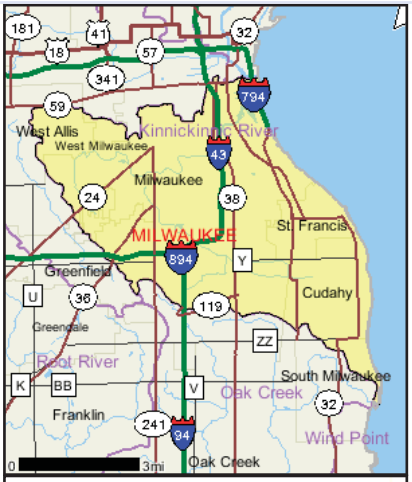
Kinnickinnic River Watershed

2011 Water Quality Management Plan Update

Milwaukee River Basin, Wisconsin

December 2011

The Kinnickinnic River Watershed is the smallest (33 square miles) and most urban of the Milwaukee River Basin watersheds. This watershed includes the 25-square-mile drainage area of the Kinnickinnic River, plus areas discharging directly to Lake Michigan. The watershed is located within the southern portion of Milwaukee County and contains 25 miles of perennial streams and seven park ponds, but no lakes are found within the watershed. The Kinnickinnic River is the only officially named stream, and comprises about half of the total stream miles in the watershed.



Map 1: Kinnickinnic River Watershed

Land cover in this watershed is mostly urban (90%), with park/recreational lands (5.3%) and woodlands (1.5%) creating open spaces. Remaining wetlands comprise only 0.36 percent of the land area. prise only 0.2 percent of the land area.

Contents

Watershed Details

Population and Land Use

The Kinnickinnic River watershed lies entirely within Milwaukee County. Seven civil divisions lie in part or entirely within the Kinnickinnic River watershed. Geographic boundaries of the civil divisions are an important factor which must be considered in watershed planning since the civil divisions form the basic foundation of the public decision making framework within which intergovernmental, environmental, and developmental problems must be addressed. Portions of the Cities of Milwaukee (21.4 square miles), Greenfield (2.2 square miles), West Allis (1.7 square miles), Cudahy (4.5 square miles), St. Francis (2.6 square miles), South Milwaukee (0.75 square miles) and the Village of West Milwaukee (0.47 square miles) make up the watershed (see Appendix, Map 2).

As of the year 2000, the Kinnickinnic River watershed was predominantly in urban uses (90 percent). Urban land uses within the watershed were primarily residential (35 percent), followed by transportation, communication, and utilities (30 percent); commercial and industrial (12 percent); governmental and institutional (7.6 percent), and recreational (5.3 percent). The seven percent of unused and other open lands in this watershed are predominantly urban in character and therefore characterized as urban. The remaining 3 percent of the rural category is made up of surface water (0.84 percent); wetlands (0.37 percent); woodlands (1.48); and agriculture and related land uses (0.31 percent).

Over the long term the number of persons living in the watershed has declined. From

1970 through 1990, the population in the watershed decreased by about 23,267, from 172,453 to 149,186; however, during that time period the number of households increased by 3,182, from 56,233 to 59,415. Between 1990 and 2000 the size of the population in the watershed has grown slightly, increasing to 152,137 persons, or an increase of 2,951 persons. During that time period of relatively stable population numbers, the number of households in the watershed remained nearly stable, decreasing by 24 units to 59,391.

Table 1: Kinnickinnic River Watershed Land Use

Land Use	Acres	Percent of Area
Urban	19,393.75	90.00%
Open Water & Open Space	1,668.75	7.75%
Woodlands	319.03	1.48%
Wetland	79.79	0.37%
Agriculture	67.62	0.31%
Total Acres in Watershed	21,528.94	

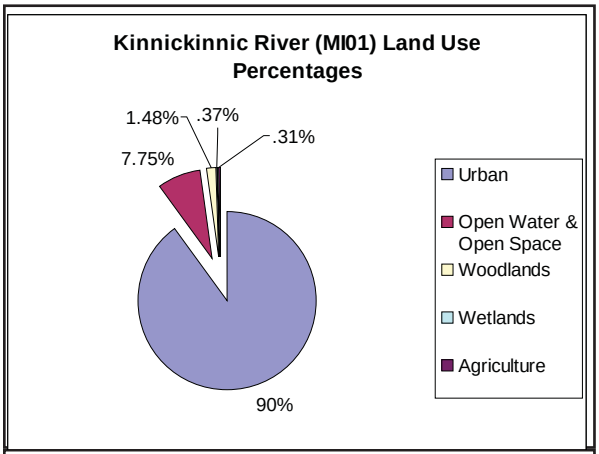


Figure 1: Kinnickinnic River Watershed Land Use Percentages

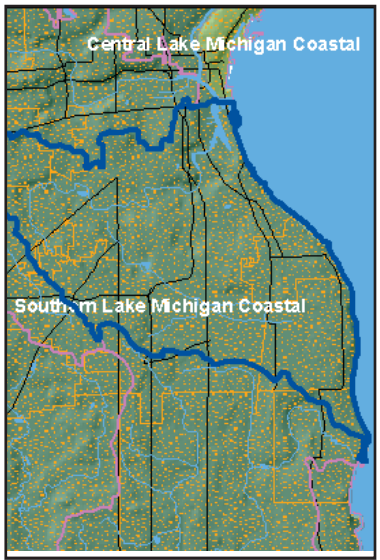
Hydrology

The water resources within the Kinnickinnic River Watershed have been extensively modified (see Map 4 and Appendix, Map 3). Most of the streams in watershed have been straightened and/or lined with concrete to carry stormwater off the land and downstream at a faster rate. Urbanization increases impervious surfaces, which leads to an increase in stream flashiness. This affects the stability of streambanks and streambeds, increases pollutant loadings and affects sediment dynamics (see Appendix, Figure 2). The Kinnickinnic River watershed is 40% impervious (SEWRPC 2009).

Kinnickinnic River before concrete channel installed (year unknown) – photo courtesy of MMSD

Ecological Landscapes

The Kinnickinnic River Watershed is located primarily within the Southern Lake Michigan Coastal Ecological Landscape in the southeastern corner of Wisconsin along Lake Michigan. The landforms in this ecological landscape are characteristic of glacial lake influence, with ridge and swale topography, clay bluffs, and lake plain along Lake Michigan. Further inland, ground moraine is the dominant landform. Soils typically have a silt-loam surface overlying loamy and clayey tills.



Map 4: Kinnickinnic River Watershed Ecological Landscapes

The historic vegetation in the northern part of this ecological landscape was dominated by sugar maple-basswood-beech forests with some oak; while the southern part was dominated by oak forest, oak savanna, and prairies. Wet, wet-mesic, and lake plain prairies were common in this area. Black ash and relict cedar and tamarack swamps were found in this ecological landscape. Today, most of the area is dominated by dairy and cash grain agriculture and intense urban development. Only about eight percent of the ecological landscape is forested. Maple-beech forests are about half of the remaining forest types with the remainder split equally between oak-hickory and lowland hardwood forest types. There are some areas of wet-mesic and wet prairie, but only small preserves remain since the landscape is heavily disturbed and fragmented.

Because of this isolation, fragmentation, and high level of disturbance, non-native plants are abundant.

Primary Environmental Corridors
The primary environmental corridors in Southeastern Wisconsin generally lie along major stream valleys and around major lakes, and contain almost all of the remaining high-value woodlands, wetlands, and wildlife habitat areas, and all of the major bodies of surface water and related undeveloped floodlands and shorelands. As shown on Map 5 in the Appendix, in the year 2000 primary environmental corridors in the Kinnickinnic River drainage area encompassed about 584 acres, or about 2.7 % of the drainage area. Primary environmental corridors may be subject to urban encroachment because of their desirable natural resource amenities. Unplanned or poorly planned intrusion of urban development into these corridors, however, not only tends to destroy the very resources and related amenities sought by the development, but tends to create severe environmental and development problems as well. These problems include, among others, water pollution, flooding, wet basements, failing foundations for roads and other structures, and excessive infiltration of clear water into sanitary sewerage systems.

Secondary Environmental Corridors
Secondary environmental corridors are located generally along intermittent streams or serve as links between segments of primary environmental corridors. As shown on Map 5, secondary environmental corridors in the Kinnickinnic River drainage area encompassed about 184 acres, or about 0.85 % of the drainage area. Secondary environmental corridors contain a variety of resource elements, often remnant resources from primary environmental corridors which have been developed for intensive agricultural purposes or urban land uses, and facilitate surface water drainage, maintain "pockets" of natural resource features, and provide for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species.

Isolated Natural Resource Areas
In addition to primary and secondary environmental corridors, other small concentrations of natural resource base elements exist within the drainage area. These concentrations are isolated from the environmental corridors by urban development or agricultural lands and, although separated from the environmental corridor network, have important natural values. These isolated natural resource areas may provide the only available wildlife habitat in a localized area, provide good locations for local parks and nature study areas, and lend a desirable aesthetic character and diversity to the area. Important isolated natural resource area features include a variety of isolated wetlands, woodlands, and wildlife habitat. These isolated natural resource area features should also be protected and preserved in a natural state whenever possible. Such isolated areas five or more acres in size within the Kinnickinnic River drainage area also are shown on Map 5 and total about 97 acres, or about 0.45 % of the drainage area.

Historical Note

Lincoln Village is a south side neighborhood within the City of Milwaukee and is located in the Kinnickinnic River Watershed. The neighborhood is bounded on the south by the Kinnickinnic River and was founded by Milwaukee's Polish community in the late 19th century. The growing number of Polish immigrants coming to Milwaukee in the late 19th and early 20th centuries created a great demand for new home construction. In 1880, there were approximately 30,000 Polish living in Milwaukee making it the second largest ethnic population in the city.

The neighborhood's main commercial street, West Lincoln Avenue, is the home of two historic landmarks - the Basilica of St. Josaphat and Forest Home Cemetery which were added to the National Register of Historic Places in 1973 and 1980, respectively. Much of the neighborhood's housing and commercial building stock have been preserved in their original condition. Because of this, Lincoln Village is the densest neighborhood in the State of Wisconsin and the streets have a strong European feel.

Overall Condition

About 30 percent of the streams within the Kinnickinnic River system are concrete lined, 30 percent are in an enclosed channel, and most of the remaining are in an open stream channel that is unstable and eroding (see Appendix, Map 6). The upper unchannelized sections of the Kinnickinnic River are severely incised (downcut or eroded streambed) and laterally unstable. Comparison of historic longitudinal profiles indicates that up to four to five feet of incision has occurred since the 1970s. This channel instability is due to a combination of elements: a large amount of urban development and associated impervious area; a stormwater management system designed to move runoff quickly and efficiently off the land surface and into the stream; significant encroachment of urban development near the stream, which confines flows within a narrow area and exposes the streambank and streambed to extremely high velocities and shear stresses; and steep slopes.

A high degree of bank instability is associated with extensive areas within the Kinnickinnic River watershed with riparian buffers less than 75 feet in width (see Appendix, Map 5). More than 70 percent of the river corridors within the Kinnickinnic River watershed contain buffers that are less than 75 feet wide.

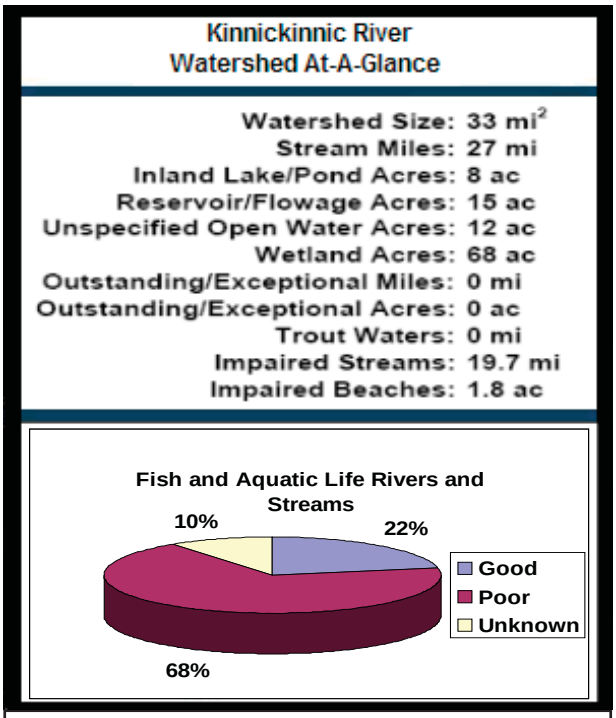


Figure 3: Kinnickinnic River WAG

Healthy riparian corridors help to protect water quality, groundwater, fisheries and wildlife, and ecological resilience to invasive species, as well as reducing potential flooding of structures and harmful effects of climate change. In turn, the health of riparian corridors is largely dependent upon width (size) and continuity. Therefore, efforts to protect and expand the remaining riparian corridor width and continuity are the foundation for protecting and improving the fishery and recreation within the Kinnickinnic River watersheds.

The watershed contains no named lakes, and 7 park ponds totaling about 23 acres. No Exceptional or Outstanding Resource Waters have been identified for the Kinnickinnic River watershed, nor are any Trout waters listed. The Kinnickinnic River suffers from chronic aquatic toxicity caused by a variety of pollutants, including polychlorinated biphenyls (PCBs), E. coli, phosphorus, unspecified metals, and fecal coliform. The source of these pollutants is a mixture of agricultural runoff and discharges from municipal storm sewer systems.

The stressors on the waterbodies within the Kinnickinnic River watershed have greatly limited the ability for the waterbodies to fully support fish and aquatic life uses. Because most of the stream channels are severely degraded, concrete lined or in conduit, fish and aquatic life uses have not been recently assessed (Table 2). The Southeastern Wisconsin Regional Planning Commission (SEWRPC) completed an assessment of water chemistry (years 1970-2003) and fish and aquatic life data (years 1902-2002) for the Kinnickinnic River watershed as part of their Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds (2007).

The SEWRPC Plan noted that some water chemistry indicators showed water quality improvements within the Kinnickinnic River and Wilson Park Creek, while other constituents showed no improvement or a decline in water quality.

The Kinnickinnic River watershed contains a very poor fishery and benthic macroinvertebrate community (insects and other organisms that provide food for fish). The fish community contains relatively few species of fishes, contains few or no top carnivores, and is dominated by tolerant fishes. The macroinvertebrate community also lacks variety and dominated by tolerant organisms. Since water quality has generally been improving in the watershed for some constituents, habitat seems to potentially be the most important factor limiting both the fishery and macroinvertebrate

community. It is also important to note there are several other factors that are likely limiting the aquatic community, including but not limited to the following: 1) periodic stormwater loads; 2) decreased base flows, and flashy stream flows following rainfall; 3) continued fragmentation due to culverts and concrete lined channels, enclosed conduits, and drop structures; 4) past channelization; and/or 5) increased water temperatures due to urbanization.

In Wisconsin, high-quality warmwater streams are characterized by many native species, darters, suckers, sunfish, and intolerant species (species that are particularly sensitive to water pollution and habitat degradation). Within such environments, tolerant fish species also occur that are capable of persisting under a wide range of degraded conditions and are also typically present within high-quality warmwater streams, but they do not dominate. Insectivores (fish that feed primarily on small invertebrates) and top carnivores (fish that feed on other fish, vertebrates, or large invertebrates) are generally common. Omnivores (fish that feed on both plant and animal material) are also generally common, but do not dominate. Simple lithophilous spawners, which are species that lay their eggs directly on large substrate, such as clean gravel or cobble, without building a nest or providing parental care for the eggs, are also generally common.

The Kinnickinnic River watershed fishery has been and continues to be largely dominated by a high proportion of low dissolved oxygen tolerant fishes, with low numbers of native fish species—this combination is indicative of a poor fishery. The proportions of such tolerant fish species have all increased, as shown in Table 3 in the Appendix. Most notable are the exotic invasive common carp and goldfish species. Carp are likely to be having a negative effect on the overall fishery in this watershed by destroying habitat and competing for food and spawning areas of native fish species.

Index of Biotic Integrity (IBI) results indicate that there has not been any significant change in the quality of the fishery of the Kinnickinnic River watershed compared to the historical conditions (see Appendix, Map 7). Although some of the samples over time achieved a poor community IBI rating score of 20 to 30, in the majority of the sites over all years, samples have generally remained in the very poor (IBI score 0-20) classification.

The apparent stagnation of the fishery community within the Kinnickinnic River watershed can be attributed to habitat loss and degradation as a consequence of human activities primarily related to the historic and current development that has occurred within the watershed.

It is important to note that the loss of species has been disproportionately greater among reaches that are further away from a connection with Lake Michigan. For example, comparison of historic (pre-2000) versus current (post-2000) fish species abundance within the Kinnickinnic River indicates that species abundance has been and continues to be much greater in the most downstream reach connected to the Milwaukee River estuary and Lake Michigan compared to any other areas in the watershed. This indicates that the poor habitat, hydrology, and water quality conditions primarily associated with concrete lining continue to severely limit fisheries within this watershed. However, due to its connection with the Estuary and Great Lakes system, the lower reach of the Kinnickinnic has the greatest potential for fishery improvement.

River and Stream Condition

According to the WDNR's Register of Waterbodies (ROW) database, there are 27 miles of streams and rivers in the Kinnickinnic River Watershed; 21 miles of these waters have been entered into the WDNR's assessment database for Fish and Aquatic Life uses. Of these 21 miles, less than five miles are meeting Fish and Aquatic Life uses and are specified as in "good" condition; another 14.6% of stream miles are considered to be in "poor" condition and are listed as impaired. The condition of the remaining 2.0 stream miles is not known or documented.

Additional uses for which the waters are evaluated include Fish Consumption, Public Health and Welfare, and Recreation. As Table 2 shows, these uses have not been directly assessed for many of the waterbodies in the watershed. However, a general fish advisory for potential presence of mercury is in place for all waters of the state. In addition, about three stream miles in the watershed are indicated as not supporting Fish Consumption and 16 miles are not supporting Recreation uses.

Table 2: Designated Use Support Summary for Kinnickinnic River Watershed Rivers and Streams (all values in miles)				
Use	Supporting	Not Supporting	Not Assessed	Total Size
Fish Consumption		2.83	18.56	21.39
Fish and Aquatic Life	4.8	14.59	2	17.89
General			21.39	21.39
Public Health and Welfare			21.39	21.39
Recreation		19.99	1.4	21.39

Kinnickinnic River

The Kinnickinnic River is 9.6 miles long with a watershed that covers 25 square miles of drainage area. Along with the main river, many of the tributaries have been extensively modified through straightening, enclosure and concrete lining. The Kinnickinnic River discharges into Lake Michigan via the federal navigation harbor at Milwaukee, Wisconsin.

Water quality has improved for some constituents within the Kinnickinnic River. Concentrations in the Kinnickinnic River of several pollutants associated with combined sewer overflows, such as Biochemical Oxygen Demand (BOD), fecal coliform bacteria, and ammonia, have decreased. In addition, total phosphorus concentrations in the estuary have decreased. These reductions in nutrients and oxygen-demanding wastes have produced some improvements in dissolved oxygen concentration and in lower chlorophyll-a concentrations in the estuary portion of the River. One important, though not the only, factor responsible for these decreases is the reduction in combined and separate sewer overflows resulting from construction and operation of the Milwaukee Metropolitan Sewerage District (MMSD) inline storage system.

Concentrations of suspended and dissolved pollutants typically associated with stormwater runoff and other nonpoint source pollution, such as chloride, copper, total suspended solids, and zinc have remained unchanged or increased. For some of these pollutants, such as copper, increases in concentration have occurred in all reaches sampled along the Kinnickinnic River. For others, such as chloride and zinc, concentrations have increased in some reaches while remaining unchanged in others. In addition, specific conductance has increased in at least two reaches of the River, suggesting that the total concentration of dissolved material in the water has increased. In other reaches, the concentration of dissolved material, as indicated by specific conductance, has remained unchanged.

Sediment Conditions

Sediment in the Kinnickinnic River (KK) contains concentrations of chromium, lead, PCBs, polycyclic aromatic hydrocarbons (PAHs), zinc, and some pesticides high enough to pose substantial risks of toxicity to benthic organisms, and contains concentrations of cadmium, copper, iron, mercury, nickel, and other pesticides high enough to likely produce some toxic effects in benthic organisms.

Efforts are being made to address the legacy of sediment contamination within the Kinnickinnic River. In 2009 over 167,000 cubic yards of contaminated sediment were removed from the Kinnickinnic River between Becher Street and Kinnickinnic Avenue under the U.S. Environmental Protection Agency (USEPA)/WDNR Kinnickinnic River Environmental Restoration Great Lakes Legacy Act Project. This area contained the upstream-most significant deposits of contaminated sediment within the Kinnickinnic River. This project removed about 1200 pounds of PCBs and 13,000 pounds of PAHs from the Kinnickinnic River.

In addition to the positive environmental effects to the Milwaukee Estuary Area of Concern, removing contaminated sediment from this stretch of the Kinnickinnic River leaves a safer, deeper and more navigable river. Several property owners along the project area have expanded or improved their businesses as a result of this project.

The Kinnickinnic River downstream from Kinnickinnic Avenue is a federally maintained navigation channel. The river is routinely maintained to a depth adequate for deep draft commercial navigation. One significant area of known sediment contamination on the Kinnickinnic River is at the Milwaukee Gas and Solvay Superfund Alternative Site. This is an EPA lead project at the site of a former coal gasification facility. The project is in the remedial investigation phase, and involves studies of contamination to land, groundwater and sediment.

Wilson Park Creek

Wilson Park Creek is a five-and-a-half-mile long tributary to the Kinnickinnic River that originates on the city border of Milwaukee and Cudahy. From its mouth to three and a half miles upstream the current use of Wilson Park Creek is listed for Limited Aquatic Life, while the remainder of the stream is listed for Fish and Aquatic Life. The attainable use of the entire stream, however, is believed to be as a Warm Water Forage Fishery.

Some improvement has occurred in the concentrations of BOD in Wilson Park Creek. While BOD concentrations downstream of General Mitchell International Airport were often very high during the period 1998 to 2001, they were lower than during the period from 1996 to 1997. Deicing compounds from General Mitchell International Airport (GMIA) are likely to constitute a major source of BOD to this stream. The GMIA has implemented management measures over the last few years to reduce the amount of glycol reaching the storm sewers and the tributary draining over 2000 acres of airport lands. A monitoring effort with the U.S. Geological Survey is currently underway to document the changes in water quality in Wilson Park Creek as a result of glycol management practices in place at the airport.

In early 2012, petroleum products were found floating on the Kinnickinnic River and ultimately traced to a jet fuel leak at General Mitchell International Airport. Emergency response teams recovered over 5,000 gallons of fuel from Wilson Park Creek and the Kinnickinnic River.

Lake Health

The WDNR's ROW database shows that there are eight acres of ponds in the Kinnickinnic River Watershed contributed from Holler Park Pond, Humboldt Park Pond, Kosciuszko Park Pond, Saveland Park Pond, and Sheridan Park Pond. There are over 15 acres of reservoirs and flowages from Jackson Park Pond and Wilson Park Pond, and another 12 acres of unspecified open water in the watershed. A total of 43 lake acres has been entered into the state's assessment database. Of these 43 acres, 26 acres are indicated as supporting Fish and Aquatic Life uses. The remaining lake acres within the watershed have not been assessed for Fish and Aquatic Life use support. In addition, seven lake acres within the watershed are indicated as supporting Fish Consumption uses, while the remainder of lake acres have not been assessed for this use.

No fish or water chemistry surveys are routinely conducted on the park ponds. In some ponds, illegal stocking of goldfish and management of Eurasian Water Milfoil and Curly Leaf Pondweed macrophytes are issues. Shoreline erosion is also a general problem around many of the ponds.

With the exception of Jackson Park Pond, which had a history of PCBs in fish tissue, the park ponds are enrolled in the Wisconsin Department of Natural Resources' Urban Fishing Program. This program, which is operated in partnership with Milwaukee County, was initiated in 1983 for the metropolitan Milwaukee area. This program, still active today, provides fishing in these urban ponds for anglers who don't have opportunities to leave the urban environment. The program stocks rainbow trout and other species to provide seasonal and year-round fishing.

Table 3: Designated Use Support Summary for Kinnickinnic River Watershed Lakes (all values in acres)					
Use	Supporting	Fully Supporting	Not Supporting	Not Assessed	Total Size
Fish Consumption	7.36			36.03	43.39
Fish and Aquatic Life	7.36	19		17.03	43.39
General				43.39	43.39
Public Health and Welfare				43.39	43.39
Recreation				43.39	43.39

Wetland Health

Wetland Status

The Kinnickinnic River Watershed is the most urbanized watershed in the state of Wisconsin. Roughly 0.37% of the current land uses in the watershed are wetlands. It is difficult to estimate the acres of wetlands lost in the watershed due to the lack of soil survey information in the Milwaukee area. Wisconsin original vegetation surveys indicated there were about 1100 acres of wetlands within the Kinnickinnic River watershed drainage area, or about 5 percent of the area. If there are about 79 acres of wetlands remaining, that means we have lost about 93% of the wetlands originally in the watershed.

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 five percent of the existing shallow open water habitats and 10% of the remaining forested wetlands. Reed canary grass domination inhibits successful establishment of native wetland species.

About 9 acres of wetland in the Milwaukee Harbor Grand Trunk area have been identified for restoration by the city of Milwaukee and local partners. The city received grants from Wisconsin Coastal Management Program and the Fund for Lake Michigan to plan for and implement wetland restoration at this site.

Wetland Restorability

Of the 128 acres of estimated lost wetlands in the watershed, approximately 6.3% are considered potentially restorable based on modeled data, including soil types, land use, and land cover (Chris Smith, DNR, 2009).

Groundwater

One of the consequences of urban development is the increase in the amount of stormwater, which runs off the land instead of infiltrating into the groundwater. A parking lot or driveway produces much more runoff than an undisturbed meadow or agricultural hay field. Depending on the degree of watershed impervious cover, the annual volume of storm water runoff can increase by up to 16 times that for natural areas. In addition, since impervious cover prevents rainfall from infiltrating into the soil, less flow is available to recharge groundwater. Therefore, during extended periods without rainfall, baseflow levels are often reduced in urban streams such as those within the Kinnickinnic River watersheds.

Park lands, natural areas, and remaining environmental corridors include areas with the best groundwater recharge potential within the Kinnickinnic River watershed (see Appendix, Map 8). Developed areas are associated with the lowest groundwater recharge potential; therefore, preservation and, where practical, expansion of open space would protect, and perhaps enhance, the groundwater recharge potential within the watershed.

The following groundwater information is for Milwaukee County (from Protecting Wisconsin's Groundwater through Comprehensive Planning website, http://wi.water.usgs.gov/gwcomp/), which roughly approximates to the Kinnickinnic River Watershed.

No municipal water systems have adopted wellhead protection plans within the Kinnickinnic River Watershed and Milwaukee County has not adopted an animal waste management ordinance.

From 1979 to 2005, total water use in Milwaukee County has decreased from about 223 million gallons per day to about 150 million gallons per day. The decrease in total water use is due to decreases in public, industrial, and commercial uses. The proportion of county water use supplied by groundwater has decreased from about six percent to 3.2% during the period 1979 to 2000, and increased to about five percent in 2005.

Private Wells

All 30 private well samples collected in Milwaukee County from 1990 to 2006 met the health-based drinking water limit for nitrate-nitrogen. 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.

A 2002 study estimated that 21% of private drinking water wells in the region of Wisconsin that includes Milwaukee 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. There are no atrazine prohibition areas in Milwaukee County. All four private well samples collected in Milwaukee County met the health standard for arsenic.

Potential Sources of Contamination

The Falk Corporation operates the only licensed landfill in the Kinnickinnic River Watershed in South Milwaukee. The Milwaukee Solvay Coal Gasification Facility site along the Milwaukee Inner Harbor is a Superfund Alternative Site located within the watershed. There are no concentrated animal feeding operations (CAFOs) located in the Kinnickinnic River Watershed.

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 1,692 sites in Milwaukee County that are specified 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 464 Leaking Underground Storage Tank (LUST) sites, 611 Environmental Repair (ERP) sites, 558 spill sites, and 59 Voluntary Party Liability Exemption (VPLE) sites.

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, $213,437,225 has been reimbursed by the PECFA program to clean up 2,133 petroleum-contaminated sites in Milwaukee County. This equates to $233 per county resident, which is less than the statewide average of $264 per resident.

Point and Nonpoint Pollution

The Kinnickinnic River Watershed is ranked overall as a high priority for nonpoint source (NPS) pollution, as its streams, lakes, and groundwater have all been ranked as high priorities for NPS pollution. Four waterbodies in the watershed have been rated as high stream under NPS rankings: Kinnickinnic River, Wilson Park Creek, Cherokee Creek, and an unnamed ditch off of South 43rd Street. Other waterbodies in the watershed have not been ranked.

Three fishkill investigations within the watershed are ongoing from 2006, all of which are categorized as having environmental conditions impacted by human activity. The first investigation took place at Holler Park Pond, followed

by fishkill investigations at Kosciuszko Park Pond and Saveland Park Pond. An ongoing investigation by Mark Baldock has found that industrial activity was the cause of the fish kill at Holler Park Pond. The other two ongoing fishkill investigation sites have been found to be the result of nutrient influxes from residential and commercial areas causing dissolved oxygen levels to decline.

Three other fishkill investigations have been concluded recently in the Kinnickinnic River Watershed. The first incident occurred in 2004 and the investigation concluded that the natural infectious agent Columnaris was likely what caused the fishkill. Canada geese were observed in large numbers prior to the incident and it is believed that rain washed large amounts of goose feces into the pond, causing Columnaris to spread to the fish population. The next incidents took place in 2008 at Humboldt Park Pond and Saveland Park Pond and were found to be a natural winterkills, which lowered levels of dissolved oxygen in the ponds. The table below summarizes these fishkill investigations.

Table 4: Recent Fish Kill Investigations in the Kinnickinnic River Watershed

Investigation Number and Investigator Name	Waterbody Name	Start/End Date	Status	Description
Investigation #80 by Mark Baldock	Saveland Park Pond	01/30/2006	Ongoing	Cause: D.O. sag - Nutrient Influx; Land Use: Residential; Activity: Residential
Investigation #78 by Mark Baldock	Kosciuszko Park Pond	01/24/2006	Ongoing	Cause: Nutrient influx - D.O. sag; Land Use: Residential; Activity: Residential and Commercial
Investigation #77 by Mark Baldock	Holler Park Pond	01/18/2006	Ongoing	Activity: Industrial
Investigation #563 by SER fish ops	Humboldt Park Pond	04/08/2008	Concluded	Cause: Dissolved Oxygen, winterkill
Investigation #568 by SER fish ops	Saveland Park Pond	04/07/2008	Concluded	Cause: Dissolved Oxygen, winterkill
Investigation #31 by Tom Burzynski	Humboldt Park Pond	08/29/2004	Concluded	Cause: Suspect columnaris due to concentration of kill to mostly bluegill, and the fact that rain likely washed large amounts of goose feces into water just prior to event.; Land Use: Residential/Parkland; Activity: County parkland - large numbers of Canada geese observed, along with goose feces; Recommended Action: Prohibit geese from accessing shoreline or install buffer strip to prevent immediate deposition into water.

Waters of Note

Trout Waters

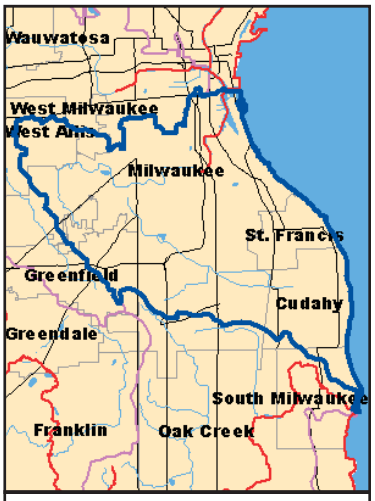
No trout waters are listed for this watershed.

Outstanding and Exceptional Resource Waters

No Exceptional or Outstanding Resource Waters are listed for this watershed.

Impaired Waters

The entire mainstream of the Kinnickinnic River is severely degraded. Over 30 years of water quality data collected by the Milwaukee Metropolitan Sewerage District (MMSD) and U.S. Geological Survey (USGS) were used to calibrate HSPF (Hydrological Simulation Program - Fortran) models for assessing baseline water quality in the Kinnickinnic River Watershed. The entire length of the Kinnickinnic River is being listed for recreational restrictions due to high bacteria (Fecal Coliform) levels. Fecal coliform concentrations exceed the variance criterion (1,000 chu/100 mL) or WisCALM threshold more than 20% of the time. A large portion of the Kinnickinnic River is concrete lined, in conduit, and contains drop structures.



Map 9: Kinnickinnic River Watershed Impaired waters (in red)

Tributaries in the Kinnickinnic River Watershed, where modeling assessment points exist, are also being proposed to be listed for fecal coliform as work is being done in the entire watershed to address this impairment.

Previous assessments have found elevated levels of phosphorus, E. coli, PCBs, and other unspecified metals. More current sampling is required to determine if these other impairments persist. Two parks along Lake Michigan, Grant Park and South Shore Beach, are also impaired by high E. coli counts.

Table 5: Kinnickinnic River Watershed Impaired Waters

WATERS ID	Stream Name	Local Water-body Name	WBIC	Start Mile	End Mile	Pollutants	Impaired Water ID	Impairments
9973	Kinnickinnic River	Kinnickinnic River	15100	0	2.83	PCBs, E. coli, Total Phospho-rus, Unspecified Metals, Fecal Coliform	2010-29, 289	Contaminated Fish Tissue, Chronic Aquatic Toxicity, Low DO, Recreational Restric-tions - Pathogens
9974	Kinnickinnic River	Kinnickinnic River	15100	2.84	9.61	Fecal Coliform	2010-29	Recreational Restrictions - Pathogens
1527102	Lake Michigan	Bayview Park Beach	20	0	0.41	E. coli	2010-36	Recreational Restrictions - Pathogens
1452696	Lake Michigan	Grant Park Beach	20	0	0.7	E. coli	822	Recreational Restrictions - Pathogens
481411	Lake Michigan	South Shore Beach	20	0	0.65	E. coli	721	Recreational Restrictions - Pathogens
9977	Unnamed	Cherokee Creek	15250	0	1.6	Fecal Coliform	2010-34	Recreational Restrictions - Pathogens
9979	Unnamed	Holmes Avenue Creek	15550	0	1.8	Fecal Coliform	2010-32	Recreational Restrictions - Pathogens
9981	Unnamed	South 43rd Street Ditch	15900	0	1.16	Fecal Coliform	2010-31	Recreational Restrictions - Pathogens
9975	Wilson Park Creek	Wilson Park Creek	15200	0	3.5	Fecal Coliform	2010-35	Recreational Restrictions - Pathogens
9976	Wilson Park Creek	Wilson Park Creek	15200	3.5	5.5	Fecal Coliform	2010-42	Recreational Restrictions - Pathogens

Fish Consumption

Wisconsin's fish consumption advisory is based on the work of public health, water quality, and fisheries experts from eight Great Lakes states. Based on the best available scientific evidence, these scientists determined how much fish is safe to eat over a lifetime based on the amount of contaminants found in the fish and how those contaminants affect human health. Advisories are based on concentrations of the following contaminants along with angler habits, fishing regulations and other factors.

Milwaukee and Kinnickinnic River have had specific fish consumption advisories in effect for polychlorinated biphenyls (PCBs) since 2009, as does Lake Michigan.

Studies indicate that people exposed to PCBs are at greater risk for a variety of health problems. Infants and children of women who have eaten a lot of contaminated fish may have lower birth weights and be delayed in physical development and learning. PCBs may affect reproductive function and the immune system and are also associated with cancer risk. Once eaten, PCBs are stored in body fat for many years. Each time you ingest PCBs the total amount of PCB in your body increases (Proposed Guidance For the Classification, Assessment, & Management of Wisconsin Surface Waters, Lowndes & Helmuth, March 12, 2007).

Aquatic Invasive Species

Lake Michigan hosts several aquatic invasive species, including Eurasian water-milfoil, spiny water fleas, round goby, rainbow smelt, zebra mussel, and fishhook water fleas. Eurasian water-milfoil have also invaded Holler Park Pond.

Table 6: Kinnickinnic River Aquatic Invasive Species

Database Key	Waterbody Name	WBIC	Bio. Common Name	Status	Subtype	Start Date
1262	Holler Park Pond	9400	Eurasian Water-milfoil	Verified and Vouchered	Mainbody	08/01/1985
1404	Lake Michigan	20	Eurasian Water-milfoil	Verified and Vouchered	Mainbody	07/01/1978
31	Lake Michigan	20	Zebra Mussel	Verified and Vouchered	Interstate	01/01/1991
22707869	Lake Michigan	20	Spiny Water Flea	Verified and Vouchered	-	12/31/1986
29304802	Lake Michigan	20	Round Goby	Verified and Vouchered	-	-
29304803	Lake Michigan	20	Rainbow Smelt	Verified and Vouchered	-	12/31/1923
29305528	Lake Michigan	20	Fishhook Water Flea	Verified and Vouchered	-	07/01/2000

Species of Special Concern

A full list of special concern plants and animals in this watershed are found on the state's Natural Heritage Inventory (NHI).

State Natural Areas

Warnimont Bluff Fens

Warnimont Bluff Fens features highly unusual alkaline wetlands situated on 100-foot-high clay banks along the Lake Michigan shore. Numerous groundwater rivulets run down the bluffs and into Lake Michigan and some of the larger rivulets have carved larger, micro gorges into the bluff. The moist, seeping bluffs support a variety of fen plants of considerable botanical interest including grass-of-Parnassus, lesser fringed gentian (Gentiana procera), Ohio goldenrod (Solidago ohiensis), swamp lousewort, and Kalm's lobelia. Other species included soapberry, elk and brittle-leaf sedge, field horsetail, and numerous rushes. Also present are white cedar, here at the southern limit of its range in Wisconsin, and slender bog-arrow grass (Triglochin palustris), a species of special concern. Of significance is the presence of a thriving population of the state-threatened false asphodel (Tofeldia glutinosa). Another state-threatened plant, blue-stemmed goldenrod (Solidago caesia) is also found in the surrounding area and the site also harbors a state-threatened reptile. The bluffs are subject to erosion, making the banks dynamic and continually changing. But the permanently moist parts are vegetated and stabilized. Warnimont Bluff Fens, being uniquely situated on steep Lake Michigan bluffs, are believed to be the only natural community of this type in the state. Warnimont Bluff Fens is owned by Milwaukee County and was designated a State Natural Area in 2002.

Natural Areas and Critical Species Habitat

The Regional Natural Areas and Critical Species Habitat Protection and Management Plan (SEWRPC 1997, updated 2010) ranked natural resource features based upon a system that considered areas to be of statewide or greater significance, NA-1; countywide or regional significance, NA-2; or local significance, NA-3. In addition, certain other areas were identified as critical species habitat sites. An amendment to the natural areas and critical species habitat protection and management plan was completed in 2010.

In the amended plan, SEWRPC identified seven natural area sites within the Kinnickinnic River drainage area. St. Francis Seminary Woods is a 52 acre southern mesic forest classified as an NA-2. The diverse ground flora includes the state endangered blue-stemmed goldenrod (Solidago caesia). Warnimont Park Fens, a two-acre NA-2, has clay bluffs with spring seepage along Lake Michigan that supports regionally rare flora. Grant Park Woods—Old Growth is a 42 acre beech-maple woods remnant of the original Lake Michigan forest classified as NA-3. Grant Park Woods—South is a 45 acre (42 acres within the Kinnickinnic River Watershed) narrow strip of remnant beech-maple mesic woods classified as NA-3. Mitchell's Woods is 37 acres of mixed-quality woods bordering the Kinnickinnic River, and Glenwood School Woods is seven acres of relatively good-quality dry mesic woods. Both are classified as NA-3 natural areas. Warnimont Park Woods is 47 acres of NA-3 designated mesic and dry-mesic woods located on the bluffs of Lake Michigan.

Five critical species habitat sites, totaling 24 acres, were identified within the Kinnickinnic River Watershed. Oak Creek Bluffs and Beach—North are seepage areas on eroding clay banks along Lake Michigan and supports two State-designated special concern species. Lyons Park Woods is a woodland within an urban park that supports a population of reflexed trillium (Trillium recurvatum), a State-designated special concern species. Trestle Ravine Woods and Greene Park Woods are small woodlands, both containing the State-designated endangered blue-stemmed goldenrod (Solidago caesia). Cudahy Park Woods is a small woodland within an urban park.

Watershed Actions

Grants and Projects

NPS Grant - City of Cudahy DPW: Storm Water Projects 01/01/2007 – Complete
State cost-sharing updating of the City of Cudahy's storm water data base, modeling, practice priority analyses, utility credit system, and creation of public–private partnerships (PPPs) for municipal facilities.

NPS Grant – City of Cudahy - DPW: High Efficiency Street Sweeper 01/01/2005 – Complete
Incremental difference in pricing between a high efficiency street sweeper and a standard brush model.

NPS Grant – City of Milwaukee: Stormwater Treatment Devices 01/01/2004 – Complete
State cost shared (at 50%) installation of four stormwater treatment devices.

NPS Grant – City of St. Francis: Underground WQ Device 01/01/2004 – Complete
State cost-shared (at 50%) design & construction of an underground water quality device, which was to be determined from completion of recommendations of analysis project.

NPS Grant - City of Milwaukee: Public Works Yards BMPs 01/01/2003 – Complete
State cost-shared (@50%) installation of Best Management Practices (BMPs) at City of Milwaukee public works yards.

NPS Grant – City of St. Francis Engineering: Subsurface BMP Design Study 01/01/2003 – Complete
State cost-shared (@70%) analysis of alternative subsurface urban retention products.

River Planning Grant – Kinnickinnic River Land Trust: New outreach Media Project 10/18/2000 – Complete
New outreach media will enable the KRLT to reach new and more diverse constituencies, expand their membership base, educate and inform more people and promote the greater protection of the Kinnickinnic River. More specifically they wish to receive new materials for: Changing demographics of the Kinnickinnic River watershed, build new opportunities to publicize the KRLT and its work to protect the River, Highlight the land protection successes of the KRLT, gain new members, build a larger river protection constituency, educate the community about new threats to the River, promote protection opportunities in the watershed, educate the public about the many values of the River and its watershed, enhance outreach opportunities and leverage new sources of funding.

Lake Planning Grant - Kosciuszko Park Lagoon Water Budget & Watershed Study 04/01/1996 – Complete
Milwaukee County proposed to determine and evaluate the water budget of the Kosciuszko Park Lagoon and evaluate the influence of the local watershed on the lagoon. Recreation usage and aesthetics were also investigated and evaluated. A final report was produced describing the data collected and evaluation results. The sponsor provided the Department of Natural Resources with a paper copy and an electronic copy of the final report. The sponsor disseminated information about the project results to the public by public meeting and press release.

Lake Planning Grant – Kosciuszko Park Lagoon Comprehensive Management Plan 10/01/1996 – Complete
Milwaukee County proposed to develop a comprehensive lake management plan for the Kosciuszko Park Lagoon. Project activities included a review and analysis of the empirical field data collected, quantification and analysis of causes and contributors to present water quality, and recommendations for an overall management plan for water quality and volume maintenance. The Department of Natural Resources was provided with both a paper copy and an electronic copy of the final report. Information about the project's results was disseminated to the public by public meeting and press release.

Lakes Baseline and Trends Monitoring
River monitoring is done to comply with Clean Water Act implementation and water quality standards, including use designations, criteria, 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.

The Milwaukee Metropolitan Sewerage District (MMSD) has an extensive monitoring program with several sites on the Kinnickinnic River and tributaries. The WDNR receives annual monitoring reports from MMSD and has data access availability to supplement state monitoring.

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 lake's 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 work in this watershed, which is not done on a regular basis, consists of lake monitoring and surveys for water quality, aquatic plants, aquatic invasive species, and ice observations.

River Volunteer Monitoring - Water Action Volunteers
There have been six stations monitored by at least 11 volunteer stream monitors in the MI01-Kinnickinnic River Watershed from 2007 through 2010. Two of the stations are monitored for dissolved oxygen, pH, instantaneous and continuous temperature and transparency using Level 2 procedures, and results are entered into the SWIMS database (http://prodoasjava.dnr.wi.gov/swims/welcome.do). Four stations are monitored for biotic index, flow, dissolved oxygen, instantaneous temperature and transparency using Level 1 procedures, and results are entered in the WAV database (http://www.uwex.edu/erc/wavdb/). On average, stations in the watershed were monitored monthly from May through October.

Volunteers collect macroinvertebrates twice a year 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 poor quality (ranging from 1.3-2.0).

Most of the streams in the watershed have low flow throughout the season unless affected by a storm event. Average stream flow measurements for the eighteen field events were 5.07 cubic feet per second (cfs) and ranged from stagnant to 24.6 cfs.

Generally, dissolved oxygen levels in the watershed were sufficient to sustain aquatic life. Levels ranged from 7-16.33 mg/l. Three of the six field events for Kinnickinnic River at 43rd Street, CBSM-10030403 during 2009-2010, dipped below ideal levels of dissolved oxygen with measurements of 4 mg/l. Overall measurements for the stream ranged from 4-7.5 mg/l. Throughout the monitoring seasons, volunteers collected pH measurements primarily within state standards (which range from 6 to 9) ranging from 7.59 to 8.75.

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 recorded at all stations and continuously recorded at both of the Level 2 stations throughout a season. Maximum instantaneous temperatures were recorded below 25°C for all streams using this method, suggesting they may be cold water streams. Continuously measured temperatures

confirm instantaneous measurements and classification of cold water streams in both streams. Stream transparency measurements indicated good water quality with over 90% of the eighteen field measurements less than 10 NTU. None of the remaining 10% measured greater than 240 NTU.

Basin/Watershed Partners

The Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water) is a unique partnership established in 2008 to achieve healthy and sustainable water resources throughout the 1,100 square mile Greater Milwaukee Watersheds through coordinated, collaborative efforts. Members include independent units of government, special purpose districts, non-profit organizations, local residents and representatives of business and academia, all sharing common goals for our shared waters. Recognizing that our rivers travel through our region irrespective of municipal or sewerage district boundaries and that the health of our waters reflects our shared land use and common stressors, the cooperating organizations have unified to address the issues facing our rivers and Lake Michigan through a basin-wide, collaborative approach.

Sweet Water operates with three broad goals:
1. Make measurable progress toward improving the water resources in the region.

2. Identify/support land use practices and designs that enhance/improve water resources and promote and restore ecological benefits.

3. Forge and strengthen relationships to leverage funding and recommend policies to assist in the implementation of projects to produce lasting water resource benefits and cost savings throughout the Greater Milwaukee Watersheds and nearshore Lake Michigan.

Sweet Water formed a Kinnickinnic River Watershed Action Team (WAT) to focus on efforts to improve the watershed. The WAT completed a watershed restoration plan and a watershed implementation plan in 2010 that outlines priority actions to meet its goals.

The Klaper Lab at the Great Lakes WATER Institute (GLWI) and the Sixteenth Street Community Health Center (SSCHC), along with a grant from Wisconsin Coastal Management, developed an action plan to raise awareness of the Kinnickinnic River. For more information see: http://www.glwi.uwm.edu/research/aquaticecology/kkriver/index.php.

The MMSD and Sixteenth Street Community Health Center developed the Kinnickinnic River Corridor Neighborhood Plan (December 2009). The plan contains a realistic vision for the river corridor. Highlights of the plan include river rehabilitation through widening the floodplain, removing the concrete lining in the channels, improving public safety and integrating the new Kinnickinnic River corridor into the community. The complete plan can be found at www.sschc.org/kkplan/.

As part of the graduate school of the University of Wisconsin at Milwaukee, the Great Lakes WATER Institute (GLWI) is the only major aquatic research facility studying the Great Lakes in the country. Owned by the University of Wisconsin System since 1973 and located in Milwaukee's inner harbor (along the Kinnickinnic River), GLWI conducts multidisciplinary and interactive quality scientific research of the Great Lakes, its ecology, and related environmental issues. In addition, GLWI collaborates with other organizations to promote educational outreach programs throughout the University of WI-Milwaukee campus and for other educational institutions.

Another basin partner, Milwaukee Riverkeeper (formerly Friends of Milwaukee's Rivers), serves as an advocate and voice for the Milwaukee, Menomonee and Kinnickinnic Rivers. Their core programming involves patrolling, monitoring, and advocating on behalf of the rivers. Further activities include hands-on river restoration projects, as well as organizing thousands of volunteers each year in river cleanup activities. Milwaukee Riverkeeper is a licensed member of the Waterkeeper Alliance, an international coalition ensuring clean water and strong communities. The group is a licensed 501(c)3 non-profit organization with the U.S. Internal Revenue Service, and a charitable licensed organization through the State of Wisconsin.

The MMSD received several grants to develop third party Total Maximum Daily Load (TMDL) analyses for the Kinnickinnic, Milwaukee, and Menomonee Rivers and the Milwaukee Estuary. Work began mid 2011. TMDLs will be developed with implementation plans by 2013.

Priority Issues

- The Kinnickinnic River downstream from Chase Avenue is within the Milwaukee Estuary Area of Concern. Priority projects within the area should be focused on removing beneficial use impairments.
- High chloride concentrations are found throughout the Kinnickinnic River Watershed, and in some areas exceed chronic and acute toxicity thresholds.
- Dissolved oxygen concentrations within the lower Kinnickinnic River are very low. MMSD is monitoring the lower Kinnickinnic River to better understand the mechanisms underlying the low dissolved oxygen concentrations.
- Bacteria and phosphorus concentrations regularly exceed water quality standards throughout the Kinnickinnic River Watershed.
- The Kinnickinnic River Watershed is the most urbanized watershed in the state. Stormwater management is a high priority in this watershed.

Goals

- Protect and expand riparian buffers with a priority on reducing fragmentation through linking public, private, and other protected lands.
- Control stormwater quantity to reduce flashiness and improve stormwater runoff quality to moderate contaminant loads including nutrients, metals, and salts (chloride), among others.
- Restore fish and aquatic organism passage to enhance connectivity with Lake Michigan.
- Protect and enhance in-stream habitat through stabilization of areas with excessive bank and bed erosion; removal of concrete and restoration of stream hydrology dynamics, subject to satisfying floodland management objectives; and reconnection with floodplain.
- Promote newly emerging technologies such as green roofs, bio-retention, and porous pavement to promote both water quality improvement and peak flow improvements (reduction in flashiness) throughout the watershed.
- Fisheries enhancement projects within the Kinnickinnic River should consider habitat re-creation to provide for fish spawning, juvenile rearing, and refuge and feeding areas. Habitat restoration methods could include provision of spawning reefs that have been successfully established by WDNR staff within and adjacent to the Milwaukee Harbor estuary as well as habitat baskets and floating habitat islands within the areas lined with steel sheet piling.

Recommendations

- Support efforts to restore the Grand Trunk Wetland Site at the Milwaukee Harbor
- Support work by the Great Lakes WATER Institute to identify sources of human bacteria in the Kinnickinnic River Watershed.
- Cooperate on third-party TMDL work being conducted by MMSD in the Kinnickinnic River Watershed.
- Rehabilitate in-stream and riparian habitat within the eroding portions of the mainstem of the Kinnickinnic River between Chase Avenue and Becher Street. Actions required could include land acquisition for buffer expansion, bed and streambank protection measures, and fisheries habitat improvements.
- Continue expansion of trash and debris cleanup efforts and programs within Kinnickinnic River Watershed waterways and associated riparian lands.
- Identify and Implement Best Management Practices for use of salt to decrease loading into the waterbodies of the Kinnickinnic River Watershed.

Additonal Resources

Planning Report No. 50—A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, 2007

Part 1 (Chapters 1-12): http://www.sewrpc.org/SEWRPCFiles/Publications/pr/pr-050_part-1_water_quality_plan_for_greater_mke_watersheds.pdf

Part 2 (Appendices): http://www.sewrpc.org/SEWRPCFiles/Publications/pr/pr-050_part-2_water_quality_plan_for_greater_mke_watersheds.pdf

Supplement to Part 2 (Appendices C-F): http://www.sewrpc.org/SEWRPCFiles/Publications/pr/pr-050_the_appendices_c-f_of_the_water_quality_plan.pdf

Technical Report 39—Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds, 2007

Part 1 (Chapters 1-4): http://www.sewrpc.org/SEWRPCFiles/Publications/TechRep/tr-039-part-01-water-quality-greater-mke-watersheds.pdf

Part 2 (Chapters 5-12): http://www.sewrpc.org/SEWRPCFiles/Publications/TechRep/tr-039-part-02-water-quality-greater-mke-watersheds.pdf

Part 3 (Appendices): http://www.sewrpc.org/SEWRPCFiles/Publications/TechRep/tr-039-part-03-water-quality-greater-mke-watersheds.pdf

Memorandum Report No. 194—Stream Habitat Conditions and Biological Assessment of the Kinnickinnic and Menomonee River Watersheds: 2000-2009
http://www.sewrpc.org/SEWRPCFiles/Publications/mr/mr-194-kk-mnr-stream-habitat-biological-assessment.pdf

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Appendices

- Map 2: The Kinnickinnic River Watershed
- Map 3: Historical Versus Current Stream Channel Alignment Within the Kinnickinnic River Watershed
- Map 5: Environmental Corridors, Riparian Corridor Widths, and Plant Community Conditions Within the Kinnickinnic River Watershed: 2009
- Map 6: Channel Bed Conditions in the Kinnickinnic River Watershed: 2000
- Map 7: Fisheries (1902-2000) and MacroInvertebrates (1987-2002) Sampling Locations and Conditions Within the Kinnickinnic River Watershed
- Map 8: Environmental Corridors and Groundwater Recharge Potential Within the Kinnickinnic River Watershed: 2009
- Figure 2: Interactions of Land Use
- Table 3: Fish Species Composition in the Kinnickinnic River Watershed: 1902-2000

Kinnickinnic River Shoreline, WDNR Photo

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DNR PUB WY-036 2011

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.

Kinnickinnic River Watershed