Wisconsin Watersheds

Upper and Lower Willow Watershed

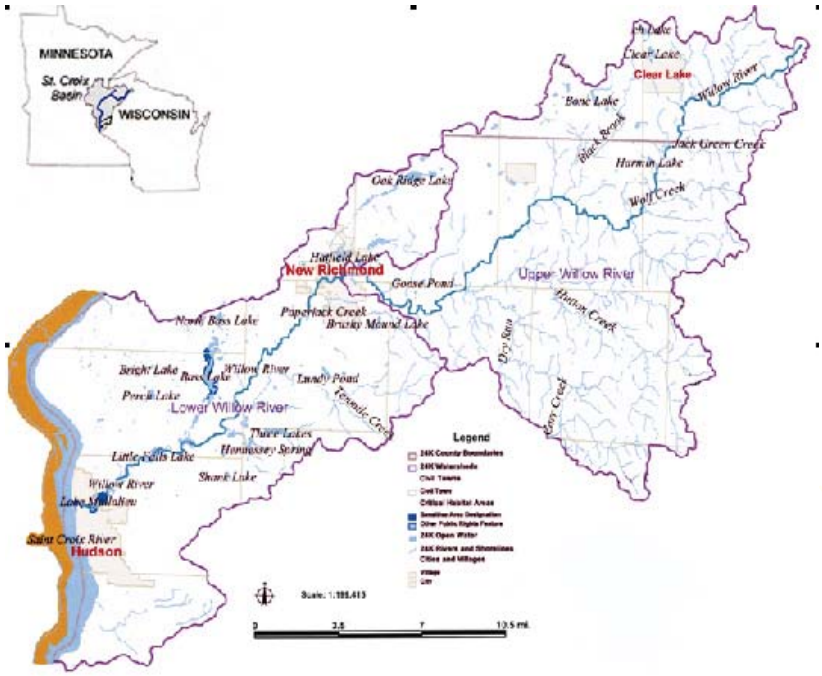
2010 Water Quality Management Plan Update

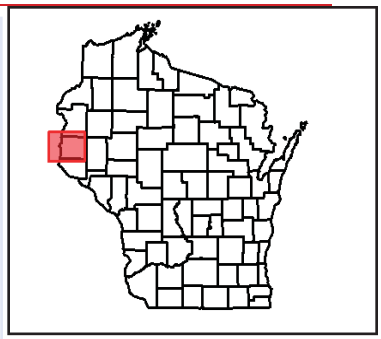
St. Croix River Basin, Wisconsin

August 2010

The Upper and Lower Willow watersheds are located in west-central Wisconsin in Polk and St. Croix counties (Map 1). These watersheds are part of the St. Croix River Basin (which is located in both northwest Wisconsin and east Minnesota). The Willow watersheds are two of twenty-two Wisconsin watersheds in this basin. This water-rich area is sprinkled with an assortment of inland lakes, major rivers and small streams.

Map 1. Willow River Watershed, St. Croix Basin





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Watershed Details

The Upper Willow River watershed's approximately 184 square miles originates in the southeastern portion of Polk County and extends south into the northeastern portion of Saint Croix County. This watershed contains 319 total stream miles, 517 lake acres and approximately 5,600 total wetland acres. Streams joining the Willow in the upper portion include the South Fork of the Willow, Dry Run Creek, Carr Creek, Hutton Creek, Black Brook, Wolf Creek, Jack Green Creek, and other unnamed creeks. Pine Lake in St. Croix County is the only lake over 100 acres in this watershed.

The Lower Willow watershed is situated entirely within St. Croix County. In this watershed,

the Willow mainstem flows from the City of New Richmond, through Willow River State Park, Lake Mallalieu, and then joins the St. Croix River at Hudson (in the lower 25-mile Lake St. Croix reach).

The Lower Willow covers 115 square miles. Tributaries to the Lower Willow include Paperjack Creek, Tenmile Creek, the Willow River Race Branch, and other unnamed creeks. These streams, in addition to the Willow River, account for 99 stream miles in the Lower Willow watershed. There are also 2139 acres of lakes and 2482 acres of wetlands. Lakes over 100 acres in this watershed include Oakridge and Bass Lakes and three impoundments on the Willow mainstem: the New Richmond Flowage, Little Falls Lake (in Willow River State Park), and Lake Mallalieu in Hudson

Population and Land Use

Approximately 72% of the combined watershed areas lie in St. Croix County. This county was one of the most rapidly-growing areas in the state in the 1990s. Census date for 1990 projected a population of 50, 251 for the entire county (including other watersheds). . In 2000, the county population was estimated at 63,155, which is a 26% increase over the decade. A similar increase within the Willow watersheds hydrologic boundaries would be expected over the same time period, especially with the larger communities of New Richmond and Hudson located in the watersheds. The increase was likely from new suburban and rural residential and commercial development from the expanding Twin Cities metro area in Minnesota.

Figures 1 and 2 show the percent breakdown of land use and cover throughout the two watersheds, based on 2001 National Land Use Cover data provided by the United State Geologic Survey. The watersheds are very similar with agriculture being the main use in both basins (56% in the Lower Willow (SC02) and 66% in the Upper (SC03)). The Lower Watershed has more open water in streams and impoundments (10%), and more urban and suburban land use (totaling 5%) with the two larger communities of Hudson and New Richmond. The Upper Watershed has more agricultural land, but less urban land cover and open water. Forest and wetland percentages are nearly the same in each watershed.

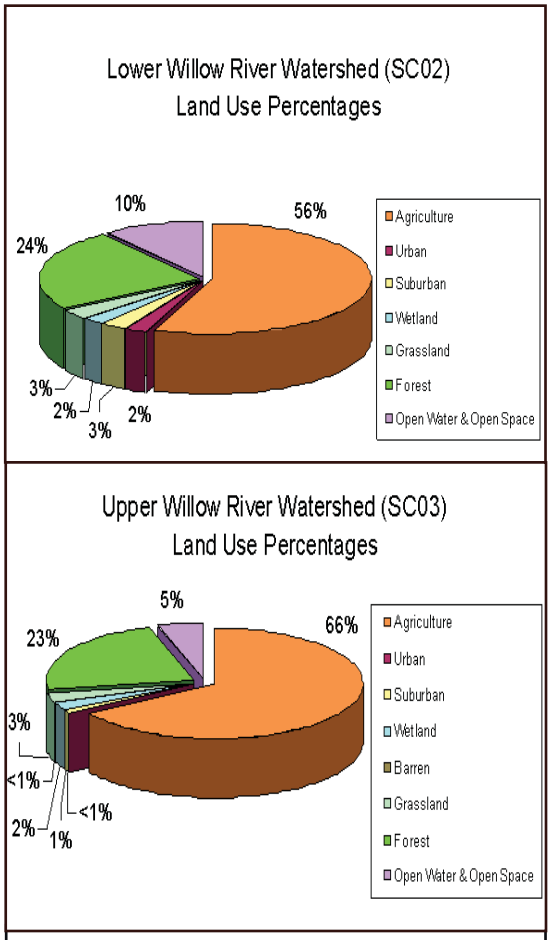


Figure 1 & 2: Land use in the Willow River Watershed

Hydrology

Karst geology is found within the watershed. The underlying limestone bedrock can be fissured and represent a threat to groundwater. There are intermittent streams that actually disappear into the ground. Careful land use practices and well construction in particular are needed in areas with karst formations.

Ecological Landscapes

The Willow watersheds are located along the boundary between two ecoregions (c.f., Omernik and Gallant, 1988): the Western Corn Belt Plains to the south, and the North Central Hardwood Forest to the north. The watersheds are characterized by nearly level to rolling glacial till plains and significant agricultural land use.

The entire Willow River Watershed is located primarily in the Western Prairie Ecological Landscape on the far western edge of the state, just south of the Tension Zone; it contains the only true representative prairie potholes in the state. It is characterized by its glaciated, rolling topography and a primarily open landscape with rich prairie soils and pothole lakes, ponds, and wet depressions, except for forested areas along the St. Croix River. The climate and growing season are favorable for agricultural crops. Sandstone underlies a mosaic of soils. Silty loams that can be shallow and stony cover most of the area. Alluvial sands and peats are found in stream valleys.

Historic vegetation was comprised of dry to mesic prairie grasses in the rolling areas and wet prairies in the broad depressions. Open oak savannas and barrens were found on the hilly topography, with small inclusions of sugar maple-basswood forest in small steep sites. Prairie pothole type wetlands were mainly found in St. Croix and Polk counties. Barrens were found along the river terraces of the St. Croix River. Almost half of the current vegetation is agricultural crops and almost a third of the area is grasslands, with smaller areas of open water, open wetlands, and urban areas. The major forest types are maple-basswood and oak-hickory, with smaller amounts of lowland hardwoods and lowland conifer.

Ecosystem Features:

Willow River State Park is located 5 miles northeast of Hudson. It has 2,891 acres of prairie, forests, waterfalls, and panoramic river scenery, and offers year-round recreational and scenic attractions in western Wisconsin. The park has a campground, a boat launch, and a 400-foot beach and picnic area centered on 172-acre Little Falls Lake. Willow River State Park draws more than 300,000 visitors each year. More information is available at this web address: http://dnr.wi.gov/org/land/parks/specific/willowriver/index.html

The **Western Prairie Habitat Restoration Area project** was established in 1999 and encompasses 350,000 acres within 15 townships in St. Croix and Polk Counties. Part of this area lies in the Willow watersheds. The acreage goal of 15,000 acres will permanently protect approximately 10% of the historic grassland acreage within the project. The project area includes prairie remnants from one of the largest prairies found in the state along with a mix of grasslands, potholes and marshes that are extremely conducive to pheasant and waterfowl production.

The large, landscape scope of the project is based upon comprehensive research of biodiversity and ecosystem management practices. Restoration of viable grasslands and wetlands to provide habitat for waterfowl, pheasants and grassland birds is the primary objective of the project. The intent is to widely scatter suitable habitat throughout the area, rather than concentrating the habitat in one place. Reductions in habitat quality and quantity because of land use changes have contributed to the decline of grassland nesting wildlife populations. In addition, wetland loss and degradation has been an important factor in the decline of many wetland wildlife species. Ten species of birds known to occur in this area are state-listed as endangered or threatened and 19 species are listed as special concern. The area also includes 54 rare plant species, 18 of which are state-listed endangered or threatened. This web address provides more complete information: http://dnr.wi.gov/org/land/wildlife/wphra/

Discovery Farms (University of Wisconsin-Extension) is conducting a program in the Willow River watersheds to demonstrate a relationship between changes in land management and improvements in water quality. The work underway includes identification of critical, heavy-loading sites; evaluation of level of risk for agricultural fields; helping farmers make changes that protect water quality; and nutrient management plan preparation. The project also includes monitoring edge of field water quality and education on nutrient management and the links between agriculture and natural resources in the local area. Here is the link to their website: http://fyi.uwex.edu/discoveryfarms/

Historical Note

The Willow River was featured in a famous court case that confirmed the public's right to use the waters of the state. The Northwest Ordinance of 1787 declared that all navigable waters in the territory would remain "forever free," held in trust for all people of the United States. When Wisconsin became a state, it adopted this concept into its constitution. Subsequent court cases upheld the provision.

During the 1890's, a group of private sportsmen bought up land along the Willow River. They claimed the sole and exclusive right to fish there, on the grounds that most of the

year the Willow was too shallow to be navigable. When locals ignored their claim, the club's complaints to the sheriff resulted in more than 40 trespass citations, most of which were dismissed.

One local farmer, logger and fisherman named Frank Wellesley Wade insisted on pressing the issue. Ultimately, the St. Croix County Court ruled that, even though navigable only during high water in spring, the Willow was nonetheless considered a public waterway. Willow River Club v. Wade was subsequently upheld by the Wisconsin and US Supreme Courts. It became a landmark case in confirming what is today known as the Public Trust Doctrine, maintaining that the waters of the state belong to all citizens regardless of who owns the shoreline.

Watershed Condition

Priority Issues, Water Quality Goals

Due to a significant level of non-point source pollution, the Upper Willow watershed was established (in 1981) as a priority watershed as part of the Wisconsin Nonpoint Source Pollution Abatement Program. Some of the major water quality concerns included sediment deposition, protection of ground water resources from contamination though sink holes, and a reduction in the potential for fish toxicity from ammonia by controlling livestock waste entering the streams. Addressing non-point source runoff from both rural and urban sources remains a high priority in both of these watersheds and throughout the basin.

TMDL Underway

Because of impairments in Lake Mallalieu at the end of the Willow watershed, a nutrient-based Total Maximum Daily Load (TMDL) effort is presently underway to address phosphorus loading throughout the entire watershed (SC02 and SC03). TMDLs for reduction of phosphorus loadings are also underway across the entire St. Croix Basin and all waters tributary to Lake St.Croix and Lake Pepin in Wisconsin and Minnesota.

Completing the Willow TMDL report and TMDL Implementation Plan are priorities for the entire Willow watershed. The TMDL will set a goal for phosphorus loading reduction, in order to see an expected improvement in water quality in Lake Mallalieu (particularly lower densities of algae, improved Secchi depth readings, and less frequent nuisance algal blooms). Phosphorus reduction goals will be set for both point and non-point sources.

Lake St. Croix comprises the lower 25 miles of the St. Croix River mainstem, from Stillwater, Minnesota to Prescott, Wisconsin. With increasing frequency and intensity of algal blooms in Lake St. Croix, both states have listed the lake as a nutrient-impaired water. With the Willow being one of the tributaries that empties directly into Lake St. Croix, and one of the heaviest loading watersheds to the lake, it is imperative that significant phosphorus reductions be achieved in the Willow.

Lake Mallalieu is listed as impaired. This lake is an impounded portion of the Willow mainstem, and is formed by a dam near the river mouth in Hudson. A TMDL and Implementation Plan are under development at the time of this plan was written. Preliminary projections call for a 40 % reduction of phosphorus overall to lower the in-lake phosphorus concentration from 65.5 ug/L (2006 measured level) to 45 ug/L. This represents a drop from 24.3 tons per year entering Lake Mallalieu to 12.3 tons/year. This goal and percent reduction are subject to change based on public review and comment on the draft TMDL when available.

The draft Willow River/Lake Mallalieu and Lake St. Croix TMDL reports will include mass limitations for the significant dischargers of phosphorus to the watershed. In the Willow, the main dischargers are the two larger municipalities, Clear Lake and New Richmond. Significant reductions will be needed by contributors of non-point source runoff as well.

Overall Condition

The Willow watersheds are valued resources, particularly for fishing and recreation. Willow River State Park is located on lands along the Willow mainstem in the lower watershed, and includes the Willow River gorge and waterfalls and Little Falls Lake.

The water quality of the streams and Willow mainstem is impacted by agricultural, urban, suburban, and rural non-point

source runoff. Loss of soil from cropland, farmyards, parking lots, and other impervious surfaces results in sediment, nutrients (nitrogen and phosphorus) and other pollutants entering the surface waters of the watershed.

Fish Consumption Advice

Specific fish consumption advice for PCBs is in place for St. Croix River.
For more information see: http://dnr.wi.gov/fish/consumption/

Point and Nonpoint Sources

The Willow watersheds have been identified as major contributors of nutrients to the St. Croix River. USGS flow gaging and Wisconsin DNR monitoring were used to estimate the total load discharged from the Willow. In 1999, the monitoring showed a measured load of 24.3 tons/year, and in 2006 the loading was 20.5 tons per year. Some of the sources of nutrients cannot be controlled to any great extent, such as runoff from wetlands, uncultivated grasslands, and forestland (except through silvicultural best management practices to protect water quality). However, the majority of the land use is agriculture or urban/suburban, meaning gains can be made in reducing these impacts through improved practices.

There are 4 wastewater treatment plant discharges and one cooling water discharge to surface waters in the Willow. There are also 5 large farms (Confined Animal Feeding Operations or CAFOs) and 9 facilities that discharge via seepage to groundwater. The table below summarizes data regarding these facilities:

Table 2: Permitted Facilities

Facility Name	Location	County	Watershed	Number	Permit Type	Receiving Water
Arcand Poultry Farm, Inc	Clear Lake	Polk	Upper	WI-0059366	CAFO	Groundwater
Emerald Dairy, LLC.	Baldwin	St Croix	Upper	WI-0059315	CAFO	Groundwater
Jennie O – Turkey Store Farm	New Richmond	St. Croix	Lower	WI-0062049	CAFO	Groundwater
Minglewood Inc.	Deer Park	Polk	Upper	WI-0059358	CAFO	Groundwater
Schottler Dairy, Inc.	Somerset	St. Croix	Lower	WI-0058289	CAFO	Groundwater
AFP - Advanced Food Products	Clear Lake	Polk	Upper	WI-0039781	Industrial	Groundwater and Clear Lake
Lakeside Foods, Inc.	New Richmond	St. Croix	Lower	WI-0002836	Industrial	Groundwater and the Willow
Nor Lake Inc.	Hudson	St. Croix	Lower	WI-0057843	Industrial	Groundwater
Spring Point Project	New Richmond	St. Croix	Lower	WI-0063495	Industrial	Groundwater
Clear Lake, Village of	Clear Lake	Polk	Upper	WI-0023639	Municipal	Tributary to the Willow
Deer Park, Village of	Deer Park	St. Croix	Upper	WI-0025356	Municipal	Willow River
Emerald Glenwood Sanitary, District No.1	Emerald	St. Croix	Upper	WI-0031607	Municipal	Groundwater
Forest Sanitary District No 1	Emerald	St. Croix	Upper	WI-0060747	Municipal	Groundwater
New Richmond, City of	New Richmond	St. Croix	Lower	WI-0021245	Municipal	Willow River
Richmond Sanitary District No. 1	New Richmond	St. Croix	Lower	WI-0061069	Municipal	Groundwater
St. Croix Meadows Inc.	Star Prairie	St. Croix	Lower	WI-0035980	Municipal	Groundwater
Twin City East 76 Travel Center	West Lake	St. Croix	Lower	WI-0060585	Municipal	Groundwater

River and Stream Condition

The upper mainstem of the Willow (also called the North Fork) is Class III / II trout water. The subwatershed is heavily influenced by wetlands and agriculture. The fishery leans toward tolerant, warmwater species. There is a small section of Class II trout water in Cylon Wildlife Area that supports a remnant population of wild brook trout. Better agricultural conservation practices would benefit water quality in the headwaters.

The South Fork of the Willow is Class II brook trout water. There is a small section of stream between the mouth and STH 63 that could be listed as Class I. The headwater (upstream of STH 63) temperature and water quality suffers from flooding, intensive agriculture and wetland influence. Dry Run Creek (an intermittent stream) floods several times a year. Improving agricultural Best Management Practices (BMPs) to prevent soil erosion and nutrient runoff is a high priority for the headwater areas of this subwatershed.

Lake Health

Aquatic Invasive Species remain a threat to inland lakes. This website lists the waters infested in St. Croix County: http://dnr.wi.gov/lakes/invasives/AISByWaterbody.aspx?CountyCode=56. Within the Willow watersheds, Bass Lake, Little Falls Lake, the New Richmond Flowage, Lake Mallalieu and Perch Lake all have Eurasian Water Milfoil, and nearby Lake St. Croix has zebra mussels. Other species in Willow watershed lakes include Curly Leaf Pondweed, Rusty Crayfish, and Chinese Mystery Snails. Vigilant efforts are needed to stop the gradual spread throughout the watersheds and lakes in the region.

Table 3: Named lakes over 10 acres in size are listed below.

Lake Name	County	Area (Acres)	Max. Depth (feet)	Waterbody ID Code
Upper Willow Watershed				
Goose Pond	Saint Croix	14	2	2609000
Harmin Lake	Saint Croix	23	6	2612500
Pine Lake	Saint Croix	118	21	2489700
Lower Willow Watershed				
Bass Lake	Saint Croix	370	35	2450500
Brushy Mound	Saint Croix	46	5	2455400
Dry Dam Lake	Saint Croix	43	4	2461600
Hatfield Lake	Saint Croix	86	9	2468200
Little Falls Lake	Saint Croix	170	18	2607400
Mallalieu Lake	Saint Croix	289	17	2607100
New Richmond Flowage	Saint Croix	20	15	2608800
Oak Ridge Lake	Saint Croix	158		2486800
Perch Lake	Saint Croix	45	63	2488300
Three Lakes	Saint Croix	86	5	2501400

Impoundments

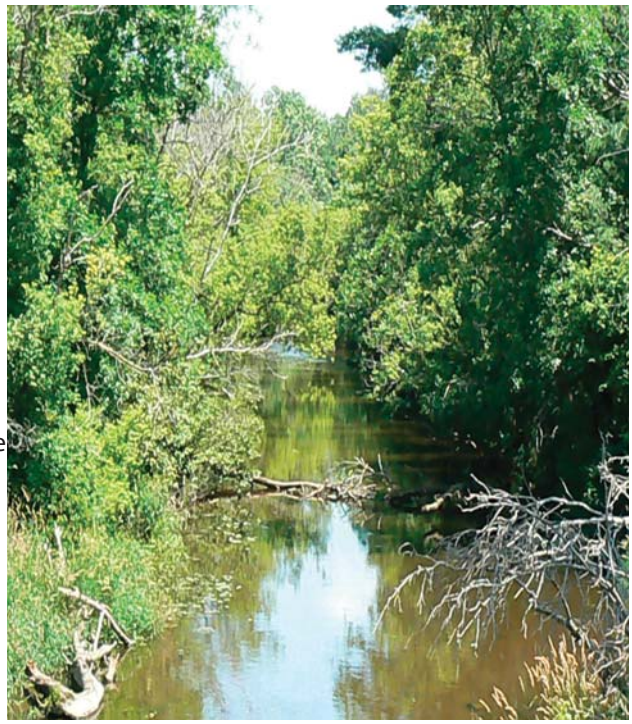
Presently, there are three impoundments on the Willow (Table 3): the New Richmond Flowage (also called the "Wide-spread"), Little Falls Lake (impoundment in Willow River State Park), and Lake Mallalieu at Hudson. Prior to 1992, there were two additional dams forming impoundments upstream of Little Falls Lake, the Willow Falls dam (removed in 1992) and the dam forming Mound Pond (removed in 1997).

Little Falls Flowage is located within Willow River State Park. It is considered eutrophic and suffers from algae blooms during the summer months. The aquatic vegetation in Little Falls Flowage consists of 14 different species, of which 2 are non-native species -- Eurasian water milfoil (Myriophyllum spicatum) and curly-leaf pondweed (Potamogeton crispus). The most common species are water stargrass, (Heteranthera dubia) coontail, (Ceratphyllum demersum), common waterweed (Elodea canndensis), and slender naiad (Najas flexilis). In the lake's watershed the primary land use is agriculture and suburban home sites, along with municipal and industrial developments in Clear Lake and New

Richmond. Nonpoint agricultural runoff, in combination with municipal and industrial inputs, contributes sediments and nutrients to Little Falls Flowage, causing water quality deterioration.

Little Falls Flowage has a high-quality, self-sustaining, sport fishery. Abundant populations of largemouth bass, smallmouth bass, northern pike and yellow perch are present, in addition to smaller populations of bluegill and black crappie. The average size distribution of game and panfish are above normal.

The New Richmond Flowage suffers from excessive nutrients, and is a shallow weed infested waterbody. Most of the flowage is 5 feet deep and is plagued with fine sediment deposition. The fine sediment obviously comes from the headwater region of the watershed. The 236 acre flowage shifts the thermal regime toward warmwater until groundwater becomes more prevalent downstream within Willow River State Park.



Willow River at HWY 46, 2010. Photo by Joe Cunningham, WDNR.

Lake Mallalieu is a 270 acre flowage near the mouth of the Willow River. The Willow River is the only inlet stream to Lake Mallalieu. The first dam was constructed in forming the lake in 1848. The present dam was constructed in 1934 after the former had washed out in April of that year. Lake Mallalieu has a maximum water depth of 17 feet with a mean depth of 5 feet. The watershed's primary land use is urban/residential, agriculture and woodlands.

Lake Mallalieu is considered to be a hypereutrophic lake with poor water quality due to high nutrient levels, high algal concentrations, and poor water clarity. There were a total of 24 species of aquatic plants found in Lake Mallalieu during the 1998 survey (Konkel 1999). Included were three non-native species: Lythrym salicaria (purple loosestrife), Myriophyllum spicatum (Eurasian water milfoil), and Potamogeton crispus (curly-leaf pondweed). Nonpoint source pollution from agricultural operations throughout the watershed has been contributing phosphorous and nitrogen loading, adding to subsequent water quality deterioration.

Lake Mallalieu has an abundant source of large woody debris along certain parts of the flowage. Residential and shoreline development has eliminated large woody debris and natural vegetative buffers in numerous locations throughout the lake. Many shoreline lots have been converted to limestone rip-rap, which has been proven to benefit young smallmouth bass, but may also fail to provide both juvenile and adult fish cover for most other fish species. Preservation of large woody debris and natural shoreline buffers consisting of emergent and submergent plant beds, trees, shrubs, grasses and forbs will assure survival of healthy fish and aquatic life resources.

Despite these impacts, Lake Mallalieu currently provides an abundant and diverse sportfish community. Both largemouth and smallmouth bass fishing is excellent with many trophy bass present. Northern pike densities are low; however, the size distribution is well above average. Panfish populations are good but growth rates and large adult densities are lower than expected for small fertile flowages.

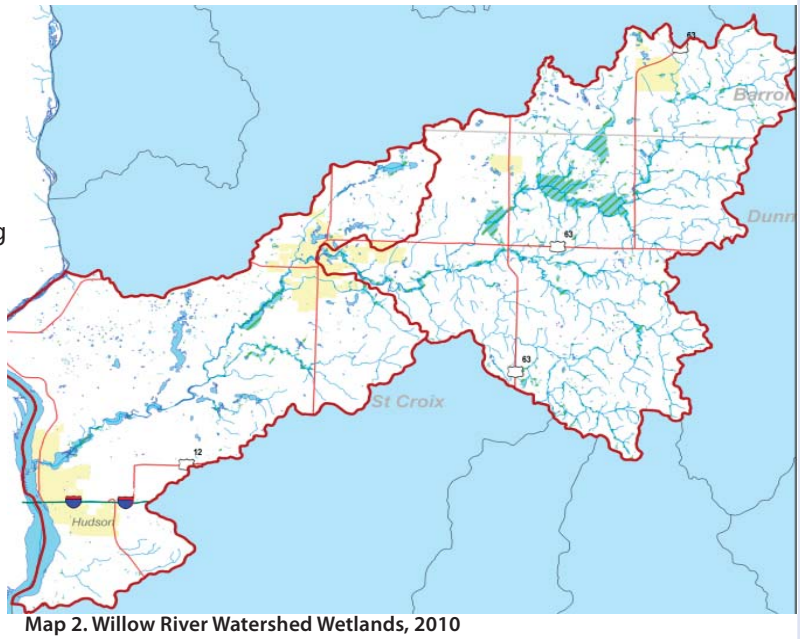
Wetland Health

Wetland Status

Wetland data for the Lower Willow River watershed is limited; therefore, an analysis on the Upper Willow River watershed was conducted. An estimated 4% of the current land uses in the Upper Willow River watershed are wetlands. Almost 52% of the original wetlands in the watershed are estimated to exist. Of these wetlands, forested wetlands (41%) and emergent wetlands (33%), which include wet meadows and marshes, dominate the landscape.

Wetland Condition
Little is known about the condition of the remaining wetlands (Map 2), but estimates of reed canary grass 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 63% of the existing emergent wetlands and 24% of the remaining shrub wetlands. Reed Canary Grass domination inhibits successful establishment of native wetland species.

Wetland Restorability
Of the 4,013 acres of estimated lost wetlands in the watershed, approximately 97% are considered potentially restorable based on modeled data, including soil types, land use and land cover (Chris Smith, DNR, 2009).



Map 2. Willow River Watershed Wetlands, 2010

Groundwater

Groundwater is an important, yet often undervalued resource in the Willow River watersheds, and the entire St. Croix Basin, as it is the sole source of drinking water to residents in the Basin and recharges over 100 trout streams and countless lakes within the watershed. Once contaminated, groundwater may take many years and potentially large monetary resources to clean.

Waters of Note

Outstanding and Exceptional Resource Waters (ORWs & ERWs)
Wisconsin Administrative Code NR 102 establishes protective classifications for different categories of lakes, rivers and streams. The Outstanding Resource Water classification is given to our most high quality waters, and is one of the highest levels of protection for surface waters under Wisconsin law. Exceptional Resource Waters are the next tier below Outstanding, and have nearly the same level of protection.

In the Willow watersheds, Bass and Perch Lakes in St. Croix County are classified as Outstanding Resource Waters. Exceptional Resource Waters include the Willow River and the Willow River Race Branch between Little Falls Lake dam and the upstream end of Lake Mallalieu.

Trout waters
There are several Class II and Class III trout waters in these watersheds (all in St. Croix County except as noted): Black Brook (Polk County); the North Fork, South Fork and mainstem of the Willow; the Willow Race Branch; Wolf Creek; Hutton Creek; 10-Mile Creek; and Hennesy Springs. The best trout water is found on the Willow downstream of Little Falls Lake, but the stream suffers from elevated water temperatures and nutrients from the top water discharge at the upstream flowage dam.

Class I trout waters support natural reproduction, whereas Class II trout waters have some natural reproduction but require supplemental stocking. Class III waters have no natural reproduction and rely on stocking for a trout fishery. More information and maps are available at this web address: http://dnr.wi.gov/fish/species/trout/streamclassification.html

Impaired Waters
Lake Mallalieu and a segment of the Willow River below New Richmond are listed as impaired. Lake Mallalieu is impaired due to total phosphorus levels from non-point source pollution, causing eutrophication and algal blooms. The approximate two-mile long segment of the Willow mainstem (from 100th Street to 140th Avenue) is listed as impaired for low dissolved oxygen, caused by Biological Oxygen Demand (BOD) and phosphorus. In addition to the Willow River

and Mallalieu Lake, the St. Croix River is listed for contaminated fish tissue caused by PCBs, and Lake St. Croix is listed for eutrophication due to total phosphorus concentrations.

Watershed Actions

Projects and Grants

*Both Willow River watersheds are discussed.

Grants
10/02/2009 Proposed – Willow River
ARRA Pass Though Project; develop a TMDL implementation plan for Lake Mallalieu/Willow River.
Lake Protection

09/01/2005 Complete – Hatfield Lake
City Of New Richmond: Hatfield Lake Acquisition: The City of New Richmond proposed a purchase of a 75.67 acre Carpenter Family parcel on Hatfield Lake in St. Croix County for Lake Protection purposes. Major project elements included: 1) acquisition costs, and 2) associated acquisition costs.

Large Scale Lake Planning
10/01/2001 Complete – Lake St. Croix
City Of Prescott: Lake St. Croix Planning Project-Phase 1: The primary goal of the project was to improve water in Lake St. Croix through inventory, testing, modeling, and analysis of hydrologic and biological data. This data provided a foundation for development of a lake/watershed and water quality management master plan (LWMMP) for the City of Prescott, Wisconsin. The project goals included: 1. meetings, 2. background data collection, 3. a field reconnaissance survey, 4. field data collection/ inventory work, 5. defining drainage basins, 6. categorizing map and land uses, 7. identifying existing biological communities, and 8. characterizing the quality of stormwater discharges. 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.

10/01/2001 Complete – Lake St. Croix
City Of Prescott: Lake St. Croix Planning Project- Phase II: The objectives of Phase II of this planning project included such things as: 1. Preserve and enhance storm water quality, 2. Preserve the natural and beneficial functions of the natural drainage, 3. Solve/prevent runoff problems, 4. Solve drainage problems, and 5. Develop City storm water management ordinance. 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.

04/01/2002 Complete – Lake St. Croix
City Of Prescott: Lake St. Croix Planning Project - Phase III: The City of Prescott proposed to finish out the work that has been done in previous grants and phases. The project activity included the final report. The Department was provided with both a paper and electronic copy of the final report.

10/01/2004 Complete – St. Croix River
River Country Rc&D Council, Inc: Green Development Conference: River Country RC&D proposed to conduct a conference entitled "The Nuts and Bolts of Green Development" in conjunction with the St. Croix Basin Partnership Team. Objectives of the conference, and associated bus tours, were to provide riparian owners, interested citizens, and municipal operators and engineers with information useful to the development of small-scale and community-wide stormwater management practices.

10/01/2006 Complete – Mallalieu Lake
City of Hudson: Mallalieu Stormwater Assessment: The City of Hudson proposed to delineate the storm sewershed for Lake Mallalieu, in St. Croix County, and to study the feasibility of stormwater treatment alternatives. Major project elements included: 1) storm sewer inventory and mapping, 2) modeling, assessment and treatment selection, and 3) reports and meetings to share information.

04/01/2008 Complete – Bass Lake
Bass Lake Rehabilitation District: Bass Plan Update: The Bass Lake Rehabilitation District proposed to develop a plan

to improve water quality, habitat and recreational use of Bass Lake in St. Croix County. Major project elements included: 1) formation of planning team, 2) sociological survey, 3) review of existing data and ordinances, 4) land use mapping, and 5) plan development.

Small Scale Lake Planning

10/01/2002 Complete – Lake Saint Croix
St. Croix County: St. Croix River Nutrient & Sediment Conference: A one-day educational conference on reducing and managing nutrients and sediments in Lake St. Croix was proposed for February 2003 at Trollhaugen in Dresser, WI, for a targeted audience of approximately 130-140 wastewater treatment managers, local officials and water resource professionals. The goal was to educate, network and obtain input in pollution budgeting. 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.

10/01/2003 Complete – Saint Croix River
St. Croix County: St. Croix Nutrient River Conference: St. Croix County Land and Water Conservation Department proposed to sponsor a conference in Februrary of 2004 to identify and begin to address factors contributing to the pollution of Lake St. Croix. The goal was to bring together wastewater treatment managers, local officials, water resource professionals, land developers and watershed manager to allow networking and sharing of information associated with nutrient and sediment loading in the lake. The DNR was provided with both a paper copy and electronic copy of the final report.

10/01/2004 Complete – Saint Croix River
St. Croix County: St. Croix Basin Conference: St Croix County proposed to sponsor an informational and educational conference relating to the protection and management of Lake St. Croix.

04/01/2006 Complete – Saint Croix River
St. Croix County: St. Croix Conference '06: St. Croix County proposed to sponsor an informational and educational conference relating to the protection and management of Lake St. Croix. Major project elements included: 1) conference costs associated with printing mailing, provision of lunch and transportation, and 2) staff coordination.

04/01/2007 Complete – Willow River
St. Croix County: St. Croix Conference 2007: St. Croix County LWCD proposed to conduct its annual nutrient and sediment loading conference to protect Lake Mallalieu and others within the St. Croix Watershed. Major project elements included guest presenters and consulting services.

10/01/2007 Complete – Willow River
St. Croix County: St. Croix Conference '08: The St. Croix County Land and Water Conservation Department proposed to sponsor an informational and educational conference to enhance lake management and watershed protection with Lake Mallalieu in St. Croix County and the St. Croix River basin. Major project elements included: a) conference planning and b) presentation development.

Projects
Wisconsin DNR completed the draft Willow River TMDL report setting lake quality goals for Lake Mallalieu and phosphorus reductions goals for point and non-point sources. The target date for completing draft report is December, 2010.

Working under contract with Wisconsin DNR, St. Croix County Land and Water Resourced Department staff will complete a draft TMDL Implementation Plan, and work with agencies and stakeholders to carry out the recommendations in the

plan.

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.
The University of Wisconsin – Stevens Point is conducting a macroinvertebrate data taxonomic analysis; individual results are associated with specific projects.

Shoreline Erosion, Lake Mallalieu. WDNR Photo.

Monitoring

Lakes Baseline Trends Monitoring is being conducted for many of the Willow River watersheds' lakes. In addition, monitoring designed to target high priority waters and issue areas is also underway. Stream water quality monitoring covering primarily biological, chemical, and habitat related monitoring to determine ambient conditions at "pour point" locations for each of state's 330 watersheds. Loon monitoring is also being conducted on Bass Lake, Oak Ridge Lake, and Perch Lake.

The Citizen Lake Monitoring Network, the core of the Wisconsin Lakes Partnership, involves over 1000 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 or alert officials about zebra mussel invasions on Wisconsin lakes. This network is also conducting ice observations on Lake Mallalieu.

Fisheries projects include a wide variety of "baseline" monitoring and targeted fieldwork to gain specific knowledge related to Wisconsin's fish communities. A study of the Lake Mallileau fisheries was conducted and a report published in 2001 by the WDNR.

Recommendations

Non-point source pollution needs to be addressed in order for needed improvements in water quality to be realized. Water quality has been heavily affected over the past 100 years by nutrient and sediment loading. County and state efforts should focus on preventing further deterioration of water quality through promoting appropriate land use practices in the watershed. This is not a small task and will take a well-planned, long-term effort to make a difference. Here are some specific recommendations to address this source of pollution:

Specific Recommendations:

Below are some actions for reducing non-point source runoff throughout the two watersheds.

1. Cropland runoff should be addressed to lower the export of nutrients and sediments. This will benefit all tributary streams, lakes, the Willow mainstem, and downstream waters such as the St. Croix River (Lake St. Croix). This is being addressed through development of the Lake Mallalieu TMDL Implementation Plan.
2. On agricultural lands, conservation tillage, lowering soil test phosphorus, nutrient management to match fertilizer addition to crop need, along with careful manure handling are important agricultural best management practices that will help achieve the non-point source reduction. Improved agricultural management practices are especially recommended for the headwaters reaches and tributaries of both the North and South Forks of

the Willow.

3. Urban runoff and stormwater management are important, regardless of the size of the community. Best management practices to capture, infiltrate, and clarify stormwater should be implemented in each of the communities in the Upper and Lower Willow. Improved practices for construction site erosion control are needed in both the urban, industrial, commercial and rural sectors.
4. Optimizing removal of phosphorus at point source discharges is also important, particularly from the communities of Clear Lake and New Richmond, as well as at other smaller, surface water discharging communities and industries.
5. Department staff and partners need to continue to fund monitoring in the basin to track phosphorus and sediment loading. This data is needed to assess progress toward reaching the goal for reducing the eutrophication impairments in both Lake Mallalieu and in downstream Lake St. Croix.

Habitat restoration for fisheries and wildlife is an on-going goal in the watersheds. Much work has been done by partner agencies and private landowners in improving wetland and upland habitat. Here are some further specific recommendations:

1. Wetland protection and restoration should continue for habitat conservation, wildlife production, and water quality improvements.
2. Restoring buffer strips on the margins of cropland and streambanks, as well as shoreline buffer zones are important steps in protecting water quality and improving shoreline and littoral habitat.
3. Working to reduce agricultural land use in dry run streams - or emphemeral streams - would help reduce agricultural related runoff and would also reduce negative changes in the watershed's natural hydrologic flows .
4. Water temperature should be safeguarded to protect trout waters from gradual warming. Infiltrating stormwater to the groundwater for eventual stream recharge is one method. Protecting wetlands for their filtering function is another.
5. Critical habitat surveys and reports should be completed on lakes and streams where habitat, native plant beds, and public rights features need to be inventoried and management recommendations developed.
6. All resource agency staff, recreational users and the public need to remain vigilant to prevent the spread of both aquatic and terrestrial invasive species.
7. Continue long-term monitoring of fisheries and habitat to track trends and develop further lake and fisheries management recommendations.

Public outreach is an important ongoing component of efforts to improvewater resources. Here are some recommendations for targeting future efforts:

1. Continue efforts to inform the public on the goal to reduce phosphorus inputs to Lake Mallalieu and Lake St. Croix, thus reducing the imputs into the Willow River, which both lakes feed.
2. Develop effective tools for conveying actions that can be taken by private citizens, industries, agriculture, municipalities, commercial and professional groups, etc.
3. Expand outreach on habitat improvement and protection, invasive species control, climate change factors and preventive measures, etc.
4. Continued efforts are needed to raise awareness of karst geology to protect groundwater and human health.
5. Support legislation and funding proposals to advance both regulatory and financial tools to accomplish the work outlined above.

Partners in Protecting the Willow

- St. Croix County Land and Water Conservation Department, Baldwin, Wisconsin; http://www.co.saint-croix.wi.us/Departments/LandWater/default.htm
- St. Croix Basin Water Resources Planning Team: Minnesota and Wisconsin state, federal, county, and local resource agencies united to protect the St. Croix.
- Willow River TMDL Implementation Stakeholder group, led by the St. Croix County Land and Water Conservation Department staff.
- Discovery Farms; http://fyi.uwex.edu/discoveryfarms/
- Trout Unlimited, KiApTuWish Chapter; http://www.kiaptuwish.org/home

Sources:

Almendinger, J. (2008). Modeled phosphorus exports from the Willow River watershed. St. Croix Watershed Research Station Fact Sheet, Science Museum of Minnesota, 4pp. (http://www.smm.org/static/scwrs/tapwaters_willowriver3.pdf)

Almendinger, J. and Murphy, M. (2005). Land-use change and agricultural practices in the Willow River watershed, western Wisconsin, 1992-2004. St. Croix Watershed Research Station Report, Science Museum of Minnesota, 32 pp. (http://www.smm.org/static/scwrs/tapwaters_willowriver.pdf)

Almendinger, J. and Murphy, M. (2007). Constructing a SWAT model of the Willow River watershed, western Wisconsin. St. Croix Watershed Research Station Report, Science Museum of Minnesota, 84 pp. (http://www.smm.org/static/scwrs/tapwaters_willowriver2.pdf)

Engel, M.P., Spangler, Sr., B.W., and Michalek, Jr., W.J. (2002). Little Falls Flowage Comprehensive Lake Survey Report, St Croix County, Wisconsin, Wisconsin Department of Natural Resources.

Magdalene, S. (2009). Lake St. Croix total phosphorus loading study. Science Museum of Minnesota, St. Croix Watershed Research Station, Report to the St. Croix Basin Water Resources Planning Team, 65 pp.

Michalek, Jr., W.J. and Engel, M.P. (2002). Lake Mallalieu Comprehensive Lake Survey Report, St Croix County, Wisconsin, Wisconsin Department of Natural Resources, (http://dnr.wi.gov/fish/reports/final/stcroixmallalieulakesurvey2001.pdf)

Magdalene, S. (DRAFT 2008). Phosphorus Total Daily Maximum Load: Willow River and Lake Mallalieu, St. Croix and Polk Counties, Wisconsin. Wisconsin Department of Natural Resources.

Wisconsin Department of Natural Resources (2002), The State of the St. Croix Basin, PUBL WT-555-2002.

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Lake Mallalieu, Arial Photo, June 2005.

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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.

Willow River