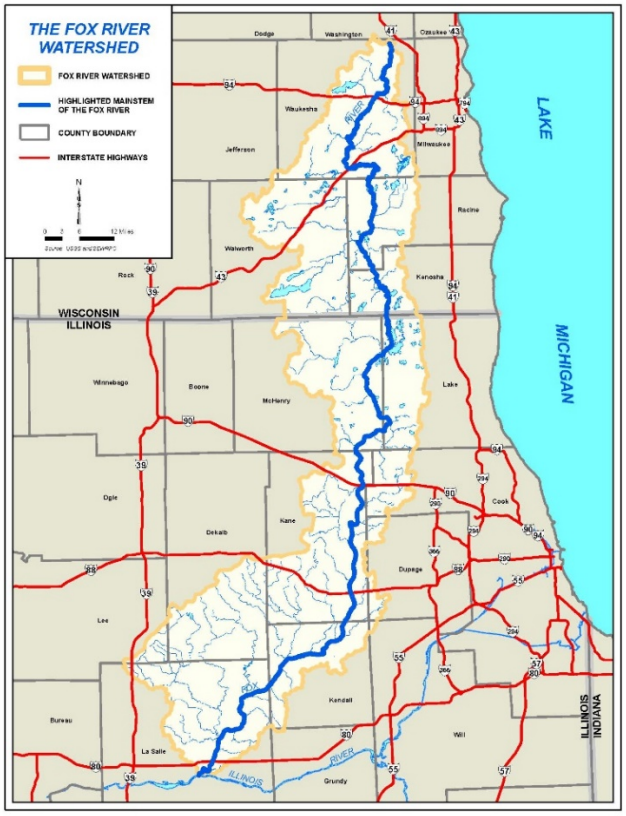

Figure ???: Fox River Watershed

A segment of the Fox River runs from north to south through McHenry County, near the eastern border with Lake County. The river enters Illinois in Lake County where it widens into a series of interconnected lakes known as the Chain O' Lakes. The Chain O' Lakes includes Pistakee Lake, which is partially located in McHenry County. From Pistakee Lake the water narrows back into a river and flows south through the McHenry County communities of Fox Lake, Johnsburg, McHenry, Holiday hills, Island Lake, Burton's Bridge, Port Barrington, Cary, Fox River Grove, and Algonquin.

*** Sidebar of CMAP Fox River Corridor Study ***

The Fox River and the Chain O' Lakes are used heavily for recreation, with seasonal motor boating being the most dominant activity, followed by fishing. The land use along the segment of Fox River in McHenry County consists predominantly of single-family homes, with large areas of open space owned by MCCD or other entities. Many of the open space areas are dedicated Illinois Nature Preserves which represent the highest quality remaining remnants of Illinois natural heritage. The Fox River corridor and the adjacent open space provide vital habitat for many of the State's most important species including birds, plants, insects, mammals, fish and other aquatic organisms. Areas of commercial development are also located along the river, featuring some businesses that are directed primarily toward boating activities. There are two dams on the river in McHenry County including the McHenry Lock and Dam which raises the river to maintain water depth in the Chain O' Lakes, and a smaller dam in Algonquin. Dams disrupt aquatic habitat by blocking the migration of fish and other aquatic wildlife, trapping sediment, promoting erosion, and increasing water temperatures.

*** Photo of Fox River from bridge with Motorboat ***

While no municipalities in McHenry County currently use the Fox River as a source of drinking water, the cities of Elgin and Aurora both rely on the Fox River as their primary source of water. The Chain O' Lakes and part of the Fox River corridor in McHenry County have been identified by the Illinois Environmental Protection Agency (IEPA) as impaired due to water quality issues such as elevated levels of nutrients including phosphorus, high concentrations of pollutants including mercury and chlorides, high pH levels, decreased levels of dissolved oxygen, high fecal coliform bacteria counts, and the presence of polychlorinated biphenyls (PCB's). Potential causes/sources for these impairments include agricultural runoff, effluent from wastewater treatment plants, highway/bridge/road runoff, urban runoff, fertilizer from lawns, septic systems, recreational activities, contaminated sediments, dam/channel modifications, and historical industrial activity 14.

Kishwaukee River - The Kishwaukee River originates in Woodstock, Illinois and extends approximately 62 miles west to Rockford, Illinois where it discharges in the Rock River. The Kishwaukee River Watershed covers a total of 779,747 acres (1,218 square miles) and encompasses portions of McHenry, Boone, Winnebago, DeKalb, Ogle, and Lee Counties as well as part of Walworth County, Wisconsin. The segment of the river located in McHenry County flows through the communities of Woodstock, Crystal Lake, Lakewood, Union and Marengo. Several major streams are located in the section of Kishwaukee River Watershed in McHenry County including: the Kishwaukee River, the North and South Branches of the Kishwaukee River, Rush Creek, Coon Creek, Mokler Creek, and Piscasaw Creek.

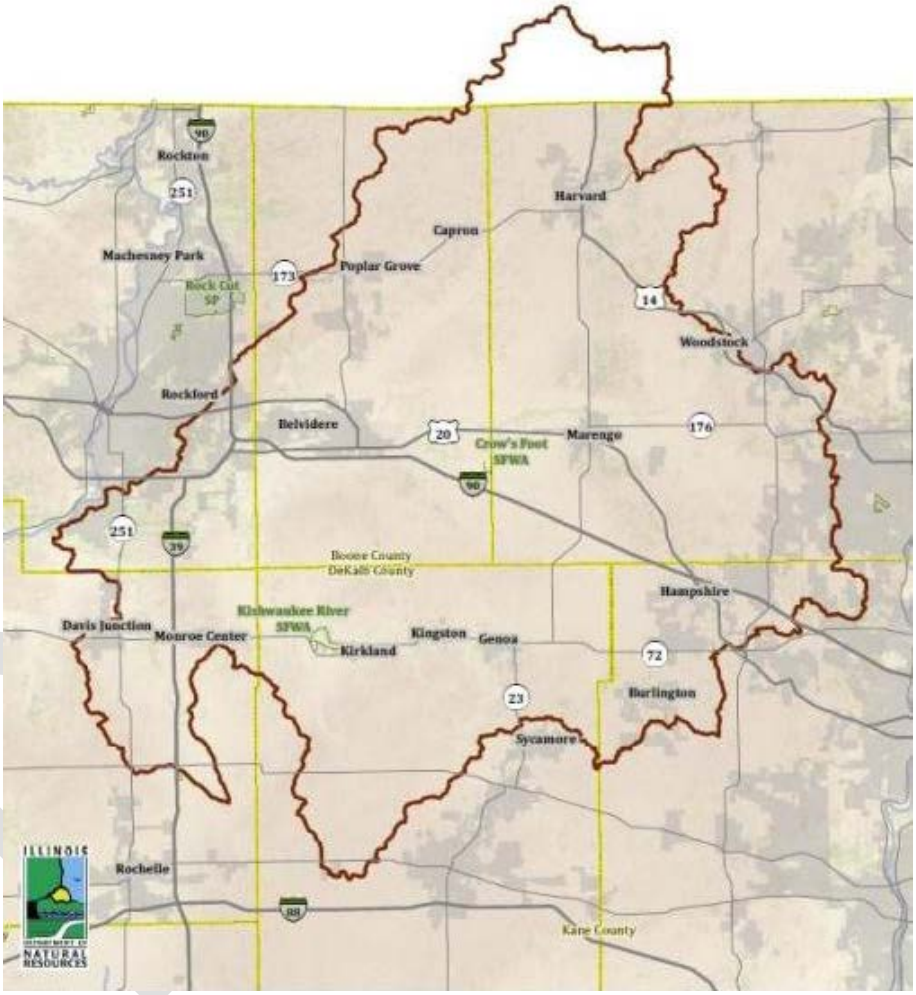

Figure ???: Kishwaukee River Watershed

The primary land use in the Kishwaukee River watershed is agricultural but urban development is expanding and some areas along the river are developed for residential and commercial use. Large sections of land along the Kishwaukee River is also open space owned by the McHenry County Conservation District, the Boone County Conservation District and the Winnebago County Forest Preserve District.

While much of the Kishwaukee River Watershed was heavily impacted by agricultural activities and urban development in the past, many areas of high quality remnant habitat have persisted. These remnant segments of river provide the foundation for diverse and highly-valued ecosystems. The Kishwaukee River, as a whole, is known to be one of the most biologically rich river systems in Illinois and it supports a wide variety of fish and wildlife species including threatened and endangered species. The Kishwaukee is characterized by the Illinois Department of Natural Resources (IDNR) as a Biologically Significant Stream from the MCCD Pleasant Valley Conservation Area in Woodstock, all the way to the Rock River in Rockford 12.

Water quality and habitat in the Kishwaukee River watershed is under threat from the agricultural practices and urban development that caused significant degradation in the past. The degradation includes ditching, erosion, sedimentation, excessive nutrient loading from fertilizers and wastewater treatment plants, and water pollution from pesticides, urban runoff and industries. The IEPA has designated segments of the river as being impaired for aquatic life, fish consumption, and swimming. Water quality problems are caused by sedimentation/siltation, PCB's, excessive nutrient loading, to high fecal coliform levels, mercury, chloride and copper. Most of these issues can be attributed to agriculture, industrial and municipal pollution 14.

While segments of Kishwaukee River in Boone and Winnebago County have long experienced heavy seasonal use for paddling, tubing, and fishing, the segment of river in McHenry County has historically only experienced light use for recreational purposes. However, starting in 2019, efforts to establish a permanent water trail for canoeing/kayaking through the section of Kishwaukee River in McHenry County were initiated by the volunteer organization "Paddle the Kish". The organization works closely with municipalities, landowners and other partners in the watershed to coordinate grants and other funding sources for water trail infrastructure. The infrastructure includes the construction of launch sites with parking areas to provide river access. Paddle the Kish and their partners also manage work days to keep the river clear for travel.

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Creeks and Streams

McHenry County has a large number of creeks dispersed across the county. The creeks with the greatest hydrologic influences in the county include Nippersink Creek that is tributary to the Fox River; and Piscasaw Creek, Coon Creek, and Kishwaukee Creek that are tributary to the Kishwaukee River. All of the creeks and streams in the county play important roles in managing stormwater, regulating flooding, processing nutrients, recharging groundwater, providing valuable habitat, and supporting tourism. However, many of these streams have been degraded due to past and current activities. The degradation includes hydrologic changes, pollution, and erosion.

Creeks and Streams of McHenry County			
Alden Creek	Franklinville Creek	Merchant Creek	Richardson Creek
Apple Creek	Geryune Creek	Mokeler Creek	Riley Creek
Barber Creek	Harmony Creek	Mud Creek	Robinson Creek
Boone Creek	Hebron Creek	Newman Creek	Rush Creek
Carver Creek	Horse Fair Creek	Nippersink Creek	Slough Creek
Cary Creek	Kingsley Creek	Nippersink Creek - N.Branch	Smallwood Creek
Coon Creek	Knickerbocker Creek	Overton Creek	Spring Creek
Cotton Creek	Laughing Creek	Piscasaw Creek	Troy Creek
Cowpie Creek	Lawrence Creek	Piscasaw Creek – West Branch	Tryon Creek
Crystal Creek	Lily Lake Drain	Ratt Creek	Union Creek
Dutch Creek	Little Beaver Creek	Reed Creek	Vander Karr Creek
Elizabeth Lake Springs	Lost Creek		Ward Creek

Examples of hydrologic changes that have impacted streams in McHenry County are channelization, ditching, agricultural drain tile and storm sewers. In the past, large sections of creeks in the county were channelized, transforming them from meandering streams to straight linear ditches in order to drain surface and groundwater more rapidly for agriculture and urbanization. Channelization along with other hydrologic changes increases the volume and velocity of runoff moving through connecting streams which results in streambank erosion, flooding downstream, and hydrologic extremes of flood and drought. These activities also have completely drained streams, particularly headwater streams. Each of these hydrologic changes also impact the aquatic habitat that supports the flora and fauna residing in or adjacent to the streams.

*** Photo comparison of Union Creek and railroad bridge with and without flowing water ***

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Additional hydrologic impacts to streams include dams and culverts that obstruct flow and movement of aquatic life. Free flowing streams are home to a diverse array of flora and fauna that all play a role in a complex food web that extends far beyond the waters they live in. By impeding flow, dams transform streams into artificial impoundments characterized by still water, warmer water temperatures, lower levels of dissolved oxygen, and sedimentation that creates a substrate of compacted silts. Passage for fish and other aquatic organisms is halted and the sediment laden bottom is no longer able to support the same diversity of plants and wildlife. There are currently over 100 dams in McHenry County's streams, ranging from the large earthen dam that forms Wonder Lake to small water level control structures in minor tributaries 26. While some dams serve important roles providing areas for recreation and wildlife habitat, many dams have outlived their intended usefulness. When dams are properly removed, streams rebound and wildlife return over time.

One of the most beneficial actions that can be taken to restore stream health is to provide or restore riparian buffers of along the streams. Riparian buffers (also called filter strips) are strips of grass, native vegetation, shrubs or trees bordering rivers or streams. The riparian buffers filter out nutrients and pollutants, slows the velocity of runoff and prevents erosion, stabilize stream banks, lowers water temperatures, improves aquatic and terrestrial habitat, and enhances the streams for wildlife and recreation. Typically, the wider the buffer the greater the benefit to water quality and wildlife. The McHenry County Conservation District (and many others) have studied the effectiveness of stream buffers and found that water quality and aquatic habitat can improve dramatically within ten years after filter strips are installed. The McHenry County Conservation District requires a minimum 65-foot buffer to be maintained on all of their farm lease properties and the U.S. Army Corps of Engineers Chicago District requires buffer widths of 100 feet or more for high quality wetlands under their permit program.

The maps in Figure ??? show how the streams of McHenry County have been altered. The first map shows the streams of McHenry County in their natural form, before any land use changes had occurred. The second map shows the segments of streams that have been channelized and drained in the past. The third panel shows the segments of streams that currently remain in their natural form. The maps help illustrate the scale of hydrologic changes that have impacts streams in McHenry County.

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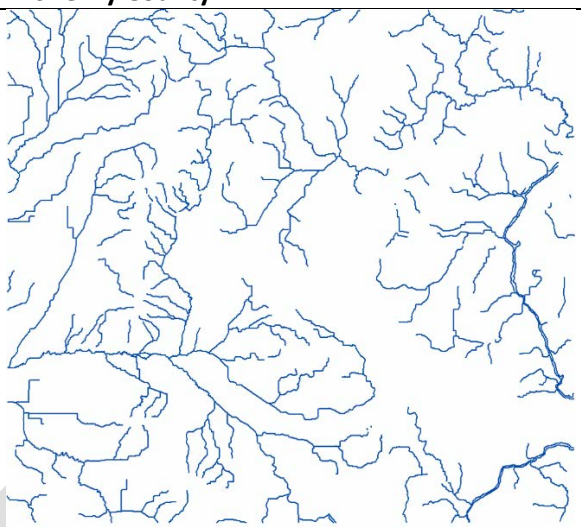
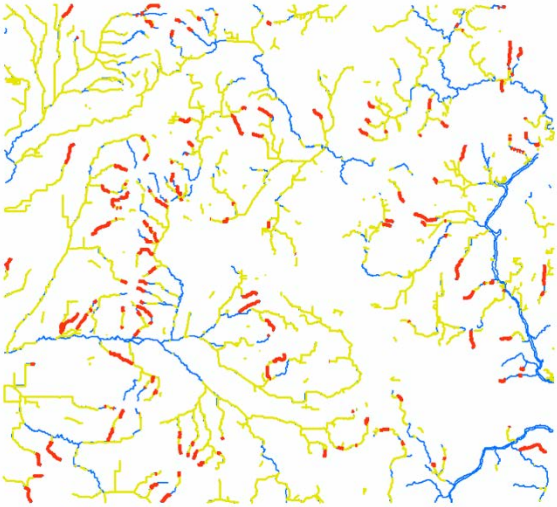
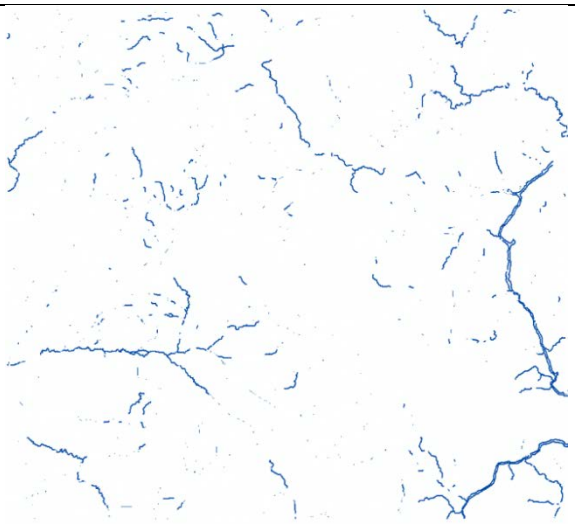
Stream Conditions in McHenry County	
All streams in McHenry County	
Channelized streams (yellow) Drained tributaries (red)	
Remaining streams in McHenry County that have not been altered	

Figure ???: Visual comparison of McHenry County streams in a natural condition, stream segments that have been channelized and drained, and stream segments that have not been altered. Courtesy of the McHenry County Conservation District

Although many segments of McHenry County's streams have been impacted, the remaining intact segments of streams contain areas of high quality habitat. The intact segments of streams are the most likely to have remaining high quality habitat while the altered stream segments may represent opportunities for restoration. The watershed plans and studies that have been prepared in McHenry County have all identified high quality segments of streams along with recommendations for ways to protect and restore the streams.

*** Photo of Nippersink Creek-East Side of Rt 47, North of Allendale ***

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McHenry County Groundwater

McHenry County relies solely on groundwater to meet all of its potable water needs and is very fortunate to have multiple sources of groundwater aquifers that are able to provide water supplies. The groundwater aquifers include:

- Shallow sand and gravel aquifers
- Shallow bedrock limestone aquifers (Silurian Dolomite)
- Deep bedrock sandstone aquifers (Cambrian-Ordovician)

The shallow sand and gravel aquifers are the main source of water in the county and are the most common aquifer used for private residential wells. Wells to these aquifers are generally between the ground surface and 300 feet deep. Sand and gravel aquifers are recharged locally from rainfall or snowmelt that infiltrates from the ground surface, down through the permeable layers of sand and gravel, and creates a water table. Wells drilled below the water table can pump groundwater for people to use. The groundwater is in constant motion, not only infiltrating downward into the water table but also moving sideways to provide a baseflow of water to McHenry County's lakes, rivers, streams and wetlands. This baseflow of cool, filtered groundwater is critical for maintaining the health of high quality aquatic systems. However, the baseflow can be disrupted when the water table is excessively drawn down from over-pumping or drought, or when land is converted to impervious surfaces that cause water to flow overland rather than infiltrating into the ground.

*** Sidebar for ISGS 3-D Modeling – Interactive Online Program ***

The capacity of sand and gravel aquifers to produce water can vary depending on factors such as where they are located, the size of their recharge area, and the permeability of the material in, and above, the aquifer. Because sand and gravel tends to be highly permeable, sand and gravel aquifers are particularly vulnerable to pollution that infiltrates downward with the water. Sand and gravel aquifers are also vulnerable to being drawn down if water is being pumped faster than it is being recharged naturally by rain and snowmelt.

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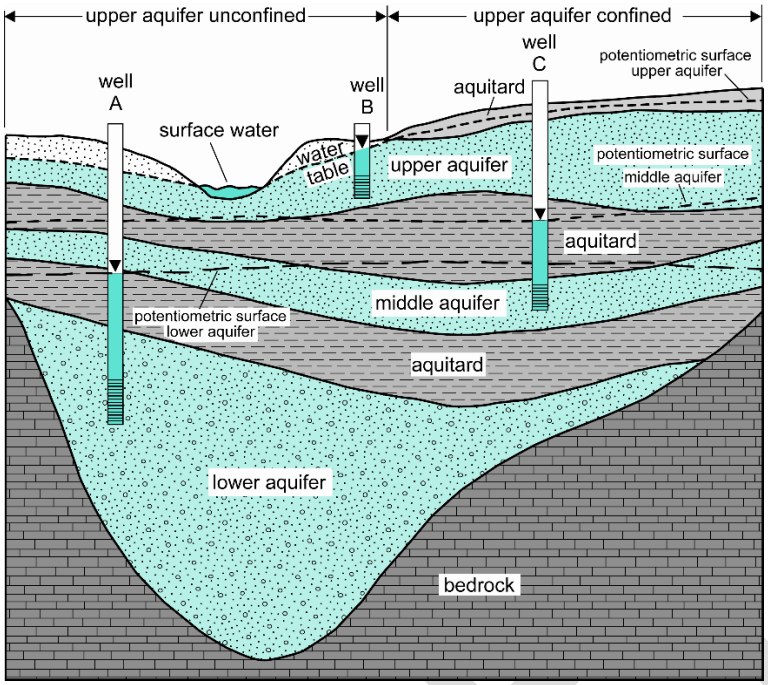

Figure ???: Conceptual illustration depicting how the variety of sand and gravel aquifers may be distributed in McHenry County. The aquifers are separated by confining layers (aquitards) and are located over limestone bedrock.

The shallow bedrock aquifers, technically called Silurian-Dolomite aquifers, are important sources of drinking water on the east half of the county, but provide the least amount of water of the three main aquifer types in McHenry County. They are referred to as shallow bedrock only in the context that they are not as deep as the bedrock aquifers below them. Wells to these aquifers are generally 100 to 300 feet deep. Shallow bedrock aquifers in the county consist predominantly of limestone which is a solid, non-porous rock. Water in these aquifers is held in the fractures and cracks of the hard rock. To function as an aquifer, the fractures and cracks have to be large, and interconnected, enough to hold significant amounts of water. Shallow bedrock aquifers are recharged by water that flows through the sand and gravel aquifers that lay above them. The presence of aquitards or aquicludes can limit the recharge of the aquifers. Because these aquifers require such specific conditions, yields can vary greatly from location to location and may be particularly susceptible to drawdown from pumping.

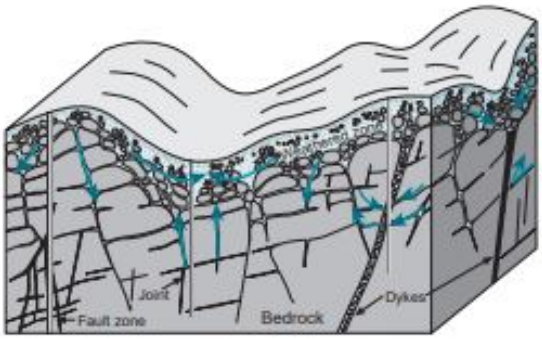

Figure ???: Profile view of fractures and cracks that serve as aquifers in bedrock aquifers.

The third type of aquifer in McHenry County are deep bedrock aquifers, technically called Cambrian-Ordovician aquifers, that consist of thick layers of sandstone. The sandstone aquifers are covered by confining layers of shale or other impermeable material that prevents infiltration and recharge of water from above. Wells to these aquifers are generally 800 to 1,400 feet deep. The sandstone aquifers underlie vast areas that not only extend throughout northeast Illinois but also underneath several states.

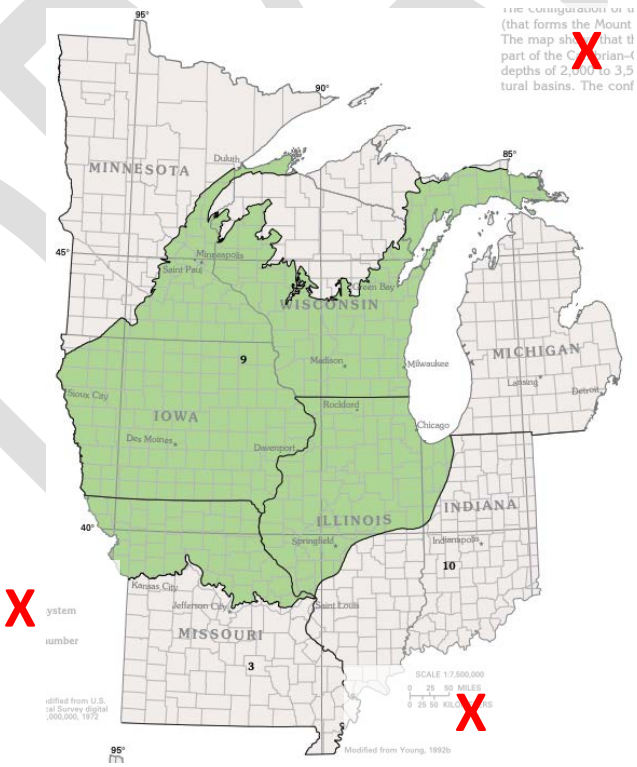

Figure ???: The deep sandstone aquifers in McHenry County are part of a larger aquifer system that extends under parts of seven states including Illinois, Wisconsin, Michigan, Minnesota, Indiana, and Missouri.

The upper layer of sandstone is called the St. Peter aquifer and it is recharged primarily in Boone County where deep bedrock valleys extend down to the aquifer. The deep bedrock valleys became filled with sand and gravel during periods of glaciation so they are no longer visible, but still allow water to infiltrate from the ground surface down to the St. Peter aquifer.

The deeper sandstone aquifer is called the Ironton-Galesville aquifer and it is the main deep aquifer used by municipalities in McHenry County. The Ironton-Galesville aquifer is recharged primarily in Central Wisconsin where that layer of sandstone rises up near the ground surface. The recharge rate of the Ironton-Galesville aquifer is very slow because of the long distance groundwater needs to travel and because the small pore size between the sandstone particles reduces the flow rate of the groundwater. It can take thousands of years for water infiltrating into the ground in central Wisconsin, to migrate through the sandstone aquifer and reach McHenry County.

At about 2,000 feet below the ground surface, the Mount Simon aquifer is the deepest sandstone aquifer under McHenry County. The water in the Mount Simon aquifer is predominantly saline and historically has not been used for potable water in the region. However, a layer of water at the top of the aquifer may have water quality sufficient for use for drinking water. Further study would be needed to evaluate the potential of the Mount Simon aquifer as a source of drinking water for McHenry County.

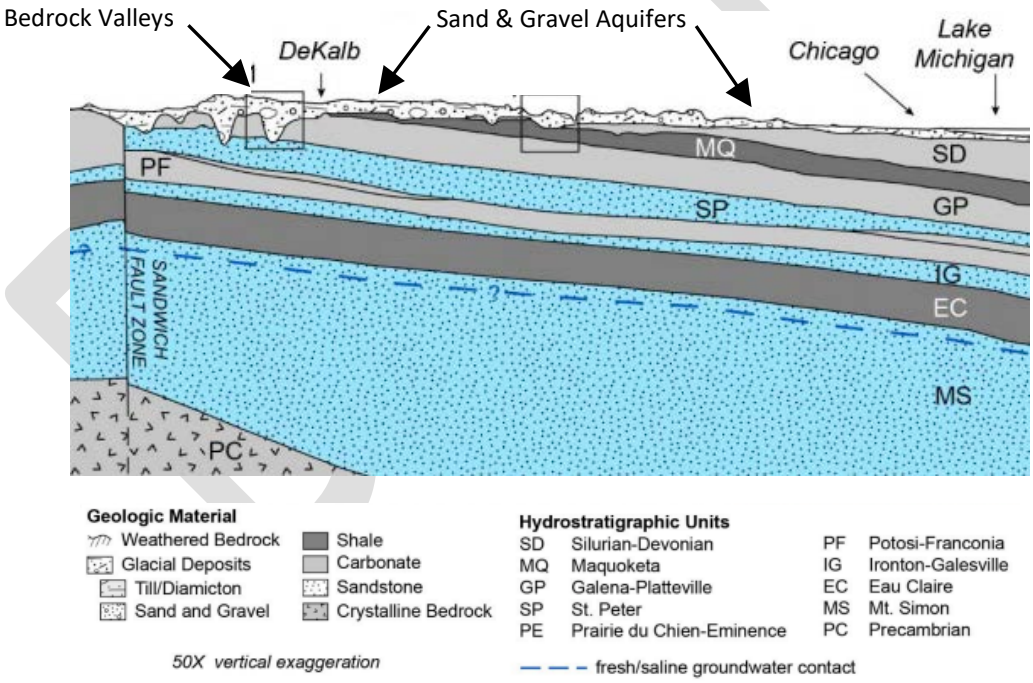

Figure ???: Illinois State Water Survey graphic showing a profile view of the subsurface geology and aquifers in northeast Illinois I24. The sand and gravel aquifers are at the surface, above the shallow bedrock/limestone aquifers (Silurian-Devonian). The layers shown in blue are the deep sandstone bedrock aquifers (St. Peter, Ironton-Galesville, Mount Simon). The dark layers between the aquifers consist of less permeable or impermeable material. The Ironton-Galesville is the primary deep aquifer used for drinking water in McHenry County.

The deep aquifers are particularly vulnerable to overconsumption due to the slow recharge rate and large number of high capacity wells, throughout northeast Illinois and beyond, that are withdrawing water from the sandstone aquifers. Wells in some areas have pumped so much groundwater that water levels in parts of the Ironton-Galesville aquifer have dropped over 800 feet. This over-pumping is accelerating regional desaturation of the sandstone aquifers. According to the Illinois State Water Survey (ISWS), withdrawals from the sandstone aquifers in northeast Illinois are occurring at twice the natural recharge rate I1. The combination of desaturation in northeast Illinois and pumping of groundwater for municipal wells is causing localized desaturation in the sandstone aquifers under McHenry County. This desaturation places future water supplies at risk. Communities in the southeast part of the county that rely on deep aquifers are the most vulnerable to future shortages I12. The maps in Figure ??? show approximate areas of the Ironton-Galesville aquifer under McHenry County at risk for not meeting supply needs in 2020 and 2050 I12. Water conservation and efficiency programs are particularly important for these communities in order to reduce the rate of desaturation, extend the availability of their existing water supplies, and prolong the life of their water infrastructure.

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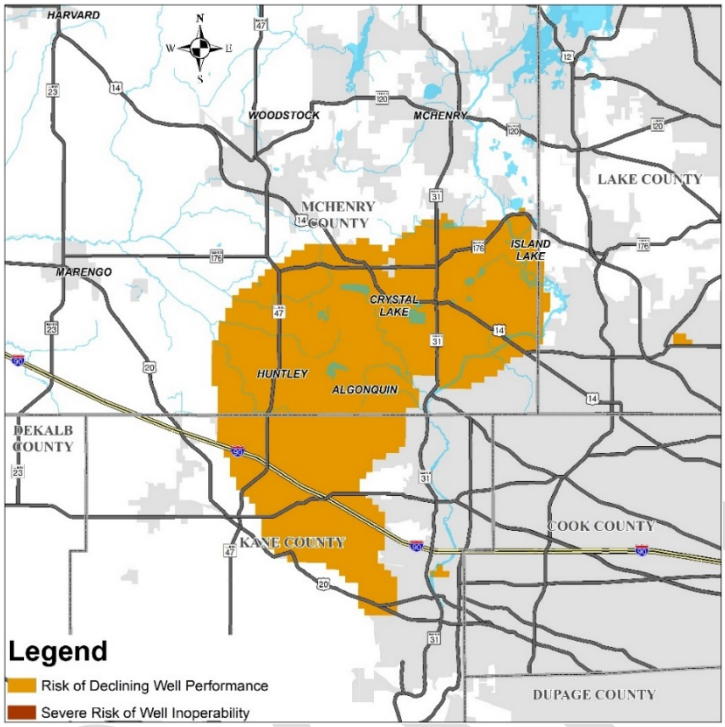
Ironton-Galesville Sandstone Aquifer Risk maps

2020



2050

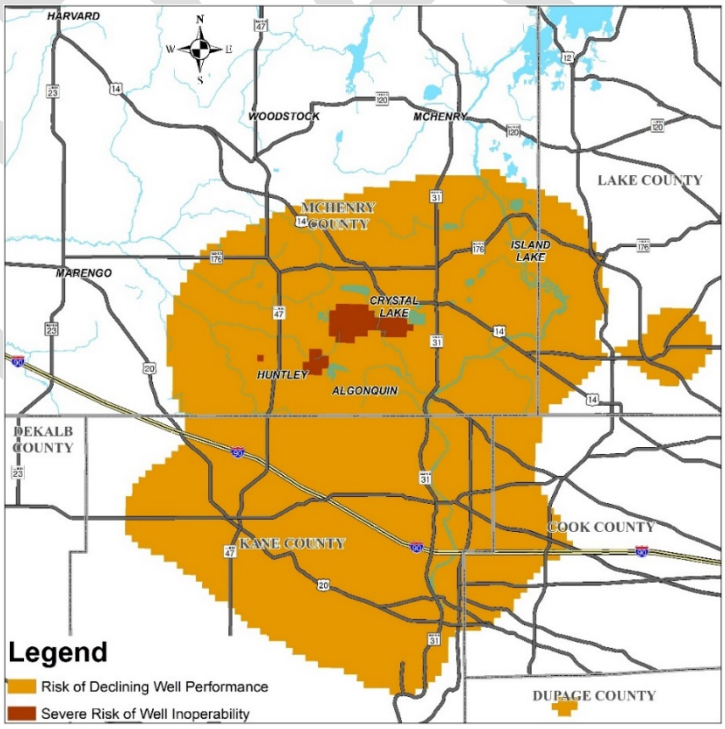


Figure ?? Illinois State Water Survey (ISWS) maps illustrating approximate zones within the Ironton-Galesville sandstone aquifer under McHenry County that are experiencing desaturation and may face increasing challenges to pumping and water supplies in the futureI12.

Although it is possible to temporarily pump water beyond the sustainable yield of the aquifer, this imbalance between withdrawals and recharge cannot be sustained indefinitely. The maps in Figure ??? are based on regional studies conducted by the ISWS and demonstrate that the long-term viability of water supplies in the deep sandstone aquifers is a significant concern, especially for the southeast part of the county. Based on the amount of water currently being pumped from the deep sandstone aquifers, all of southeast McHenry County is at risk of declining well performance and some communities face severe risks of well inoperability by 2050 ?? ISWS publication pending.

Because withdrawals from the deep aquifer already exceed sustainable yield, future growth in McHenry County will increasingly depend on water from the shallow sand and gravel aquifers as well as improved water conservation practices to meet demand for water supplies. McHenry County understands the importance of water and has made great strides to towards understanding its aquifers including the development of the Groundwater Resources Management Plan, the original Water Resources Action Plan (WRAP), 3-Dimensional modeling of the subsurface geology and aquifers, the installation of a monitoring well network that is used to monitor groundwater levels and water quality across the county, and potentiometric mapping to study direction of groundwater flow. Since groundwater systems can be extremely complex and localized, more detailed studies (in coordination with the ISWS, ISGS and USGS) should be conducted at the municipal scale to develop a more complete understanding of the potential water supplies in the aquifers. The localized studies would help municipalities develop sustainable long-term plans and better maintain the balance between supply and demand for water into the future.

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