

2011 Water Quality Management Plan Update

Lower Rock Basin, Wisconsin

December 2011 (2015)

This watershed's 288 square miles are in western Walworth County (62%) and Rock County (38%). Land use is primarily cash crop and dairy agriculture throughout the headwater tributaries and creek main stem. Turtle Creek flows into the east side of the city of Beloit to join the Rock River just above the Illinois border. Crop-land in the headwater areas and urban land use near Beloit contribute the two highest erosion rates in the watershed. Also, streambank erosion is a problem. A 1982 inventory showed that ten percent of streambanks in the watershed were eroding (Rock Co. Erosion Control Plan). In 1986, this watershed experienced an estimated average soil loss of 8 tons/acre/year.



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A priority watershed project under the Wisconsin Nonpoint Source Water Pollution Abatement Program began in 1984 and was completed in 1994. The project had four water quality and water use objectives:

- 1. Improve the smallmouth bass fishery in main stem Turtle Creek and Little Turtle Creek;
2. Protect and improve fish habitat and water quality of tributaries to Turtle Creek;
3. Protect and improve fish habitat in creeks that currently support remnant populations of Wisconsin's endangered and threatened fish species; and
4. Retard the eutrophication process in lakes Delavan and Comus.

According to the 1994 post-project evaluation report, the effectiveness of best management practice implementation was evident on a site-by-site basis, but there was no discernible watershed-wide reduction in nonpoint source (runoff) pollutant loads. Low participation rates and implementation of best management practices that brought landowners short-term benefits are cited as reasons for this result. Poor livestock management practices, such as cropping too close to stream channels, overgrazing of pastures, and livestock grazing in streambanks in headwater streams, limited the overall effectiveness of the project.

Watershed Details

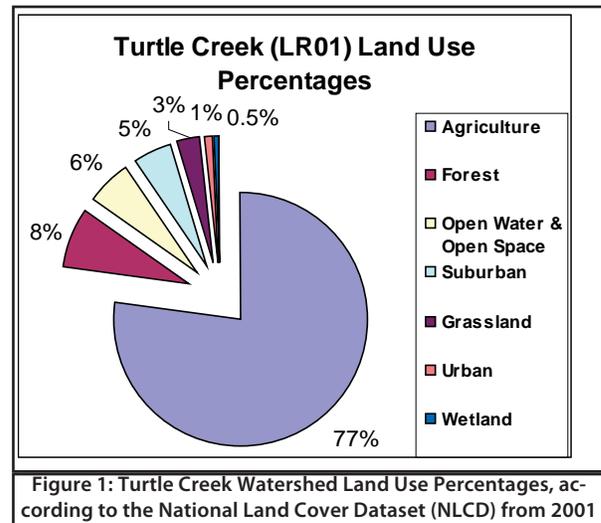
Population and Land Use

Although the Southeast Glacial Plains Region is quite urban compared to other state areas, agriculture is very important with 77% of land area in the Turtle Creek Watershed devoted to farmland. Among the regions it ranks third in percent of acreage in farmland, market value of agricultural products per acre, and milk production per acre; and it ranks second in corn production. (Farmland includes all land under farm ownership such as cropland, pastureland, and woodland.) The percentage of agricultural land sold and diverted to other uses is below average. Recreation is also important in this region. It has

the highest number of fishery and wildlife areas, the second highest number of state parks and forests, and one of the highest ratios of water to land surface area. Per capita water use is near average. The per capita income, average wage, and number of high school and college graduates are all third highest, while the rates of poverty and unemployment are both third lowest among the regions. The manufacturing sector is relatively strong, whereas farming, though very productive, does not provide a large percentage of jobs.

After agriculture, forest cover accounts for the second largest share of land use in the Turtle Creek Watershed with eight percent of the total area. Open water and open space is the third most common land use in the watershed with six percent of the total area. Suburban and urban environments amount to another six percent of the watershed's area. Grasslands and wetlands are the last significant land uses in the watershed with three percent and one-half of one percent of the watershed's area, respectively.

Land Use	Acres	Percent of Area
Agriculture	142,212.83	77.03%
Forest	14,102.72	7.64%
Open Water & Open Space	11,042.57	5.98%
Suburban	8,887.12	4.81%
Grassland	5,395.74	2.92%
Urban	2,019.35	1.09%
Wetland	885.58	0.48%
Barren	63.60	0.03%
Total Acres in Watershed	184,609.52	



Turtle Creek Watershed's largest water resource, Delavan Lake, has a watershed (drainage area) of about 26,000 acres or 40.8 square miles. As of 1995, approximately 85% of the lake's watershed consisted of rural land uses, and 15% of urban land uses. Major land uses included: 70% agriculture, eight percent woodlands, wetlands or open lands, seven percent residential, and eight percent commercial, industrial, transportation, and recreational. Under planned 2020 conditions, the Walworth County development plan and regional land use plan forecast 6,200 acres (24 percent of total area) of development within the watershed (SEWRPC 2002).

Hydrology

The Southeast Glacial Plains has the highest aquatic productivity for plants, insects, invertebrates, and fish, of any Ecological Landscape in the state. Significant river systems include the Mukwonago, Wolf, Sheboygan, Milwaukee, Rock, Sugar, and Fox. Most riparian zones have been degraded through forest clearing, urban development, and intensive agricultural practices. The Ecological Landscape contains several large lakes, including those in the Madison area and in the Lake Winnebago Pool system. These lakes are important to many aquatic species including the lake sturgeon. Kettle lakes are common on end moraines and in outwash channels. In addition to Horicon Marsh, this Ecological Landscape contains important fens, tamarack swamp, wet prairies, and wet-mesic prairies that contain rare plants and animals. However, most wetlands have experienced widespread ditching, grazing, and infestation by invasive plants. Watershed pollution in the Ecological Landscape is about average according to rankings by Wisconsin DNR, but groundwater pollution is worse than average compared to the rest of the state.

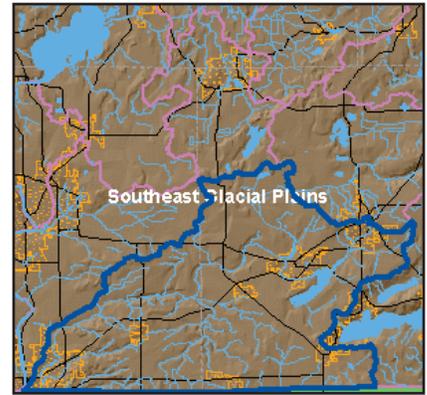
Ecological Landscapes

The Lower Rock Basin resides in the Southeast Glacial Plains Ecological Landscape, which makes up the bulk of the non-coastal land area in southeast Wisconsin. This ecological landscape is made up of glacial till plains and moraines. Most of

this ecological landscape is composed of glacial materials deposited during the Wisconsin Ice Age, but the southwest portion consists of older, pre-Wisconsin till with a more dissected topography. Soils are lime-rich tills overlain in most areas by a silt-loam loess cap. Agricultural and residential interests throughout the landscape have significantly altered the historical vegetation. Most of the rare natural communities that remain are associated with large moraines or are in areas where the Niagara Escarpment occurs close to the surface.

Historical Note

Turtle Creek originates in Turtle Lake in Walworth County, skirts the City of Delavan, meanders through Rock County and then empties into the Rock River at the City of Beloit. Although Native Americans inhabited this area almost 3,000 years ago, it was the Effigy Mound Builders of the Late Woodland Period (500 to 1000 AD), who left their mark upon the land.



Map 2: Turtle Creek Watershed Ecological Landscapes

The Effigy Mound Culture extends from Dubuque, Iowa, north into southeast Minnesota, across southern Wisconsin from the Mississippi to Lake Michigan, and along the Wisconsin-Illinois boundary. Although some mounds are abstract in shape, including the long linear embankments, or dome-shaped mounds, the animal shaped mounds have captured the public's interest. Mounds in the shapes of birds, bear, deer, bison, and lynx have been recorded. Near Lakes Michigan and Winnebago, turtle and panther mounds are common. Some of the mounds may be up to 150 feet in length.

The animal shapes may represent clan symbols or symbolized spirits of the sky, earth and water. The grouping of mounds may indicate social or religious ties among scattered communities. The purpose of the mounds may have been ceremonial or they may have delineated territory for hunting or gathering grounds.

Early maps indicate more than 20,000 Indian mounds once existed in Wisconsin; today fewer than 3,000 remain. Many of the mounds were built on the high ground overlooking the confluence of the Rock River and Turtle Creek and along the shores of Delavan Lake. Early surveyors of mineral lands and those working for railway were among the earliest Europeans to take notice of these unusual land formations. An article on the Beloit Mound Groups appeared in the November 1919 Bulletin of The Wisconsin Archeologist. This article references research from the mid 1800's and includes maps drawn by researchers from Beloit College which indicate many turtle shaped mounds in the south central part of Wisconsin.

The legacy of the Mound Builders lives on today as it is possible that Turtle Creek was named after one of the many turtle shaped mounds found along its banks. The turtle is the unofficial mascot of the college, and Beloit College's Logan Museum of Anthropology houses many of the excavated tools and broken pottery artifacts found in or near the mounds. Today the historical and cultural value of effigy mounds is recognized and they are generally well protected from development for future generations to wonder about and enjoy.



Figure 2: Effigy Mounds on the Campus of Beloit College

Watershed Condition

Overall Condition

Potawatomi Creek is considered an Outstanding Resource Waters for one mile of its length and there are over 40 stream miles of Exceptional Resource Waters spread along segments of the Turtle Creek, Little Turtle Creek, Spring Brook, and an unnamed tributary to Turtle Creek. Potawatomi Creek claims the only mile of documented trout waters in the watershed as it is a Class I Trout stream. Impaired waters account for about 11 stream miles along Turtle Creek due to excess

phosphorus loads, which is why a restoration area has been designated along the creek. Three large lakes can be found in the Turtle Creek Watershed: Comus Lake, Delavan Lake, and Turtle Lake. Five sensitive areas have been designated on Delavan Lake.

River and Stream Condition

According to the WDNR’s Register of Waterbodies (ROW) database, there are over 335 miles of streams and rivers in the Turtle Creek Watershed; 122 of these waters have been entered into the WDNR’s assessment database. Of these 122 miles, almost half (45%) are meeting Fish and Aquatic Life uses and are specified as in “good” condition; about nine percent of streams are considered to be in “poor” condition and are listed as impaired. The condition of the remaining stream miles is not known or documented.

Additional uses for which the waters are evaluated include Fish Consumption, General Uses, Public Health and Welfare, and Recreation. As Table 2 shows, these uses have not been directly assessed for the watershed. However, a general fish advisory for potential presence of mercury is in place for all waters of the state.

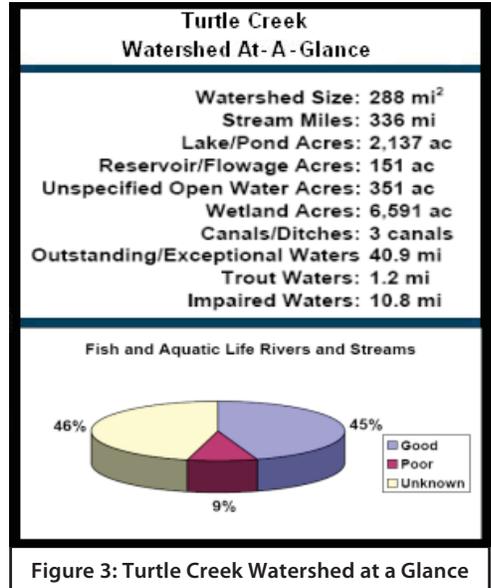
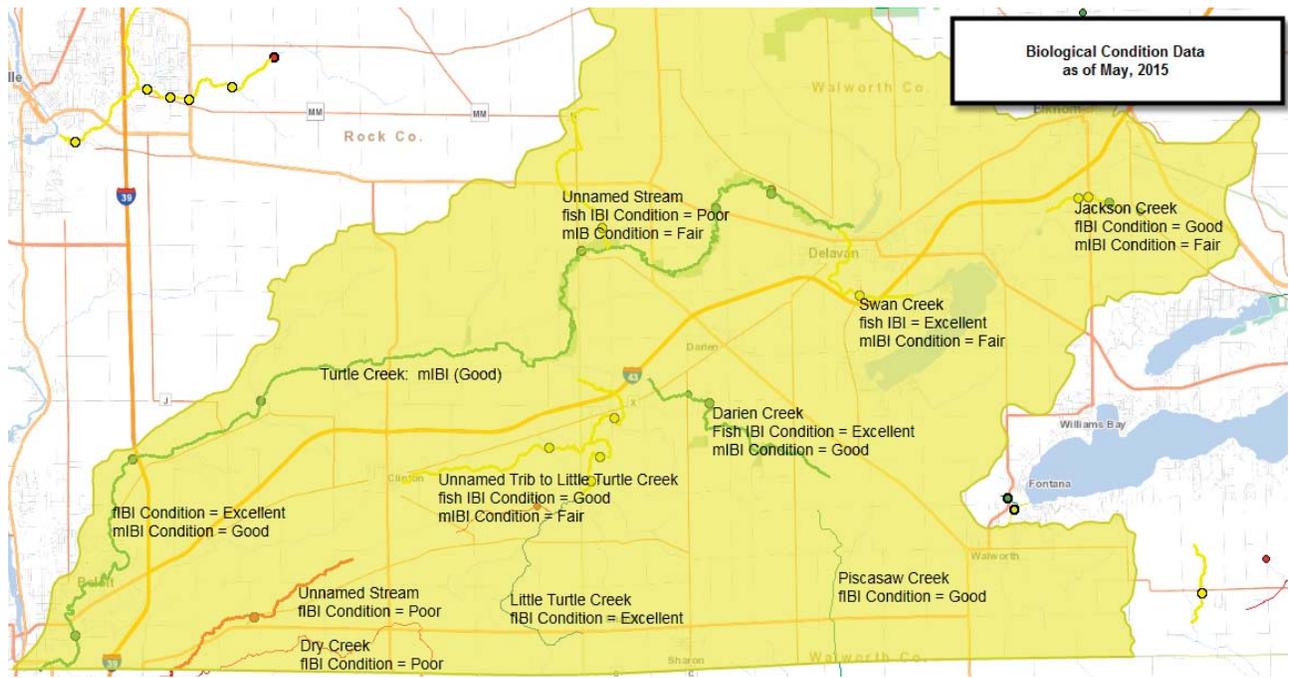


Table 2: Designated Use Support Summary for Turtle Creek Watershed Rivers and Streams (all values in miles)

Use	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Fish Consumption				121.75	121.75
Fish and Aquatic Life	11.91	42.77	10.81	56.26	121.75
General				121.75	121.75
Public Health and Welfare				121.75	121.75
Recreation				121.75	121.75



Darien Creek

Darien Creek is a small continuous stream that flows for 5.3 miles through agricultural areas. This stream has a sand, gravel and rock substrate and good water clarity. Fluctuating water levels and lack of bank and in-stream cover, however, limits the fishery to forage species. The Ozark minnow and slender madtom, state threatened species, have been found in the stream. The Darien wastewater treatment plant once discharged to this creek. Elevated five-day biological oxygen demand (BOD5) was a problem for the plant. In the past, the plant's design average for BOD5 was lower than its maximum monthly average in the effluent. Based upon a September 1995 amendment to the Village of Darien's Sewer Service Area Plan, Southeast Wisconsin Regional Planning Commission (SEWRPC) recommended that the Darien sewage treatment plant be abandoned and connected to WalCoMet. The community followed the recommendation. A 2007 macroinvertebrate survey on the stretch Mile 2.06 to 9.35 indicated "good" water quality.

Dry Creek

Dry Creek is a shallow, warm water stream flowing southwesterly in the southern part of the county and into Illinois. The fishery consists of forage species only. There are 28 acres of adjoining grass marsh wetland with little wildlife value. Access is available from two town road bridges. Biological data indicate good to excellent aquatic condition.

Jackson Creek

Water quality in this stream is fair. Fish data indicates "good" condition, while macroinvertebrate data indicate "fair". Phosphorus concentration analysis show Jackson Creek at Mound Rd near Elkhorn exceed state water quality standards. The creek flows through about 200 acres of wetland. Historically water quality has improved since the Elkhorn wastewater treatment plant stopped discharging to it. Jackson Creek is a major tributary, both inflow and outflow, to Lake Delavan. This creek has historically carried heavy nutrient and sediment loads to the lake; alterations as a part of the Lake Delavan Lake Project may have reduced nutrient and sediment loading. Downstream from the lake, the stream supports walleye, yellow perch, largemouth bass, and panfish.

Ladd Creek

The headwaters of Ladd Creek originate just northeast of Sharon in Walworth County and flow for three miles until discharging into Little Turtle Creek. The current use of Ladd Creek is listed for fish and aquatic life, but the stream's current condition has not been assessed.

Little Turtle Creek

Most of Little Turtle Creek's 12 miles have been ditched for drainage of the surrounding farm lands, resulting in habitat deterioration, increased water temperatures, high turbidity, sedimentation, infilling of deep pool habitat, and excessive nutrient and fecal bacteria concentrations. This stream is managed as a warm water forage fishery. The Rock County portion of this stream is an Exceptional Resource Water. The stream supports the gravel chub and slender madtom, two species on the state threatened and endangered species list. Little Turtle Creek is too shallow to provide habitat for game fish. On the stretch from mile 1.03 to 7.34 three stations were monitored in 2007 and 2013, indicating "fair" water quality.

A 20-mile segment of Little Turtle Creek runs from the Walworth-Rock county line southwest to where it empties into the Rock River at Beloit. The Rock County portion is designated an Exceptional Resource Water. This higher gradient segment is affected by urban polluted runoff in the Beloit area and by sediment from adjacent corn fields and severely eroding streambanks. The Shopiere Dam was removed in 2000. Walleye, catfish, northern pike, and panfish now have access to the upper reaches of the stream. Formerly, Turtle Creek supported an excellent smallmouth bass fishery below the dam and a marginal smallmouth bass fishery above the dam. The removal of the Shopiere Dam has enabled fish migration and the smallmouth bass fishery is expected to improve.

Piscasaw Creek

Surface water is the primary source of water for this extensively ditched creek, but groundwater inputs from springs support a good forage fish population. This stream traverses the state border. In Wisconsin, the stream supports a warm water forage fishery, while near Harvard, IL the stream supports one of Illinois' only naturally reproducing brown trout populations. Illinois and the U.S. Environmental Protection Agency are interested in interagency, interstate water resources planning to improve water quality in the stream. Fontana-Walworth Water Pollution Control, serving 2.5 square miles, discharges to this stream. Recent fish index of biological integrity data indicate the condition is "good".

Spring Brook (T01n R13e S31)

Spring Brook (T1N R14E S31) is a seepage-and-spring-fed, nine-mile-long tributary to Turtle Creek. The stream is shallow and its flow is greatly reduced in dry years; the stream receives flow from the Clinton wastewater treatment plant and cooling water from Hormel. Possible temperature alterations to Spring Creek from the Hormel discharge are of concern. Biotic survey work would determine what, if any, biological impacts point source discharges have had on this creek. The stream supports a diverse array of minnow species.

Spring Brook (T02n R14e S27)

This four-mile-long spring and seepage creek rises in eastern Rock County 1.5 miles west of the Rock-Walworth county line and flows southerly and at a medium gradient through the Carver-Roehl County Park to its confluence with Turtle Creek. High fecal *Streptococcus* bacteria counts have been detected in the stream, probably due to the obvious stream-bank pasturing upstream in the flat terrain of the creek's headwaters adjacent to dairy farm operations. A habitat evaluation in 1996 at the Carver-Roehl Park characterized the stream as having "good" habitat quality at that site.

Swan Creek

Swan Creek, a tributary to the upper reaches of Turtle Creek, has showed excellent condition based on fish IBI values, while macroinvertebrate index data indicated fair condition. The stream is considered in "good" condition and is managed for fishing and swimming.

Turtle Creek

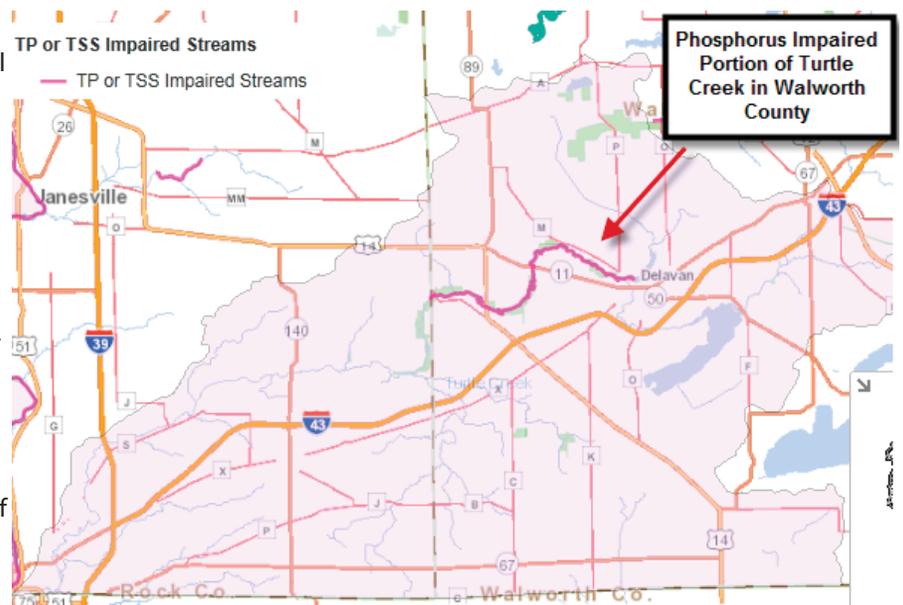
Turtle Creek is the second largest stream in Rock County and is an important recreational asset. The stream originates in Walworth County, enters Rock County at Fairfield and flows southwest to the Rock River just below Beloit in Illinois. Turtle Creek is managed for smallmouth bass; additional game fish species which occur in varying numbers include walleyes, black crappies, rock bass, northern pike, and channel catfish. The latter two species are concentrated in the lower reaches of the river. Carp are abundant at times, along with redhorse, suckers, and forage species.

Adjoining 128 acres of fresh meadow wetlands are concentrated in the upper portion of the stream. About 13 percent of the wetland is wooded. Approximately 2 miles of the stream runs through the Turtle Creek Wildlife Area which includes 312 acres of public hunting and fishing grounds in Rock County. Spring flow in both Rock and Walworth counties maintain open water the year round in the wildlife area, and approximately 2,000 mallards and 2,000 Canada geese over-winter here. The area is also used extensively by feeding and resting waterfowl during migration periods and habitat improvement has greatly increased nesting densities in recent years. The area also has a good natural pheasant population which is supplemented by stocking during hunting season. In addition to hunting and fishing, Turtle Creek is one of the better streams in southern Wisconsin for canoeing. There is also one town park and one city park located on the stream. Access is available at the wildlife area and the parks, and is possible at six town roads, two county roads and one state highway crossing.

Data indicates that Turtle Creek may exceed the phosphorus standard at Colley Road in Beloit.

Turtle Creek (Comus Lake to Rock-Walworth County Line)

This 13-mile stretch of stream (plus Comus Lake) is buffered by more than 2,000 acres of adjacent wetlands in the nearby state-owned wildlife area. This segment is, however, affected by urban polluted runoff from the city of Delavan and exhibits low dissolved oxygen and high turbidity, especially during low flow conditions. A marginal smallmouth bass fishery exists and the threatened Ozark minnow has been found in a tributary to this stretch. In the past, WDNR proposals for



habitat enhancements have been deferred due to excessive polluted runoff impacts and the stream’s natural limitations. This segment’s potential is considered warm water forage fishery.

Lake Health

The WDNR’s ROW database shows that there are 2,137 acres of lakes and ponds, 151 acres of reservoirs and flowages, and another 351 acres of unspecified open water in the Turtle Creek Watershed. Approximately 2,644 lake acres are entered into the state’s assessment database. Most of these waters (86%) are indicated as supporting Fish and Aquatic Life uses. A couple hundred acres have not been assessed for Fish and Aquatic Life use, yet, and none of the lake acres have been assessed for any other use. The following water narratives summarize the most recent information available for lakes in the watershed, which include Comus Lake, Delavan Lake, and Turtle Lake.

Use	Supporting	Fully Supporting	Not Assessed	Total Size
Fish Consumption			2,644.16	2,644.16
Fish and Aquatic Life	2,279.07	140	225.09	2,644.16
General			2,644.16	2,644.16
Public Health and Welfare			2,644.16	2,644.16
Recreation			2,644.16	2,644.16

Comus Lake

Comus Lake is a 164-acre lake in Walworth County with a maximum and mean depth of six feet and four feet, respectively. With this large size and shallow depth, fish kills occur. Other problems the lake encounters include: urban stormwater runoff and polluted agricultural runoff from the lake’s immediate watershed, including the City of Delavan. While the lake is located northeast of Delavan, one-half of the lake’s acreage is located in the city’s sewer service area and the lake’s northern shoreline will be sewered in the future (SEWRPC). The lake has recently undergone dredging by the Comus Lake Management Organization. The lake also experiences in-lake and shoreline habitat loss or degradation, turbidity from stormwater and agricultural runoff, and aquatic plants dominate the lake’s littoral zone. An endangered rattlesnake was sighted at the lake in the 1980s. In 1995 SEWRPC recommended that the Lake Comus Sanitary District participate in WDNR Self-Help Monitoring to collect water quality data.

Delavan Lake

Lake Delavan is a moderately large eutrophic lake in Walworth County. A dam on Swan Creek, the lake’s outlet stream, elevates the level by three feet. Excess nutrient inputs into the lake results in poor water quality, severe blue-green algae blooms, excessive numbers of rough fish, anoxic conditions and fish kills. Construction of a municipal sewer system eliminated septic systems surrounding the lake by 1981 and a complete restoration was undertaken in the late 1980s and 1990s. Dewatering, pesticide application for carp removal, and extensive alum treatments were conducted. However, a tremendous amount of phosphorus and nutrient-rich sediment remain in the lake. Although the lake’s excess nutrients no longer result in the large blue-green algae mats of the 1970s and 1980s, an overabundant fishery and Eurasian water milfoil presence are problematic.

An Aquatic Plant Management Plan (1993) was completed by Aron & Associates. In 1975 more than 15% of the lake’s direct drainage was urbanized; today this percentage is likely higher. Stormwater management, construction site erosion, and hydrologic modification are top concerns for this lake. The Lake Restoration Project implemented by local citizens, governmental units, the University of Wisconsin, WDNR, U.S. Geologic Survey, and U.S. Environmental Protection Agency in the 1980’s and 1990’s included the following milestones: short-circuiting the mixing of nutrients coming into the lake from Jackson Creek; drawing down the lake for treatment of rough fish (carp) with the chemical rotenone; and application of aluminum sulfate on the lake bottom to reduce nutrient exchange between lake sediments and lake water. The plan also reduced nutrient and sediment loads through wetland restoration and creation. About 125 acres of existing wetland and farmed wetlands at the confluence of Jackson Creek and its major tributary were selected for restoration/creation (Helsel and MacKinnon 1995). An 85-acre wetland was constructed to reduce sediment and nutrients entering the lake. This Lake Renewal Plan, funded by U.S. EPA’s Clean Lakes Program, was implemented in

coordination with the activities funded under the Turtle Creek Priority Watershed Project.

In 1989, a major restoration project was begun on Delavan Lake to fix the severely deteriorated lake ecosystem. The lake was temporarily lowered 10 feet and a complete fishery eradication was conducted. Modifications were made at the dam, an in-lake barrier was constructed to allow for short-circuiting of lake inflows, and a sediment control channel was built at the inlet. Sediments in the deeper portions of the lake received an alum treatment, and numerous non-point source pollution controls were conducted in the watershed. The lake's fishery was then restocked and previously farmed wetlands were reestablished. As one of the largest lake restoration projects in North America, this project has given Delavan Lake international attention in the area of lake rehabilitation. The Delavan Lake project was awarded Wisconsin's top prize for lake stewardship, and the North American Lake Management Society's 1991 Technical Excellence Award in recognition of outstanding efforts in lake restoration, protection, and management (SEWRPC 2002).

Due to restoration efforts, Delavan Lake now has multiple recreational uses including the seasonal activities of fishing, water skiing, swimming, small craft sailing, ice fishing, cross-country skiing, ice-skating, and hunting. The lake also provides natural scenic beauty throughout the year, and opportunities for walking, jogging, bird watching, and picnicking.

Department personnel conducted Delavan Lake sensitive area designation surveys on June 23, 2005, July 8, 2005 and July 27, 2005, following the Wisconsin Department of Natural Resources' sensitive area survey protocol. Sensitive areas often have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A designated sensitive area alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, lake districts, towns, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem, or may feature an endangered plant or animal.

Five sensitive areas have been designated on Delavan Lake, and development along the shoreline of each of the five sensitive areas should be carefully studied to prevent any further loss of habitat. The Delavan Lake (Walworth County, Wisconsin) Integrated Sensitive Area Report identifies the biological components of each sensitive area, identifies sensitive area characteristics, and poses management recommendations for each of the five areas (Hemmingsen and Bunk. Delavan Lake (Walworth County, Wisconsin) Integrated Sensitive Area Report, 01/22/2007).

Turtle Lake

Turtle Lake is a quiet spring-fed lake in Walworth County that covers 140 acres, has a maximum depth of 35 feet and forms the headwaters of Turtle Creek. The lake's shoreline is a mixture of wetlands with development both on the east and north sides of the waterbody. There is a trailer park on the lake's shoreline that once had problems from leaking holding tanks. About 113 of the 748 acres that directly drain into the lake were urbanized as of 1975 (SEWRPC); today the acreage of direct drainage that is urbanized is a greater amount. There is limited public access on the lake and very little water quality data exists. Eurasian water-milfoil and purple loosestrife are present in the lake and its shoreline area.

There is a lake management association for the lake and volunteer monitoring for chemistry is conducted regularly. A Lakes Planning Grant should be pursued to conduct a thorough survey of the lake's water quality and habitat and to identify and protect the remaining wetlands that surround the lake ((Rock River Water Quality Management Plan, Lower Rock River Appendix. WT-668-2002. South Central Region, WDNR).

Sensitive Areas

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Sensitive Area 1 is located in the upper inlet of Delavan Lake (see Map 3). The inlet is part of Delavan Lake, but is also considered by many as a part of Jackson Creek. This sensitive area, with its rich ecological diversity, serves as 1) a nutrient buffer reducing algae blooms; 2) a biological buffer reducing the likelihood of exotic invasions; 3) a physical buffer against shoreline erosion; 4) a micro-habitat increasing biodiversity, and 5) allows for sediment stabilization. The entire inlet area is classified as Class I or Class II Wildlife Habitat Areas by the Southeastern Regional Planning Commission (SEWRPC 2002).

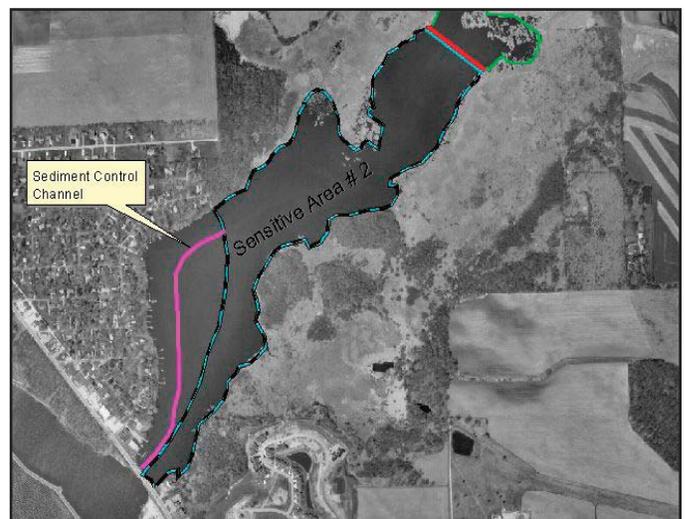
The ecological community of Sensitive Area 1 has distinctly unique features when compared to the waterbody as a whole. This site provides a visual and audible buffer from shoreline structures, roads, and boat traffic. Aquatic plants in the sensitive area include emergents, algae, potamogetons, exotics, free floating, floating leaf, and submergents. Wet edge plants include herbs, sedges, shrubs, and grasses. Game fish and forage fish are present in the sensitive area, and bass and pike use the area for spawning. The undeveloped shoreline is extremely valuable for wildlife. Wildlife present in the sensitive area include furbearers, songbirds, swallows, waterfowl, shore birds, and amphibians. State listed special concern species present within this site include black terns and least bitterns. This site could be used to educate citizens about wetlands and sensitive areas.

Sensitive Area 2, in the lower inlet of Delavan Lake, serves as a fish and wildlife refuge and has diverse aquatic vegetation, terrestrial vegetation and wildlife populations. The site acts as a nutrient buffer reducing algae blooms, a biological buffer reducing the likelihood of exotic invasions, a physical buffer against shoreline erosion, a micro-habitat increasing biodiversity, and allows for sediment stabilization. This site provides a visual buffer from shoreline structures. Aquatic plants in the sensitive area include emergents, algae, potamogetons, exotics, free floating, floating leaf, and submergents. Wet edge plants include herbs, sedges, rushes, shrubs, and grasses. Game fish, panfish, young of the year fry and forage fish are present in the sensitive area. Wildlife present include furbearers, waterfowl, shore birds (including wood ducks and brood), amphibians, and reptiles. The undeveloped shoreline is extremely valuable for wildlife. This site could be used to educate citizens about wetlands and sensitive areas, possibly by canoe.

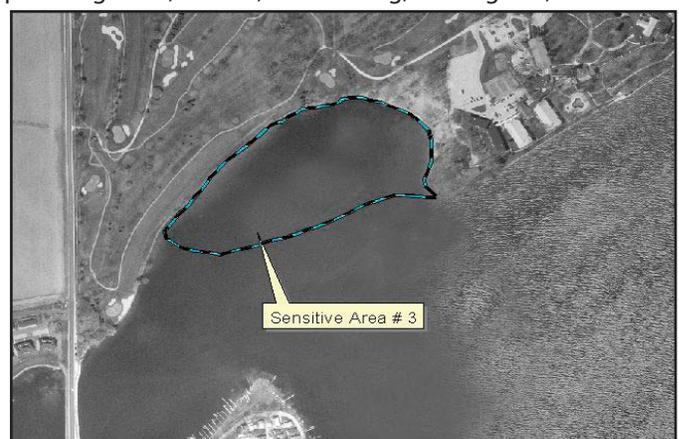
Sensitive Area 3, in Lake Lawn Bay of Delavan Lake, serves as a fish and wildlife refuge and has a diverse wildlife population. The area acts as a nutrient buffer to reduce algae blooms, a biological buffer reducing the likelihood of exotic invasions, a physical buffer against shoreline erosion, a micro-habitat that increases biodiversity, and allows for sediment stabilization. Sensitive Area 3 is very important as a refuge for fish and wildlife, away from active boating lanes. Important habitat components at this site include



Map 3: Delavan Lake Sensitive Area #1



Map 4: Delavan Lake Sensitive Area #2



Map 5: Delavan Lake Sensitive Area #3

gravel bottom, submerged vegetation, and over-hanging vegetation. This area offers a spawning area, nursery area, feeding area, and protective cover to walleye, northern pike, musky, small mouth bass, large mouth bass, centrarchid, perch, sucker, and minnows. Many bird species utilize the complex of trees and shrubs and would not be present on Delavan Lake without this refuge.

Sensitive Area 4, located in Highland's Bay of Delavan Lake, serves as an important fish nursery and has a diverse wildlife population. The area also acts as a physical buffer against shoreline erosion. This site provides a visual and audio buffer from shoreline structures, roads, and boat traffic. Aquatic plants in the sensitive area include emergents, algae, potamogetons, exotics, free floating, floating leaf, and submergents. Wet edge plants include herbs and shrubs. Game fish, panfish, and forage fish are present in the sensitive area. Wildlife species present include furbearers, song birds, waterfowl, shore birds, amphibians, and reptiles. This site could be used to educate citizens about wetlands and sensitive areas.

White water lilies patches are limited in number on Delavan Lake. The lily pads in this bay are important to the survival of many fish species. Walleye, northern pike, musky, small mouth bass, large mouth bass, centrarchid, perch, suckers, and minnows utilize this sensitive area for feeding, protective cover, and as a nursery. Additionally, northern pike, musky, perch, and minnows (various forage fish) will use this area for spawning.

Sensitive Area 5, located along the View Crest and Ravenswood sections of Delavan Lake, serves as an important fish nursery, has a diverse wildlife population, aquatic vegetation, terrestrial vegetation, and provides natural scenic beauty. The area also acts as a physical buffer against shoreline erosion. The ecological community of Sensitive Area 5 provides a visual buffer from shoreline structures, roads, and boat traffic. Aquatic plants in the sensitive area include emergents, algae, potamogetons, exotics, free floating, floating leaf, and submergents. Wet edge plants include herbs and shrubs. Game fish, panfish, and forage fish are present in the sensitive area. Wildlife present in the area includes upland species, furbearers, songbirds, waterfowl/shore birds, amphibians, and reptiles. This site could be used to educate citizens about wetlands and sensitive areas (Hemmingsen and Bunk. Delavan Lake (Walworth County, Wisconsin) Integrated Sensitive Area Report, 01/22/2007).

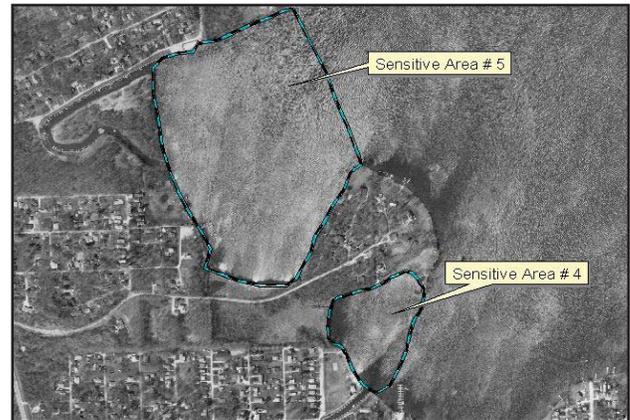
Wetland Health

Wetland Status:

The Turtle Creek Watershed is located in eastern Walworth County and Rock County. Approximately three percent of the current land uses in the watershed are wetlands. Currently, only about 23% of the original wetlands in the watershed are estimated to exist. Of these wetlands, the majority include emergent wetlands (42%), which include marshes and wet meadows, scrub wetlands (30%), and forested wetlands (25%).

Wetland Condition:

Little is known about the condition of the remaining wetlands but estimates of reed canary grass (RCG) infestations, an opportunistic aquatic invasive wetland plant, into different wetland types has been estimated based on satellite imagery. This information shows that reed canary grass dominates 35% of the existing emergent wetlands, 15% of shrub wetlands, and 7% of the remaining forested



Map 6: Delavan Lake Sensitive Areas #4 and #5

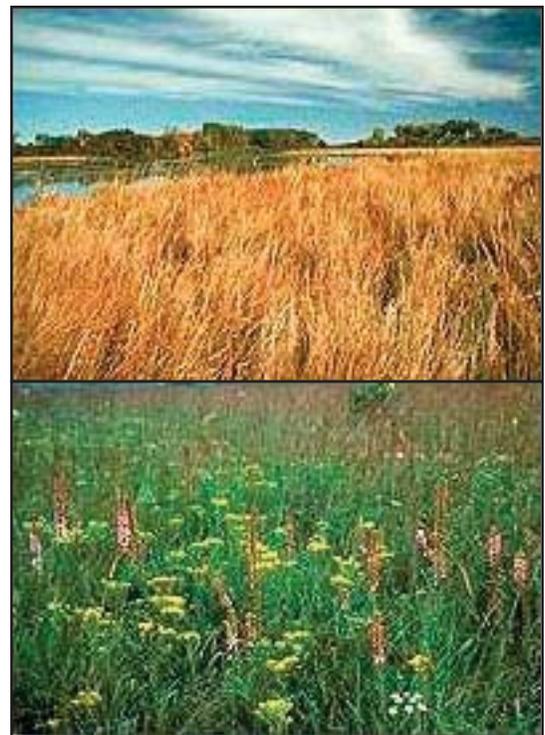


Figure 4: Marshes (above); Sedge or "Wet" Meadows (below) (Photos courtesy of WDNR)

wetlands. Reed canary grass domination inhibits its successful establishment of native wetland species.

Wetland Restorability:

Of the 17,671 acres of estimated lost wetlands in the watershed, approximately 60% are considered potentially restorable based on modeled data, including soil types, land use and land cover (Chris Smith, DNR, 2009).

Groundwater

The following groundwater information is for Walworth and Rock counties (from Protecting Wisconsin’s Groundwater through Comprehensive Planning website, <http://wi.water.usgs.gov/gwcomp/>), which roughly approximates to the Turtle Creek Watershed.

Clinton, Darien, Elkhorn, Fontana, Sharon, and Williams Bay are the only municipal water systems in the Turtle Creek Watershed that have wellhead protection plans. Sharon also has a wellhead protection ordinance in place. Walworth and Rock counties have both adopted animal waste management ordinances.

From 1979 to 2005, total water use in Walworth County has increased from about 10.0 million gallons per day to 15.3 million gallons per day due to increases in all use categories. The proportion of county water use supplied by groundwater has increased from around 89% to about 99% during the period 1979 to 2005.

During the same time period, total water use in Rock County has increased from about 27.2 million gallons per day to about 45.4 million gallons per day. The increase in total water use over this period is due to increases in domestic and irrigation uses. The proportion of county water use supplied by groundwater increased from about 92% to over 99% during the period 1979 to 2005.

Private Wells

Ninety percent of 340 private well samples collected in Walworth County and 75% of 482 private well samples collected in Rock County from 1990-2006 met the health-based drinking water limit for nitrate-nitrogen. Land use affects nitrate concentrations in groundwater. An analysis of over 35,000 Wisconsin drinking water samples found that drinking water from private wells was three times more likely to be unsafe to drink due to high nitrate in agricultural areas than in forested areas. High nitrate levels were also more common in sandy areas where the soil is more permeable. In Wisconsin’s groundwater, 80% of nitrate inputs originate from manure spreading, agricultural fertilizers, and legume cropping systems. Fonatana and the Village of Clinton have spent money to reduce nitrate levels through the construction of new wells.

A 2002 study estimated that 21% of private drinking water wells in the region of Wisconsin that includes Walworth County and 62% of private drinking water wells in the region of Wisconsin that includes Rock County contained a detectable level of an herbicide or herbicide metabolite. Pesticides occur in groundwater more commonly in agricultural regions, but can occur anywhere pesticides are stored or applied. A total of 5,128 acres of land in Walworth County and 18,941 acres of land in Rock County are in atrazine prohibition areas. Over three quarters (76%) of 33 private well samples collected in Walworth County and 100% of 18 private well samples collected in Rock County met the health standard for arsenic.

Potential Sources of Contamination

There are two Concentrated Animal Feeding Operations (CAFOs) in the Turtle Creek Watershed. These swine CAFOs are located in Elkhorn and Clinton. There are also two licensed landfills in the watershed, which are located in Darien and Beloit. The only Superfund site in the watershed is Delavan Municipal Well No. 4.

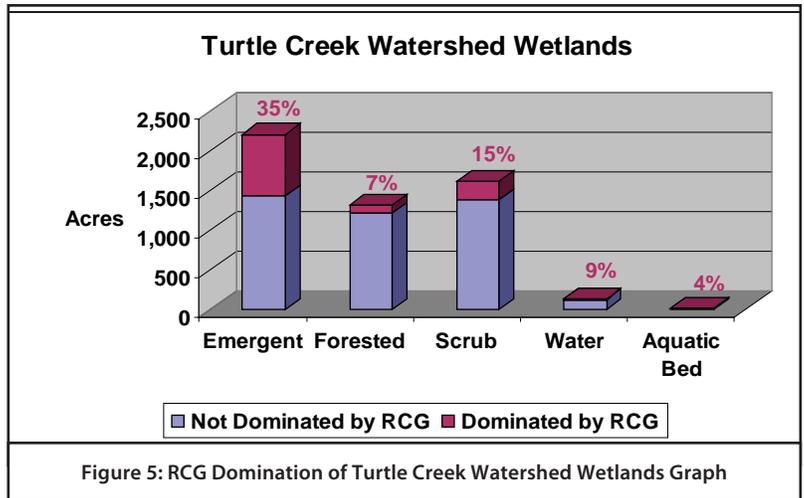


Figure 5: RCG Domination of Turtle Creek Watershed Wetlands Graph

WDNR’s Remediation and Redevelopment (RR) Program oversees the investigation and cleanup of environmental contamination and the redevelopment of contaminated properties. The RR Program provides information about contaminated properties and other activities related to the investigation and cleanup of contaminated soil or groundwater in Wisconsin through its Bureau for Remediation and Redevelopment Tracking System (BRRTS) database (WDNR 2010e).

The database shows that there are 172 sites in Walworth County that are classified as “open”, meaning “contamination has affected soil, groundwater, or more and the environmental investigation and cleanup need to begin or are underway.” These sites include 52 Leaking Underground Storage Tank (LUST) sites, 62 Environmental Repair (ERP) sites, 56 spill sites, and two Voluntary Party Liability Exemption (VPLE) sites. In Rock County, there are 85 open-status sites that have contaminated groundwater and/or soil. These sites include 34 Leaking Underground Storage Tank (LUST) sites, 47 Environmental Repair (ERP) sites, three spill sites, and one Voluntary Party Liability Exemption (VPLE) site.

The Petroleum Environmental Cleanup Fund Award (PECFA) program was created in response to enactment of federal regulations requiring release prevention from underground storage tanks and cleanup of existing contamination from those tanks. PECFA is a reimbursement program returning a portion of incurred remedial cleanup costs to owners of eligible petroleum product systems, including home heating oil systems. As of May 31, 2007, \$24,333,140 has been reimbursed by the PECFA program to clean up 187 petroleum-contaminated sites in Walworth County. This equates to \$241 per county resident, which is less than the statewide average of \$264 per resident. Over \$24 million has been spent on petroleum cleanup in Rock County from leaking underground storage tanks, which equates to \$156 per county resident.

Point and Nonpoint Pollution

The Turtle Creek Watershed is listed as a high priority overall for nonpoint source (NPS) pollution due to its listing as a high priority for groundwater and stream NPS pollution. Individual streams and lake in the watershed have not yet been ranked for NPS pollution.

Stormwater Permits

There are currently two municipalities covered by the Municipal Storm Sewer System Permit (WPDES no. WI-S050075-1): the City of Beloit and the Town of Turtle. The City of Elkhorn will need a Municipal Separate Storm Sewer System (MS4) permit coverage in the near future, now that the 2010 census data shows their population is over ten thousand people.

CAFOs

There are two Concentrated Animal Feeding Operations (CAFOs) located in the Turtle Creek Watershed. These swine CAFOs are located in Elkhorn and Clinton.

Waters of Note

Trout Waters

A little over one mile of Class I Trout waters is located in the Turtle Creek Watershed at the mouth of Potawatomi Creek. Class I trout streams are high quality trout waters that have sufficient natural reproduction to sustain populations of wild trout, at or near carry capacity. Consequently, streams in this category require no stocking of hatchery trout. These streams or stream sections are often small and may contain small or slow-growing trout, especially in the headwaters (<http://dnr.wi.gov/fish/species/trout/streamclassification.html>). The table below lists the waterbodies and stream segments (starting from the mouth at mile 0) where these trout waters can be found.

WADRS ID	Official Name	Local Name	WBIC	Start Mile	End Mile	Trout Class	Trout ID	Counties	Watersheds
10450	Potawatomi Creek	Potawatomi Creek	758700	0	1.19	CLASS I	705	Walworth	FX03,LR01

Outstanding and Exceptional Resource Waters

Wisconsin has designated many of the state's highest quality waters as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). ORW and ERWs are surface waters with outstanding recreational opportunities, valuable fisheries and wildlife habitat, good water quality, and minimum human impacts. ORW / ERW waters warrant additional protection. These designations meet federal Clean Water Act obligations for "antidegradation" designed to prevent lowering water quality, especially in waters having significant ecological or cultural value.

ORWs typically do not have direct point source discharges, though they receive runoff. New discharges may be permitted if effluent quality is equal to or better than background. No increases in pollutant levels are allowed. If a water has existing point sources at the time of designation, it is more likely to be designated as an Exceptional Resource Water (ERW). Like ORWs, dischargers to ERWs are required to maintain background water quality levels; however, exceptions can be made for certain situations when an increase of pollutant loading to an ERW is warranted due to human health (<http://dnr.wi.gov/org/water/wm/wqs/orwerw/>). Potawatomi Creek is an ORW from its mouth to one mile upstream. There are over 40 stream miles of ERWs along segments of Turtle Creek, Little Turtle Creek, Spring Brook, and an unnamed tributary to Turtle Creek.

WADRS ID	Official Name	Local Name	WBIC	ORW/ERW	ORW/ERW	Start Mile	End Mile	Counties	Watersheds
10450	Potawatomi Creek	Potawatomi Creek	758700	ORW	1627	0	1.19	Walworth	FX03, LR01
11616	Little Turtle Creek	Little Turtle Creek	791700	ERW	1636	0	1.03	Rock	LR01
895124	Little Turtle Creek	Little Turtle Creek	791700	ERW	1636	7.34	13.97	Rock, Walworth	LR01
11615	Spring Brook	Spring Brook T02n R14e S27	791300	ERW	1635	0	2	Rock	LR01
305051	Spring Brook	Spring Brook T2nr14es22	791300	ERW	1635	2	4.91	Rock	LR01
1480471	Turtle Creek	Turtle Creek	790300	ERW	1633	0.95	24.77	Rock, Walworth	LR01
305038	Unnamed	Unnamed Stream T2nr14es31	791200	ERW	1634	0	3.3	Rock	LR01

Impaired Waters

About a ten mile stretch of Turtle Creek is listed on the impaired waters list for a high total phosphorus load leading to low dissolved oxygen in the water. The source of the impairment is a combination of municipal point discharges and nonpoint sources (e.g. agricultural and stormwater runoff).

Name	Start Mile	End Mile	WBIC	County	Pollutant	Impairment	303 Status	Priority
Turtle Creek	24.77	35.58	790300	Walworth	Total Phosphorus	Low DO	TMDL Development	High

Fish Consumption

Currently, there are no specific fish consumption advisories in effect for the Turtle Creek Watershed. However, a general

fish consumption advisory for the potential presence of mercury is in place for all waters of the state.

Aquatic Invasive Species

Aquatic invasive species (zebra mussels, Eurasian water-milfoil (EWM), and purple loosestrife) are found in southeastern Wisconsin lakes. Boaters traveling from lake to lake often facilitate the propagation of exotic species. The introduction of exotic species into a lake ecosystem can lead to a decline in the native plant population and cause problems with nutrient loading. In addition, the disturbance of lake bottoms from human activity (boating, plant harvesting, chemical treatments, etc.) enhances the colonization and/or expansion of exotic species. Two simple steps to prevent the spread of exotic species include 1) Removing aquatic plants, animals, and mud from trailers and boats before leaving the boat access; and 2) Draining water from boats, motors, bilges, live wells, and bait containers before leaving the water access.

EWM is found in four of the sensitive areas on Delavan Lake. EWM is one of eight milfoil species found in Wisconsin. It is often misidentified as one of its seven native cousins. In areas within the lake, this non-native milfoil has established monocultures, outcompeting native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters. The regenerative ability of EWM is problematic for species control. Fragments of EWM detached by harvesting, boating, and recreational activities float to non-colonized areas of the lake or downstream to additional lakes creating new colonies. When controlling EWM, selective chemicals and harvesting, coupled with skimming, produces the best results. Biological agents such as milfoil weevils have helped suppress milfoil populations. However, the most effective treatment of EWM is prevention through education.

Curly-leaf pondweed is a submerged, exotic species found in Delavan Lake. Like EWM, curly-leaf often grows into large, homogenous stands. It can crowd out native vegetation, create navigational problems, and limit fish movement. Curly-leaf pondweed dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality. The unusual life cycle of curly-leaf pondweed makes management difficult. The plant germinates as temperatures decrease in fall. Curly-leaf is tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice-off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly-leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly-leaf is most susceptible and a small window of opportunity exists for chemical treatment. Prevention through education is important (Hemmingsen and Bunk. Delavan Lake (Walworth County, Wisconsin) Integrated Sensitive Area Report, 01/22/2007).

Table 9: Turtle Creek Watershed Aquatic Invasive Species

Database Key	Waterbody Name	Bio. Common Name	Status	Start Date	WBIC
28468141	Delavan Lake	Curly-leaf Pondweed	Verified and Vouchered	01/01/1975	793600
1150	Delavan Lake	Eurasian Water-milfoil	Verified and Vouchered	06/01/1995	793600
1151	Turtle Lake	Eurasian Water-milfoil	Verified and Vouchered	08/01/1994	795100
22768537	Turtle Creek	Rusty Crayfish	Verified and Vouchered	-	790300
31493788	Geneva Landings Pond #1	Yellow Floating Heart	Verified and Vouchered	09/08/2008	NA
37713428	Geneva Landings Pond #2	Yellow Floating Heart	Verified and Vouchered	09/08/2008	NA
192	Delavan Lake	Zebra Mussel	Verified and Vouchered	01/01/1999	793600
34861042	Turtle Lake	Zebra Mussel	Observed	-	795100

Eurasian water-milfoil and zebra mussels have been documented in lakes Turtle and Delavan. Rusty crayfish have also infiltrated Turtle Lake and curly-leaf pondweed have been found and verified in Delavan Lake. Furthermore, yellow floating hearts were discovered in 2008 in the stormwater retention ponds #1 and #2 in Geneva Landings.

Species of Special Concern

WDNR's Natural Heritage Inventory database indicates that the following water-dependent Endangered, Threatened, or Special Concern species and/or communities have been sighted in this watershed within the last 20 years.

Table 6: Aquatic Communities with Species of Special Concern in Turtle Creek Watershed

Plant Community	Location	Indicator Species
Dry Prairie	Rock River Prairie	little bluestem, side-oats grama, silky aster, shooting star, prairie gentian, prairie smoke, etc.
Prairie Remnant	Duggan Road Prairie	Pale-Purple Coneflower, etc.
Dry Prairie	Happy Hollow Dry Prairie	short grasses, little bluestem, side-oats grama; dry prairie forbs.
Wet-Mesic Prairie	Tiffany Prairie	deep soil prairie, various.
Dry-Mesic Prairie	Vine Prairie	side-oats grama, prairie dropseed, big and little bluestem; false toadflax, purple prairie clover, small skullcap, stiff aster, etc.
Dry-Mesic Prairie	Morningside Prairie	Remnant dry mesic prairie in residential subdivision; rare resources present; trash dumping and weedy invaders present.
Dry Mesic Prairie	Sussex Road Prairie	Located on a gravel hill stop in subdivision development east of Janesville; prairie is included as city park greenspace.
Dry-Mesic Prairie	Harmony Hill Prairie	Severely reduced in size from residential development; prairie never plowed or grazed; located on north facing slope of gravel hill. Big and little bluestem, Indian grass and prairie dropseed dominant. Several rare species present.

The following table contains federally-listed Threatened, Endangered, Proposed, and Candidate species found in Walworth and Rock counties, in which the Turtle Creek Watershed is located.

Table 7: Federally-Listed Threatened, Endangered, Proposed, and Candidate Species in Walworth and Rock Counties

Species	Status	Habitat	Taxa
Whooping crane (<i>Grus americanus</i>)	**Non-essential experimental population	Open wetlands and lakeshores	Bird
Eastern massasauga (<i>Sistrurus catenatus catenatus</i>)	Candidate	Open to forested wetlands and adjacent upland	Reptile
Eastern prairie fringed orchid (<i>Platanthera leucophaea</i>)	Threatened	Wet grasslands	Plant
Prairie bush-clover (<i>Lespedeza leptostachya</i>)	Threatened	Dry to mesic prairies with gravelly soil areas	Plant

**Whooping Crane - On June 26, 2001, a nonessential experimental population of the whooping crane was designated in a 20-state area of the eastern United States. The first release of birds occurred in Wisconsin in 2001, and the counties listed are those where the species has been observed to date. It is unknown at this time which counties the species will occupy in the future, as the birds mature and begin to exhibit territorial behavior. For purposes of section 7 consultation, this species is considered as a proposed species, except where it occurs within the National Wildlife Refuge System or the National Park System, where it is treated as a threatened species (<http://www.fws.gov/midwest/endangered/lists/wisc-spp.html>).

State Wildlife Areas

Turtle Creek Wildlife Area

Turtle Creek Wildlife Area is a 1,035-acre property located in western Walworth and eastern Rock counties. The property snakes along ten miles of Turtle Creek in four segments from Delavan to South O'Riley Road. There are ten road crossings and/or parking lots scattered through the length of the property.



Figure 6: Turtle Creek State Wildlife Area

The habitat consists of sedge meadow, shrub carr, hardwood forest, and small prairie remnants. Large fall and winter concentrations of Canada geese can be seen at Turtle Creek. It is also home to a number of rare fish and reptile species. Hunting/viewing opportunities include deer, waterfowl, small game, and partridge. Mourning dove hunting is available on natural field/dike edges as well as sharecropped fields of corn, hay, and soybeans.

Turtle Creek is featured in the Southern Savanna Region of the Great Wisconsin Birding and Nature Trail [Exit DNR] as a property on which to see yellow, blue-winged and golden warblers, along with eastern meadowlarks, brown thrashers and lark sparrows.

Turtle Creek is identified as a Conservation Opportunity Area for medium-size rivers and streams of Upper Midwest/Regional significance within the Southeast Glacial Plains Ecological Landscape according to Wisconsin's Wildlife Action Plan. The wildlife area is managed to provide opportunities for public hunting, fishing, trapping, and other outdoor recreation while protecting the qualities of the unique native communities and associated species found on the property. The sedge meadow and shrub carr communities are managed through prescribed burning, mowing, and herbicide use to limit brush encroachment, encourage the sedge meadow community and limit the spread of reed canary grass. Shelterwood harvests are prescribed to maintain and regenerate the limited oak resource along this linear property. Populations of invasive species are controlled or eliminated by cutting, pulling, burning, herbicide treatment and/or bio-control.

Turtle Valley Wildlife Area

Turtle Valley Wildlife Area is located in western Walworth County, northwest of the City of Elkhorn. County Highway P and O dissect the property into three areas. The property is approximately 1,900 acres with two small tracts of land on Turtle Lake and one large tract south of Turtle Lake. Turtle Valley Wildlife Area consists of mostly shallow marsh and wet meadow with tall grass prairie on the surrounding uplands. Cattail dominate the marshes and a few small woodlots exist on the property.

The Wildlife Area was created in 2000. Prior to restoration of the wetlands the muck soils were farmed for mint. Through cooperation with USDA-NRCS, wetlands were restored using a series of berms, breaking drainage tile, and plugging ditches. Nine flowages were created through the restoration process and prairie was planted in the uplands.

The shallow marshes are managed to maintain fifty percent open water. This hemi-marsh environment is ideal for waterfowl production and provides excellent hunting opportunity. Management activities to promote grassland and savanna are conducted on the surrounding uplands.

The habitats throughout the entire wildlife area will be maintained and improved using a number of techniques including prescribed fire, brush removal, planting native species, and removal of invasive species. Water level manipulation is used in conjunction with the aforementioned management tools. Be sure to prescout your hunting as flowages may be drawn down in the fall. A waterfowl refuge exists in the middle of the property to hold birds in the area.



Figure 7: Turtle Valley Wildlife Area

Watershed Actions

Grants and Projects

Dredging Grant - Mound Road Wetland Enhancement Project 08/01/2009 - Complete

The Town of Delavan received a Chapter 30 permit to make modifications to the existing water quality treatment wetland owned by the town located north of Mound Road in Section 12 of the Town of Delavan. The Chapter 30 permit was to conduct the following activities: 1.) Maintenance dredging of approximately 36,500 cubic yards (CY) from the north and east detention basins located on the property. 2.) Dredging of approximately 1,700 CY from in front of the U. S. Geological Survey (USGS) stream gauging station located at Mound Road to prevent the equipment intake from

becoming plugged with sediment. The majority of the material from the proposed dredging activities was disposed of through soil injection at the former 57-acre Betty Grant Farm located to the east of the project site, currently owned by Mound Road Farm, LLC. The soil/water spoil slurry was injected 6 inches deep into the agricultural field using manure injection techniques. Approximately 2,900 CY of soft sediments dredged from the north basin were found to contain low level concentrations of polycyclic aromatic hydrocarbons (PAHs). Although the PAHs levels were acceptable to the Wisconsin Department of Natural Resources (WDNR) for disposal on upland sites, they were disposed of at Mallard Ridge Landfill, W8470 State Road 11 Delavan WI at the request of Mound Road Farm, LLC.

Lake Planning Grant - Delavan Lake APM Plan 04/01/2008 – Complete

The Delavan Lake Sanitary District hired a contractor to conduct a plant survey and develop an aquatic plant management plan for Delavan Lake. The plant survey was a transect survey, conducted to match previously completed plant surveys. Four rake samples were taken at each survey point. A final report contained the following elements: 1) Results of the points sampled, including sediment type found and maximum rooting depth, 2) Results of a general lake survey to map general plant beds, map localized plant beds, map species distribution, and a list of plant species found, 3) Review of existing conditions of the watershed, identified and quantified potential point and nonpoint sources of pollution, and identified nutrient and contaminant input and balances, 4) Results of WILMS and UAL modeling, 5) Results of recreational use survey, 6) An aquatic plant management plan that meets the requirements of NR 109.09, and 7) Minutes from two public meetings regarding aquatic plant issues. Two paper copies and one electronic copy of the final plan were provided to the department. Exact details for all deliverables are described in the project description of grant application.

Lake Protection Grant - Shoreline Habitat Restoration-Walworth Co. 09/01/2005 – Complete

Walworth County continued the Walworth County Lakes Specialist position for one year. The Lakes Specialist provided educational information to lake residents regarding shoreline stabilization and shoreline restoration. The Lakes Specialist also designed shoreline restoration projects for interested landowners, provided technical assistance to contractors and held workshops on shoreland restoration. The project deliverable was a report containing the following: 1) Copies of the shoreland restoration designs; 2) Copies of the fliers for each restoration workshop and 3) Details regarding the accomplishments of the Lakes Specialist over the year of the grant. Two paper copies and one electronic copy of the report were provided to the Department of Natural Resources.

Lake Planning Grant - Lakeshore Landowners survey grant- Walworth Co. 10/01/2004 - Complete

The Walworth County Land Use and Resource Management Department developed a survey to send out to approximately 6,000 lakeshore landowners. The survey inquired about landowner knowledge, views, perceptions, and interest in water quality problems and water quality protection measures. The project deliverables included a copy of the survey and the final report containing the analysis of the completed surveys. The grantee provided a final report to DNR Lake Coordinator. DNR received both paper and electronic PDF copies of the final report along with, or prior to submission of grantee's final payment request.

Lake Planning Grant - Lake Community Planning Inventory-Walworth Co. 10/01/2004 - Complete

The Walworth County Land Use and Resource Management Department developed a survey to send out to 99 units of government and lake associations in Walworth County that are directly involved with the 36 lakes in Walworth County. The survey inquired about institutional tools, laws, ordinances, studies, and educational programs that existed or were needed. The project deliverables included a copy of the survey and the final report containing the analysis of the completed surveys. The grantee provided a final report to DNR Lake Coordinator. DNR received both paper and electronic PDF copies of the final report along with, or prior to submission of grantee's final payment request.

Aquatic Invasive Species Grant - Clean Boats/Clean Waters Program-Delavan 10/01/2004 – Complete

The Town of Delavan hired a part-time Coordinator to run a Clean Boats, Clean Waters volunteer program at the Town of Delavan public boat launch. Volunteers staffed the boat launch and talked to boaters about exotic species and cleaning boats. The project deliverable were: 1) Entering boater/volunteer contact data into the statewide database and 2) A short report written by the coordinator detailing how the program started and operated as well as summary statistics of numbers of boaters, bait shops and private launches contacted during the grant program. The grantee provided a final report to DNR Lake Coordinator.

Lake Planning Grant - Wetland Restoration Project - Delavan Lake 04/01/2003 - Complete

The Town of Delavan redesigned and retrofitted their stormwater pond/wetland restoration complex. The total costs

for engineering, construction and monitoring were estimated to be \$375,000. The costs for engineering alone cost an estimated \$70,000. This grant covered a small portion of the costs for design of the retrofit. The project deliverable was the design specifications (i.e. construction plans) to allow this project to be constructed. Approval of this plan set for the purposes of fulfilling the grant contract requirements did not include Chapter 30 permit approval. The Town of Delavan had to apply for Chapter 30 permits in order to carry out the project. The DNR was provided with both a paper copy and an electronic copy of the final report. Information was disseminated to the public as described in the grant application.

Lake Protection Grant - Delavan Lake Wetland Restoration 07/01/2002 – Complete

Grant funds were used for the seeding and planting in connection with the Mound Road Sedimentation Pond Project which the Town of Delavan has undertaken. The DNR was provided with both a paper copy and an electronic copy of the final report. Information was disseminated to the public as described in the grant application.

NPS Grant - Lake Comus Shoreline TRM 01/01/2002 –Complete

State cost-shared (@70% with City of Delavan DPW) the installation of the Lake Comus Shoreline Protection TRM project.

NPS Grant - Ann Street Basin 01/01/2002 – Complete

State cost-shared (@50% with City of Delavan DPW) the design & construction of Ann Street Basin.

Lake Protection - Walworth County Shoreland Protection Initiative 01/01/2001 – Complete

Walworth County implemented the Shoreland Protection Initiative project that included: 1. A baseline lakeshore inventory; 2. Ten lakeshore demonstration sites; 3. The preparation of lake lawn and yard nutrient management plans; 4. Fact sheets on lakeshore stabilization, shoreland buffers, shoreland regulations and lawn care; 5. An annual lakeshore inventory and distribution of shoreland regulation materials; 6. Formation of a Walworth County Lakes Association and meetings with and newsletter pertaining to Walworth County lakes; 7. Workshops, information packets and news articles pertaining to the Fox River Basin Partnership Team Lakes Initiative; and 8. The formation of the Walworth County Land Conservancy.

Lake Planning - Lake Delavan Nonpoint Pollution Study and Alum Treatment Analysis 04/01/1997- Complete

The Town of Delavan proposed to analyze the role of nonpoint source pollution in the external loading of nutrients of Delavan Lake. Project activities included a watershed inventory review and update, water quality impact assessment/ modeling, and identification of alternative management actions. The 1992 alum treatment of the lake to control internal nutrient loads was also analyzed with regard to future applications.

Lake Planning - Delavan Lake Phosphorus Loading Study 04/03/1995 - Complete

Identified the biological consequences of the internal loading. Investigated the causative factors underlying the reduced biological response. Investigated the role of bio-manipulation in the control of the biological response. Refined the recommended management plan. Continued the on-going public information program and other management actions. Disseminated information to the public by public meetings, and local newspaper articles.

Lake Planning - Delavan Lake Land Use Inventory & Analysis & Nonpoint Source Pollution Study 03/31/1995 - Complete

Reviewed the rural land inventory and control plan compiled for the Delavan Lake portion of the Turtle Creek Priority Watershed. Assessed the degree to which rural nonpoint source control practices have been implemented. Identified practices requiring repair and the changes in land use that have occurred since the Turtle Creek plan was completed. Evaluated additional practices that may be implemented. Refined the recommendation plan to control nonpoint source pollutants. Information was disseminated to the public by public meetings and local newspaper articles. Project results were repositied at the Town of Delavan, Walworth County, DNR, Delavan Public Library and SEWRPC offices.

Lake Planning Grant - Delavan Lake Watershed Nonpoint Pollution Source Assessment 03/31/1995 - Complete

Prepared a description of existing conditions in the Delavan Lake Watershed. Quantified the extent of existing and potential future point and nonpoint sources of pollution. Assessed the degree and intensity of recreational uses of Delavan Lake. Assessed the impacts of sediments and plants on the lake ecosystem and lake use. Formulated appropriate management actions, information strategies, ordinances, and other potential responses to identified problems. The grantee disseminated information to the public by public meetings, local newspaper articles, and has copies available from the town offices. Project results were repositied at the Town of Delavan, Walworth County, DNR, SEWRPC, and Delavan Public Library.

Lake Planning Grant - Delavan Lake Nutrient Loading Study & Rehabilitation Plan 03/31/1995 - Complete
Quantification of the sources of the enhanced nutrient loading. Determination of the management actions necessary to reduce or eliminate loading. Refinement of the recommended lake rehabilitation plan. Continuation of the public information program. The grantee disseminated information to the public by newsletter, fact sheet distribution, public meetings, local newspaper articles, and a comprehensive management plan. Project results were reposted at Walworth County and Town of Delavan.

Lake Protection Grant - Mound Road Wetland Restoration-Delavan 04/11/1994 – Complete
In 1992 the Town of Delavan installed an 85-acre water quality wetland treatment system north of Mound Road in Section 12, Township 2 North, Range 16 East as a result of a WDNR Environmental Impact Statement (EIS) completed in March 1989 as part of the Delavan Lake Rehabilitation project. The wetland system was constructed on previous agricultural land purchased by the Town of Delavan from Adelheid Karg. The purpose of the wetland treatment was to reduce sediment and phosphorus entering Delavan Lake. The project was one component of a several million-dollar restoration of Delavan Lake. Monitoring of the wetland system's performance by the USGS has indicated that the system was not performing to the original expectations. Shallow depths of the constructed detention basins and channelization of the stream channels reduced the efficiency of the wetland to trap pollutants. An analysis by the consulting firm of Hey and Associates, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the USGS recommended that deepening of two of the three detention basins could improve the performance of the wetland treatment system. A follow-up dredging project was completed on the Mound Road wetlands in August of 2009.

Lake Planning Grant - Delavan Lake Phosphorus Release Study 01/01/1990 - Complete
The town of Delavan proposed to seek information relating to existing conditions with respect to phosphorous release into inlet waters and identify the factors that are most likely to affect such releases. In addition, the field work provided data from the natural system that may be used for verification of laboratory findings. Project activities included: 1) Construction of a base site and monitor water quality biweekly for 24 weeks 2) Purchase and temporarily installation of four limno corrals 3) Collection of dissolved oxygen, pH, and temperature data from each limno corral and the base site 4) Collection and analysis of water quality samples within each limno corral 5) The report was provided to the Department, Town of Delavan and the Delavan Lakes Sanitary District within two months of the completed work. Information was disseminated to the public by local newspaper articles and public meetings. Project results were reposted at Delavan Public Library, WDNR, Walworth County and City of Delavan.

Monitoring

Lakes Baseline and Trends Monitoring

River Monitoring is conducted to comply with Clean Water Act implementation - water quality standards: use designations, criterion, permit issuance and compliance, assessments and impaired waters management.

Fisheries projects include a wide variety of "baseline" monitoring and targeted fieldwork to gain specific knowledge related to Wisconsin's fish communities.

In close cooperation with UW Extension and Wisconsin Sea Grant, education efforts focus on working with resource professionals and citizens statewide to teach boaters, anglers, and other water users how to prevent transporting aquatic invasive species when moving their boats. Additional initiatives include monitoring and control programs.

Volunteer Monitoring

The Citizen Lake Monitoring Network, the core of the Wisconsin Lakes Partnership, involves over 1,000 citizen volunteers statewide. The goals are to collect high quality data, to educate and empower volunteers, and to share this data and knowledge. Volunteers measure water clarity, using the Secchi Disk method, as an indicator of water quality. This information is then used to determine the lakes trophic state. Volunteers may also collect chemistry, temperature, and dissolved oxygen data, as well as identify and map plants, watch for the first appearance of Eurasian water-milfoil near boat landings, or alert officials about zebra mussel invasions on Wisconsin lakes. Monitoring consists of lake monitoring and surveys for water quality, aquatic plants, aquatic invasive species, and ice observations.

Citizen Stream Monitoring - Water Action Volunteers

There have been seven stations monitored by at least 10 Volunteer Stream Monitors in the LR01-Turtle Creek Water-

shed from 2005 through 2010. Two of the stations are monitored for dissolved oxygen, pH, instantaneous and continuous temperature and transparency using Level 2 procedures, and entered into the SWIMS database (<http://prodoasjava.dnr.wi.gov/swims/welcome.do>). Six stations are monitored for biotic index, flow, dissolved oxygen, instantaneous temperature and transparency using Level 1 procedures, and entered in the WAV database (<http://www.uwex.edu/erc/wavdb/>). On average, stations in the watershed were monitored monthly from May through October; however Turtle Creek at Heidt Property, CBSM- 10012287 (Level 1 and 2) and Turtle Creek, Creek Rd, Beloit, upstream from Shopiere Rd, CBSM- 10029793 (Level 1) were also monitored during winter months.

- Volunteers collect macroinvertebrates twice a year (the first and last sampling event of the season) to determine a biotic index for each stream monitored. Streams are considered in poor quality if biotic index is between 1.0-2.0, fair quality if between 2.1-2.5, and in good quality if the index is between 2.6-3.5. Overall, biotic index values rated streams in the watershed to be in fair to good quality (ranging from 2.1-3.5).
- Stream flow varied depending on season and local weather patterns each year. Volunteers recorded stream flow almost year round at Turtle Creek at Creek Road. Generally, there was a higher flow rate in the spring than late summer and fall throughout the watershed. Average stream flow measurements for the sixty-one field events were 133 cubic feet per second (cfs) and ranged from 36.4 to 368 cfs.
- Overall, volunteers recorded dissolved oxygen levels in the watershed ranging from 5 -18mg/l, which are sufficient to sustain aquatic life. Throughout the monitoring seasons, volunteers collected pH measurements primarily within state standards (which range from 6 to 9) ranging from 7.37 and 8.35.
- Temperature measurements, used to classify streams as cold, cool or warm water habitats, and which are indicative of the ability of a habitat to sustain aquatic species were manually and continuously recorded at both stations each season. Maximum instantaneous temperatures were between 26-28°C for all streams using this method; suggesting they may be cool water streams. Maximum daily mean temperatures from the continuously measured temperatures indicate streams transition between cool and warm water throughout the four to five years they were monitored using the data loggers.
- Stream transparency measurements were erratic throughout the monitoring season with 48% of the 89 field events measuring less than 10 NTU. The remaining 50% of readings ranged from 10-230 NTU. Only one reading at Turtle Creek at Heidt Property measured greater than 240 NTU in June 2009.

Total Maximum Daily Loads (TMDL) Implementation

The entire Rock River Basin is the subject of a multi-year, large-scale basinwide Total Maximum Daily Load (TMDL) implementation. This large-scale multi-agency effort has been supported by nonprofits (Rock River Coalition), governmental entities, including the USEPA and Wisconsin DNR and municipal and industrial interests and businesses. While only mile 24.77 through 35.58 of Turtle Creek is currently listed as impaired on the state's Clean Water Act 303(d) list, this downstream portion of the very large Rock River Basin is part of a large, growing, heavily used basin, which is the subject of a large scale restoration.

TMDL implementation is active with multiple sectors and active committees. Formally the following areas are delineated and reported on regularly for TMDL Implementation: Overall Implementation, Agriculture, Education and Outreach, Monitoring, MS4 (Stormwater) and Wastewater. The Rock River TMDL Implementation Team is an active group with close interaction with and support by the UW Extension, the Rock River Coalition and local municipalities, businesses, citizens groups and volunteers. A quarterly implementation newsletter is distributed through "Gov Delivery". For more information on how to become engaged in this TMDL process contact Mark Riedel, Rock River TMDL project manager .



Monitoring in the Rock River Basin

Basin/Watershed Partners

Kettle Moraine Land Trust (KMLT) has partnered with the Delavan Lake Improvement Association to develop a land conservation plan that will help reduce pollutants such as nutrients and sediments entering Delavan Lake. This plan will be developed as part of the Delavan Lake Watershed Initiative Network (WIN), which is a coalition of municipalities and organizations created in 2010 with a goal of protecting the lake from industrial, agricultural and storm water pollution.

In addition, a preserve located along Jackson Creek, just east of Highway 67 and south of Elkhorn, was donated to Walworth County Land Conservancy (WCLC) by the developer of the Jackson Creek Subdivision located along the preserve's southern border. The WCLC was renamed Land Trust of Walworth County (LWTC) in 2005 and merged into Kettle Moraine Land Trust during 2009. The creek flows east to west through the property and then through a culvert located under Highway 67 to Delavan Lake. This preserve protects native prairie/fen and provides a view of beautiful native flowers for the community. It comprises 9.4 acres of wetland south of Jackson Creek and 12.9 acres on the north side. The parcel also includes 1.1 acres of upland old field. Public access is limited to volunteers and contractors, as there is no on-site parking and no trails are planned for the future. The topography and wetness does not lend itself to a trail.

Delavan Lake and Jackson Creek are the continued focus of conservation efforts in Walworth County as part of the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through a cooperative agreement between the USDA Natural Resources Conservation Service (NRCS) and the Kettle Moraine Land Trust, financial and technical assistance is available to farmers to begin using conservation practices that result in the reduction of nutrients and sediment flowing into Lake Delavan. Through this initiative, the Kettle Moraine Land Trust has been awarded a total of \$200,616 over three years (2010-2012) from the NRCS.

Another basin partner, the Rock River Stormwater Group (RRSG), was established in 2008 for the creation and operation of a Stormwater Education Program to help groups fulfill the Wisconsin Department of Natural Resources MS4 permit requirements and to promote sustainable stormwater practices in the Rock River Basin. The Town of Beloit is a full member of RRSG and other municipalities and agencies within the Turtle Creek Watershed that do not have to meet MS4 permit requirements, but participate with stormwater education and outreach in their communities may be associate members.

Recommendations

- The City of Beloit and Rock County should take advantage of Federal, state and private funding opportunities to acquire additional public access and lands along Turtle Creek. (Type 2)
- Biotic survey work should be conducted on Spring Brook Creek (T1N R14E S31) to determine if point source discharges have caused any biological impacts from changes in water temperature. (Type 1)
- The Turtle Lake Management Organization should apply for a lakes planning grant to gather three to four years of baseline water quality and habitat information and to identify and possibly protect the lake's remaining riparian wetlands. (Type 2)
- The cities of Beloit, Delavan and Elkhorn should develop comprehensive stormwater management plans that are integrated with their respective cities' urban sewer service area plans and zoning plans and the counties' land use plans. (Type 2)
- The cities of Delavan, Elkhorn and Beloit should enact and enforce construction site erosion control and storm water management ordinances. (Type 2)
- The Comus Lake Management Organization should participate in WDNR's Self-Help Monitoring Program on Comus Lake to track water quality trends in the lake, especially as the City of Delavan grows. (Type 2)
- The Lower Rock River Basin Team should construct wildlife ponds in the Turtle Creek Wildlife Area. (Type 1)
- The Lower Rock River Basin Team should conduct a stream classification survey for Little Turtle Creek to determine if its use classification should be changed from limited forage fishery to warm water forage fishery. This should include an assessment of remaining major sources of polluted runoff affecting stream water quality. (Type 1)
- The Lower Rock River Basin Team should conduct a formal stream classification for Ladd, Piskasaw and Swan creeks, including an assessment of remaining major sources of polluted runoff that may affect water quality of the streams. (Type 1)
- The Walworth County Land Conservation Department should track enforcement of its 1994 Land Disturbance and Erosion Control and Stormwater Management Ordinance to protect water quality in Lake Delavan and the Turtle

Creek Watershed. (Type 2)

- The Turtle Lake Association should become involved in WDNR's Self-Help Monitoring Program to collect water quality data.
- The Lower Rock River Basin Team should evaluate Turtle Creek for adverse impacts to water quality or recreation due to the abandoned Shopiere Dam and develop a long-term plan for dam removal if adverse effects are documented. (Type 1)

Contributors

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Inlet into Delavan Lake, Walworth County

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DNR PUB WY-031 2011 (2015)

Wisconsin DNR's mission involves preserving, protecting, and restoring natural resources. Watershed Planning provides a strategic review of water condition to enhance awareness, partnership outreach, and the quality of natural resource management.

Turtle Creek Watershed