

Milwaukee River Basin Grade:

C-

The Milwaukee River Basin, consisting of the Milwaukee, Menomonee, and Kinnickinnic River Watersheds, scored a disappointing (but slightly improved) overall grade of C- (Fig. 1). The year 2012 was a tumultuous year in weather, contributing to continued poor grades for several parameters across all watersheds. An early thaw coupled with a wet spring made monitoring swollen streams difficult in May. A prolonged drought ensued in summer, bringing streamflows in several streams to a near halt, if not completely drying up in spots. Low water conditions led to high turbidity, phosphorus, chloride, conductivity and bacteria concentrations in the Kinnickinnic and Menomonee River watersheds, with these parameters earning seven F's, one D and two C's.

The Milwaukee River Watershed, consisting of the North Branch, East & West Branch, and South Branch Subwatersheds of the Milwaukee River, and the Cedar Creek Subwatershed, maintained a C average from 2011. All subwatersheds received A's for pH, water temperature and dissolved oxygen. Turbidity remained a problem in the South Branch and phosphorus, conductivity, and bacteria received across the board D's and F's in all Milwaukee River subwatersheds.

What Do the Grades Mean?

A

All water quality indicators meet desired targets 90-100% of the time. Streams or river segments have "good" water quality, which are capable of supporting fish and other aquatic life.

B

Most water quality indicators meet desired targets roughly 80-89% of the time. Quality of these streams and river segments tends to be good; most areas are capable of supporting fish and other aquatic life.

C

There is a mix of healthy and unhealthy water quality indicators, or indicators are only meeting water quality targets 70-79% of the time. Water quality of these waters tends to be fair, as well as conditions for fish and aquatic life.

D

Few water quality indicators meet desired targets, or only meet water quality targets 60-69% of the time. Water quality and wildlife habitat of these waters tends to be poor.

F

Very few or no water quality indicators meet desired targets. Quality of these streams and river segments is very poor, most often leading to poor conditions for fish and aquatic life.

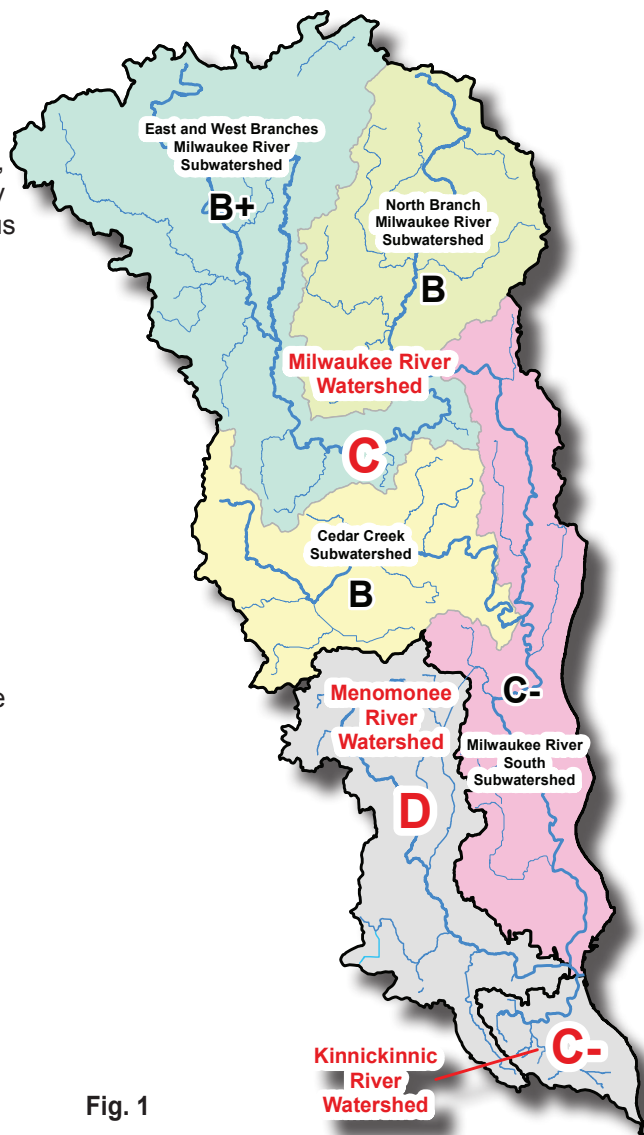


Fig. 1

Report card grades for the Milwaukee, Menomonee and Kinnickinnic Rivers and their tributary streams in 2012.

Grades are largely based on water quality data collected by Milwaukee Riverkeeper volunteer stream monitors at 100 sites throughout the Milwaukee River Basin. The Milwaukee Metropolitan Sewerage District (MMSD) also collected data at 22 sites in the Menomonee River Watershed, 18 sites in the Milwaukee River South Subwatershed, and 8 locations in the Kinnickinnic River Watershed. The Wisconsin Department of Natural Resources (WDNR) monitored 16 sites in the Milwaukee and Kinnickinnic River Watersheds.

More information on water quality grades and targets for watershed health can be found on pages 3-5 and on our website at www.milwaukeekeeper.org.

Introduction

Dear Friend of the River,

Welcome to our third annual Milwaukee River Report Card. This year's report card summarizes the 2012 water quality of the Milwaukee River Basin, which includes the Kinnickinnic and Menomonee River Watersheds, in addition to the Milwaukee River Watershed (consisting of the Cedar Creek, East & West Branch, North Branch, and South Branch Subwatersheds). Water quality grades are based on data from our dedicated cadre of Milwaukee Riverkeeper citizen stream monitoring volunteers, as well as data from the Milwaukee Metropolitan Sewerage District (MMSD) and the Wisconsin Department of Natural Resources (WDNR).

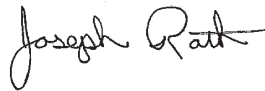
This annual report card keeps you informed of our progress towards meeting the fishable, swimmable goals for our local watersheds as envisioned under the Clean Water Act. It provides a snapshot of the health of the river at subwatershed, watershed, and basin levels, as measured by basic water quality parameters such as dissolved oxygen, temperature, turbidity, pH, and macroinvertebrates (aquatic organisms). This year's report card also includes data for contaminants such as bacteria, phosphorus, chloride, and conductivity, which are major impediments to our rivers meeting their fishable and swimmable goals.

Lastly, the report card provides ideas for what you can do to help improve the water quality of our watersheds. If we are serious about achieving clean water and healthy communities, we must change the way we live on the land. By all working together, we can be the solution to the pollution affecting our waterways!

Sincerely,



Cheryl Nenn, Riverkeeper



Joe Rath, Water Quality Specialist

P.S. If you are interested in becoming a citizen stream monitor, please contact us!

Table of Contents

Basin Grades.....	1
Introduction.....	2
How Do We Grade?.....	3
The Big Picture.....	5
Milwaukee Watershed.....	6
Kinnickinnic and Menomonee Watersheds..	8
Bacteria.....	10
Turbidity/Transparency.....	12
Phosphorus, Chloride/Road Salt.....	14
Conductivity.....	16
Volunteer Profiles.....	18
What You Can Do.....	19
About Us/Contact Us.....	20



1845 N. Farwell Ave., Suite 100
Milwaukee, WI 53202
414-287-0207
www.milwaukeekeeper.org

How Did We Grade Water Quality Parameters?

To determine water quality grades for the Milwaukee River Basin, a combination of Milwaukee Riverkeeper volunteer stream monitoring data and water quality data from two government agencies, WDNR and MMSD, were analyzed.

Data collected by Riverkeeper volunteers was assessed for several water quality parameters to determine grades for this report, including dissolved oxygen (DO), water temperature, pH, turbidity (or water clarity), and macroinvertebrate life.

Our citizen water quality monitors use standard, calibrated monitoring equipment to measure DO, water temperature, and pH on a monthly basis between May and October. Volunteers use transparency tubes to test for turbidity. Most volunteers also deploy continuous water temperature loggers called thermistors, which record hourly water temperature readings throughout the monitoring season. Macroinvertebrate data was used to assess aquatic ecosystem health. A subset of volunteers also

collected conductivity data, as well as collected water samples that were sent to the State Lab of Hygiene for chloride and total phosphorus analysis. WDNR water quality data for 16 sites and MMSD data from 48 sites was analyzed to supplement volunteer data.

Below is a description of water quality parameters assessed for the report card, and the targets or goals that water quality data was assessed against to determine health and condition of waterways.

DISSOLVED OXYGEN (DO)

Dissolved oxygen is crucial for aquatic life. Some streams and stream segments in the Milwaukee River Basin have regulatory variances (per State of Wisconsin Administrative Code) allowing DO concentrations as low as 2 mg/L, which is suitable only for the most pollution tolerant fish species. However, we believe all streams and stream segments in the Milwaukee River Basin can reach at least the Warm Water Sport Fishery (WWSF) concentration of 5 mg/L (most streams in the watershed are designated WWSF), and this was the target we used to determine if waterways could support a diverse ecosystem of fish and aquatic life. There are many streams in the basin already meeting or capable of meeting cool or cold water standards for fish and aquatic life.

TEMPERATURE

Water temperature also greatly affects fish and aquatic life. As the majority of streams and stream segments in the Milwaukee River Basin are classified as existing or attainable WWSF streams, we believe the water temperature target should at least remain below the WWSF continuous water temperature

maximum standard of 31.7°C. Both instantaneous water temperatures (measured monthly using meters) and continuous water temperatures (measured hourly by thermistors) were analyzed against this standard.

pH LEVEL

pH is a measure of acidity, or the amount of hydrogen (H⁺) ions in the water. pH ranges from 0 to 14 (0 being most acidic, 14 being most basic) with a value of 7 representing a “neutral” solution. Milwaukee River Basin streams generally run on the basic side of neutral, with values typically between 7 or 8 on the pH scale. It is generally accepted that a pH range of 6-9 can support a healthy aquatic ecosystem.

TURBIDITY

Turbidity, or water clarity, affects both the light and energy inputs available to aquatic ecosystems. Our volunteers measure turbidity using transparency tubes; clear, plastic tubes, which are filled and/or emptied of stream water until they barely reveal the black and white pattern on the bottom of the tube (similar to a lake secchi disc). A height of at least 54.7 cm of stream water in a 120 cm transparency tube indicates a healthy water turbidity acceptable for

aquatic life, and this was used as the target for stream health.

PHOSPHORUS

Phosphorus is an essential nutrient for plants, animals, and aquatic life. Phosphorus is typically low to absent in natural freshwater systems. Human activities have led to large inputs of phosphorus into our rivers and lakes. These activities include fertilization of lawns and fields; sewage treatment discharge; and the addition of phosphorus into our water supply as an anti-corrosion inhibitor for old, lead pipes. Excess phosphorus entering our waterways causes growth of nuisance algae as well as a cascade of water quality problems (see phosphorus article on pg. 14). Milwaukee Riverkeeper advanced volunteers (or Level II) take monthly water samples that are shipped to the State Lab of Hygiene for total phosphorus analysis. These sample results are assessed against Wisconsin phosphorus standards, which are generally 0.075 mg/L for smaller streams and 0.1 mg/L for larger rivers and the Milwaukee Estuary.

MACROINVERTEBRATES

To assess macroinvertebrates,

Continued on next page

Water Quality Parameters continued

Milwaukee Riverkeeper volunteers use a simple biotic index developed by a group of Wisconsin scientists and specifically designed for streams in Wisconsin. Index score classifications range from Excellent-Good-Fair-Poor. Our target for sites in the Milwaukee River Basin is a “good” classification. Because macroinvertebrates can’t readily migrate like fish, they provide a good overall indicator of the health of a certain reach of stream, and tend to be classified per their tolerance to a range of oxygen conditions

CHLORIDE

High chloride concentrations in rivers and streams are toxic to aquatic organisms. Road salt runoff constitutes a large source of chloride. Elevated levels of chloride can disrupt an organism’s ability to maintain a natural internal water balance, which leads to impaired survival, growth, and/or reproduction. The Environmental Protection Agency (EPA) has set an acute chloride standard at 860 mg/L and a chronic chloride standard of 230 mg/L as targets for healthy streams. These levels recognize that high levels of chloride can be acutely or instantly toxic to fish, but that lower levels of chloride over a longer period of time or chronic exposure can be just as toxic (see chloride article on pg. 15 for more information). Chloride data was assessed against these targets to determine grades. Grades for acute and chronic criteria were averaged to determine an overall grade.

CONDUCTIVITY

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by charged particles (ions) which can be both positive (cation) and negative (anion). Anions (negative ions) include chloride, nitrate, sulfate and phosphate, and positive ions (cations) include sodium, magnesium, calcium, iron, and aluminum. Conductivity in streams is naturally affected by geology; for instance bedrock streams tend to have lower conductivity whereas streams passing through clay soils tend to have higher conductivity. Anthropogenic discharges to streams--such as discharge of industrial waste (e.g. heavy metals), sewage, or other “charged” contaminants such as chloride, phosphate, and nitrate--can raise conductivity. A conductivity reading of 150 - 500 umhos/cm provides for a healthy aquatic ecosystem with a diverse fishery, and this threshold was used as the target for determining water quality grades for this parameter.

BACTERIA

High bacteria concentrations impact not only stream health, but also human health. Regulatory agencies such as MMSD and WDNR regularly test for fecal coliform and *E. coli* bacteria. According to State of Wisconsin Recreational Use Standards, fecal coliform levels should never exceed 200 CFU/100 mL (colony forming

units/100 milliliter sample) and the EPA established an *E. coli* standard of 235 CFU/100 mL (colony forming units/100 milliliter sample). The percentage of samples meeting these targets was used to determine water quality grades for bacteria.

HUMAN BACTEROIDES

Historically high levels of bacteria along stretches of the Menomonee and Kinnickinnic Rivers in Milwaukee and Wauwatosa led Milwaukee Riverkeeper (along with the School of Freshwater Sciences of the University of Wisconsin - Milwaukee or UWM-SFS) to investigate the possibility that failing sewer infrastructure was the culprit. Sandra McLellan’s Lab at UWM-SFS has developed techniques to identify and quantify the presence and concentration of human bacteria in stormwater using a genetic test called qPCR, which can count DNA sequences in a sample that are associated with human sewage. After five years of testing and analysis, we have found large concentrations of human waste entering the Menomonee and Kinnickinnic Rivers as well as Honey Creek and Underwood Creek, major tributaries to the Menomonee. We graded the streams based on the presence of human waste (percentage of samples testing negative for human strains of Bacteroides) entering the stream from stormwater outfalls.

NOTE: Grades for each water quality parameter are based on the percentage of time that the data points for the monitoring stations in each subwatershed meet our targets relating to overall aquatic ecosystem health. Grades were assigned on a typical percentage basis (90-100%=A, 80-89%=B, 70-79%=C, 60-69%=D and below 60%=F). Overall grades for each subwatershed were determined based on averaging grades for each individual parameter, and the overall watershed grade was determined by averaging the overall grades for each subwatershed. The overall Milwaukee River Basin grade was determined by averaging overall grades for the three watersheds.

Looking at the individual grades for the water quality parameters that we monitor and analyze for each of the subwatersheds in the Milwaukee River Basin, there is cause for some celebration as well as some alarm. Grades for dissolved oxygen, pH, and temperature continue to be pretty good in most areas, and these are key indicators for healthy fish and wildlife populations. Removal of the North Avenue Dam in 1997, as well as upstream dams such as the Chair Factory Dam, Woolen Mills Dam, and Lime Kiln Dam on the Milwaukee River, have led to large water quality improvements, reflected in better oxygen and temperatures for fish and aquatic life, and improved conditions for fish passage.

However, we continue to see subpar grades for turbidity (the amount of suspended solids or sediment in the water), bacteria, phosphorus, and conductivity/chloride levels. Many of our rivers don't meet acceptable standards for these pollutants, and are considered "impaired". The good news is that many partners have come together-- from MMSD, WDNR, and the Southeastern Wisconsin Watersheds Trust (SWWT), of which we play an active part--to craft Total Maximum Daily Loads (TMDLs) for three of our biggest pollutants of concern: bacteria, phosphorus, and total suspended solids. These plans can be thought of as pollution diets that establish loading reductions for entities discharging these pollutants to ensure our impaired streams can eventually achieve water quality standards that are safe for fish and aquatic life, as well as a variety of recreational uses. These TMDLs should be complete in early 2014, and we will create an Implementation Plan to ensure that these reductions are achieved.

It's also important to understand that even if all of the water quality parameters that we monitor came back as "straight A's" on our report card, there could still be barriers for meeting our swimmable,

fishable goals in the Milwaukee River Basin. In order to get a sense of the "big picture" of stream health, we need to look not only at basic water quality parameters (which tell us if streams can sustain a variety of fish and aquatic life), but also at issues that are not factored into our grading system, such as legacy contamination levels, emerging pollution concerns, and stream condition.

The Milwaukee River Basin is still home to many legacy contaminants that were discharged to the river before the Clean Water Act was in place, and when Milwaukee was considered the "machine shop to the world". Due to this industrial history, we still have some high levels of PCBs (an industrial contaminant), heavy metals, and other contaminants in many of our urban streams. These toxins can be present in water, sediment, or tissues of aquatic organisms, where they can cause deformities and even death. The bad news is that PCBs are still high in portions of Cedar Creek downstream from downtown Cedarburg (this is a Federal Superfund site), as well as in Milwaukee River sediments upstream from Estabrook Dam.

The good news is that much of this legacy contamination is finally being addressed. Contaminated sediments upstream of Estabrook Dam are slated to be removed in 2014, and significant levels of PCB-contaminated sediments have already been removed from the Blatz Pavilion area of the Milwaukee River (2008), Kinnickinnic River (2009), and Lincoln Creek and portions of the Milwaukee River in Lincoln Park (2011). Likewise, contaminated sediments containing PAHs (a petroleum byproduct) and copper were removed from the Burnham Canal in 2012, and removal of PAH contaminated sediments from the Little Menomonee River finally ended in 2010 after 37 years as a Superfund site.

There is also increasingly more information that pharmaceuticals and personal care products, industrial

solvents, flame retardants, insect repellents, fertilizers, pesticides, and other toxins are having a major impact on fish and other aquatic life. Many of these substances are unregulated and do not have water quality standards or material safety or disposal criteria associated with them. Some of these chemicals have been proven to affect fish behavior, as well as to cause hormonal changes that can lead fish to contain both female and male organs, or have other reproductive issues or deformities.

Finally, we could have pristine water quality, but that water could still not support fish and aquatic life if the creek is lined with concrete or dams, for example. The good news is that concrete is currently being removed from the Menomonee River upstream of Wisconsin Avenue, downstream of 6th Street on the Kinnickinnic River, and there are plans for many more of these projects in 2014 and beyond. Fish passage impediments are being removed throughout Ozaukee County, the Campbellsport Dam is out, and several more fish passage impediments will be removed from the lower Menomonee in 2014, which should help fish reach high quality spawning habitats upstream and improve fish populations.

Achieving our goals of clean, fishable and swimmable rivers depends on improving our water quality, addressing legacy contaminants and emerging chemical challenges, and rehabilitating many of our urban rivers through actions such as concrete removal, removal of fish passage barriers, and restoration of ecological function in the stream. There is still a lot of work ahead, and it can be daunting. But as AA Milne (of Winnie the Pooh fame) states "Rivers know this: there is no hurry, we shall get there someday."

How Healthy is the Milwaukee River & its Tributaries?

Our 2012 water quality data analysis results from the Milwaukee River Watershed are in! As much as we'd like to say, "we win!," unfortunately the best we can say is, "we're holding steady." The Milwaukee River Watershed earned an overall grade of "B-" in 2010. In 2011, we added additional data parameters (conductivity/chlorides, phosphorus, and bacteria), which brought the overall grade down to a "C." In 2012, the watershed showed no overall improvement, retaining our average "C" grade.

After 3 years of analyzing water quality for the Milwaukee River Watershed and its subwatersheds, the North Branch Milwaukee River, East & West Branches Milwaukee River, Cedar

Creek and the Milwaukee River South, we find one major trend: the parameters which have scored well in the past (dissolved oxygen, pH and water temperature) continue to fare well, and those parameters which have done poorly (turbidity in some areas, conductivity, chloride, phosphorus, bacteria, and macroinvertebrates) continue to do poorly (Fig. 2).

Volunteer monitor data, which serves as the backbone of this report card, currently focuses on the favorable parameters, with the exception of turbidity. A large subset of volunteers also measure phosphorus, and a few have participated in conductivity/chloride monitoring during the winter road salt season. With phosphorus,

conductivity, and chloride routinely receiving failing grades, we hope to investigate these parameters more in depth and with a greater geographic distribution in the future. Currently, the Milwaukee Metropolitan Sewerage District monitors for conductivity and bacteria, but only in their service area which falls in the Milwaukee River South Subwatershed.

With regulatory agencies not monitoring these pollutants, Milwaukee Riverkeeper continues to strive for available funds that will enable us to continue to monitor these troubling parameters: bacteria (especially human bacteroides); phosphorus; and conductivity and chloride linked to road salt.

Subwatershed	Year	DO	pH	Turbidity	Instantaneous Water Temperature	Continuous Water Temperature (Thermistors)	Phosphorus	Conductivity	Chloride	Bacteria
Milwaukee River South	2012	93.0%	99.5%	59.4%	100.0%	99.8%	30.0%	5.3%	55.6%	68.5%
		A-	A	F	A	A	F	F	F	D+
	2011	97.4%	100.0%	67.0%	100.0%	99.0%	40.0%	7.5%	89.7%	53.1%
		A	A	D+	A	A	F	F	B+	F
2010	96.0%	99.0%	67.0%	99.0%	99.9%		10.0%		48.0%	
	A	A	D+	A	A		F		F	
North Branch Milwaukee	2012	100.0%	100.0%	87.9%	100.0%	100.0%	50.0%	0.0%		
		A	A	B+	A	A	F	F		
	2011	70.0%	100.0%	85.0%	100.0%	99.0%	38.9%	0.0%		
		C-	A	B	A	A	F	F		
2010	64.7%	100.0%	76.5%	100.0%	100.0%					
	D	A	C	A	A					
Cedar Creek	2012	90.0%	100.0%	83.3%	100.0%	100.0%	62.1%	0.0%		
		A-	A	B	A	A	D-	F		
	2011	94.9%	100.0%	93.9%	94.9%	99.8%	62.5%	4.8%	100.0%	
		A	A	A	A	A	D-	F	A	
2010	95.0%	100.0%	92.5%	100.0%	99.8%					
	A	A	A-	A	A					
East & West Branches	2012	98.1%	98.0%	92.2%	100.0%	99.7%	58.5%	0.0%		
		A	A	A-	A	A	F	F		
	2011	100.0%	100.0%	100.0%	100.0%	100.0%	46.2%	0.0%		
		A	A	A	A	A	F	F		
2010	100.0%	100.0%	91.7%	100.0%						
	A	A	A-	A						

Fig. 2 Three year comparison of water quality grades in the Milwaukee River Watershed. Numbers displayed are the % of monitoring data meeting water quality goals. Parameters measured by volunteer stream monitors, with supplemental bacteria and conductivity data provided by MMSD.

2012 Milwaukee River Subwatershed Water Quality Grades by Parameter

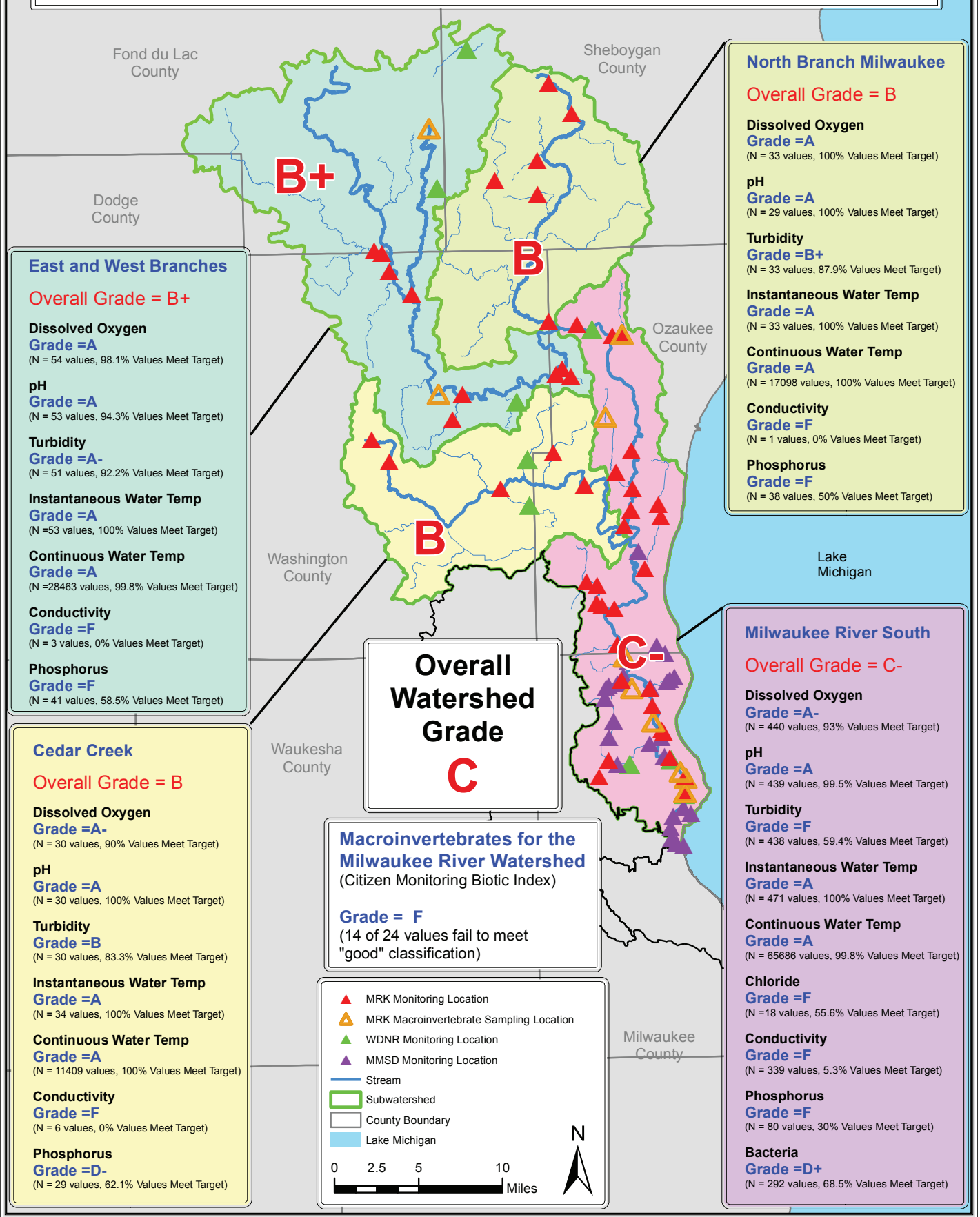


Fig. 3

Health of Kinnickinnic & Menomonee Rivers

The Kinnickinnic River and Menomonee River Watersheds are once again plagued by poor water quality. 2012 was the second year that we analyzed water quality in these two heavily urbanized and suburbanized watersheds for the report card. Even allowing for excellent marks in pH and water temperature, and slightly above average marks in dissolved oxygen, there were a resounding 9 failing grades leading to overall grades of C- for the Kinnickinnic River Watershed and a D for the Menomonee River Watershed in 2012 (Figs. 4, 5).

Bacteria continues to be a major issue. MMSD monitors *E. coli* and fecal coliform bacteria, which could be sourced to either human or other animal waste. Milwaukee Riverkeeper has taken it a step further by working with Dr. Sandra McLellan at the UWM School of Freshwater Sciences, who has developed a technique to identify bacteria specific to the human gut. High levels of human bacteria concern us due to the likely presence of viruses and pathogens more dangerous to human health, and also indicate that we have issues with sanitary sewage contaminating our stormwater. Please see our section on bacteria in this year's report card for more information (page 10).

Turbidity, phosphorus and chloride/ conductivity also remain a problem. As in the Milwaukee River South Subwatershed, we suspect stormwater runoff to be the main culprit in increased turbidity, with sediments and debris being swept from the land to the storm sewers and directly into the streams. In addition, massive stream flows occur during rain events, with water levels rising quickly (also known as "flashy" conditions) and eroding massive amounts of sediment from stream banks. Examples of this are widespread across our watersheds and one only needs to visit the Kinnickinnic River Parkway between 47th and 60th streets to observe the horrible impacts of erosion.

High loads of phosphorus and road salt are also found in stormwater runoff and have been an issue in our more urban watersheds. Milwaukee Riverkeeper has tested for both chloride and conductivity, the latter can be used as a suitable substitute for chloride when a relationship or correlation curve has been established. MMSD measures conductivity as well and they too find levels beyond recommended guidelines for a freshwater stream.

Milwaukee Riverkeeper along with our partners at Southeast Wisconsin Watershed Trust are proactively working with municipalities and regulatory agencies to establish Total Maximum Daily Loads (TMDLs) for all of Milwaukee's watersheds. A TMDL is an allocation for allowable pollutant levels released from municipalities and other dischargers. The intention is that using a watershed-wide approach to implementing TMDLs will prove more effective in ratcheting down and/or eliminating certain pollutants from our impaired streams.

Another Milwaukee Riverkeeper project started in 2012 should also help to improve water quality and aquatic connectivity in the Menomonee River Watershed - the Fish Passage Impediment Project. Milwaukee Riverkeeper staff and volunteers walked miles of streams including the Menomonee River, Little Menomonee River, Little Menomonee Creek, Nor-X-Way Channel, Dretzka Park Creek, Butler Creek, and Lily Creek, searching for potential barriers to fish passage. The next stage will be to secure funding to remove and remediate the most severe barriers in order to improve fish passage, and also to hopefully improve overall water quality.

Subwatershed	Year	DO	pH	Turbidity	Instantaneous Water Temperature	Continuous Water Temperature (Thermistors)	Phosphorus	Conductivity	Chloride	Bacteria
Kinnickinnic River	2012	82.6%	98.5%	64.2%	100.0%	98.6%	42.1%	27.0%	0.0%	49.6%
		B-	A	D	A	A	F	F	F	F
	2011	76.7%	100.0%	51.4%	100.0%	100.0%	77.8%	12.6%	35.7%	34.9%
C+		A	F	A	A	C+	F	F	F	
Menomonee River	2012	84.5%	99.7%	70.1%	100.0%	99.8%	36.9%	2.8%	75.0%	44.3%
		B	A	C-	A	A	F	F	C	F
	2011	93.8%	100.0%	53.2%	100.0%	100.0%	42.0%	5.2%	65.8%	39.6%
A		A	F	A	A	F	F	F	F	

Fig. 4 Two year comparison of water quality grades for the Menomonee and Kinnickinnic Rivers. Numbers displayed are the % of monitoring data meeting water quality goals. Parameters measured by volunteer stream monitors, with supplemental bacteria and conductivity data provided by MMSD, and human bacteria data provided by Milwaukee Riverkeeper, MMSD and UWM-SFS.

2012 Menomonee and KK River Watersheds Water Quality Grades



Fig. 5

Spotlight: Bacteria and Human Bacteroides

Do You Like to Swim, Paddle, or Drink Water? If Yes, Bacteria Levels Matter!

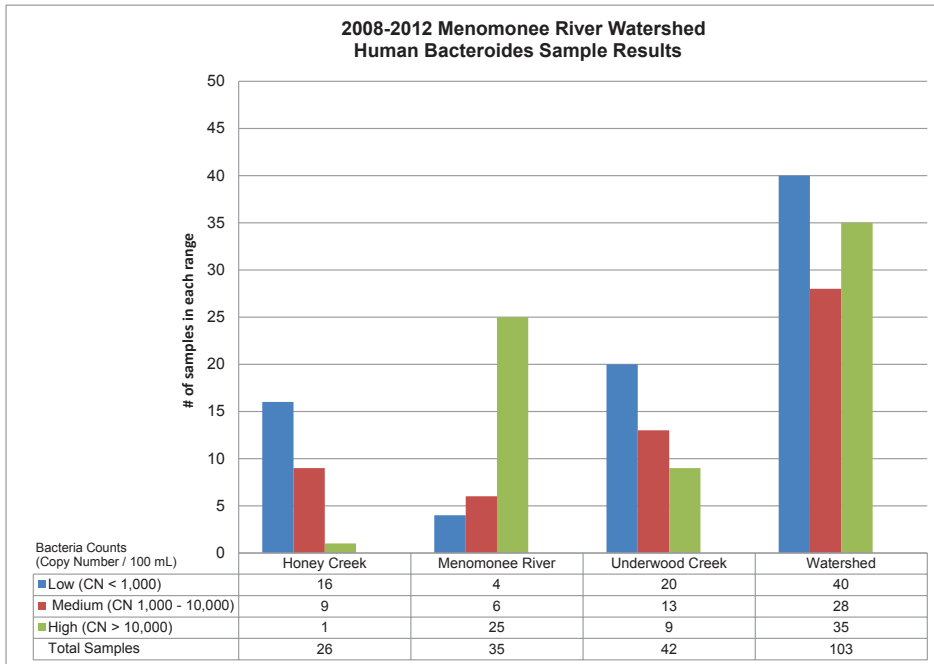


Fig. 6 Chart shows # of samples testing positive for human bacteroides in each range for the Menomonee River and its tributaries Honey Creek & Underwood Creek, and the watershed as a whole.

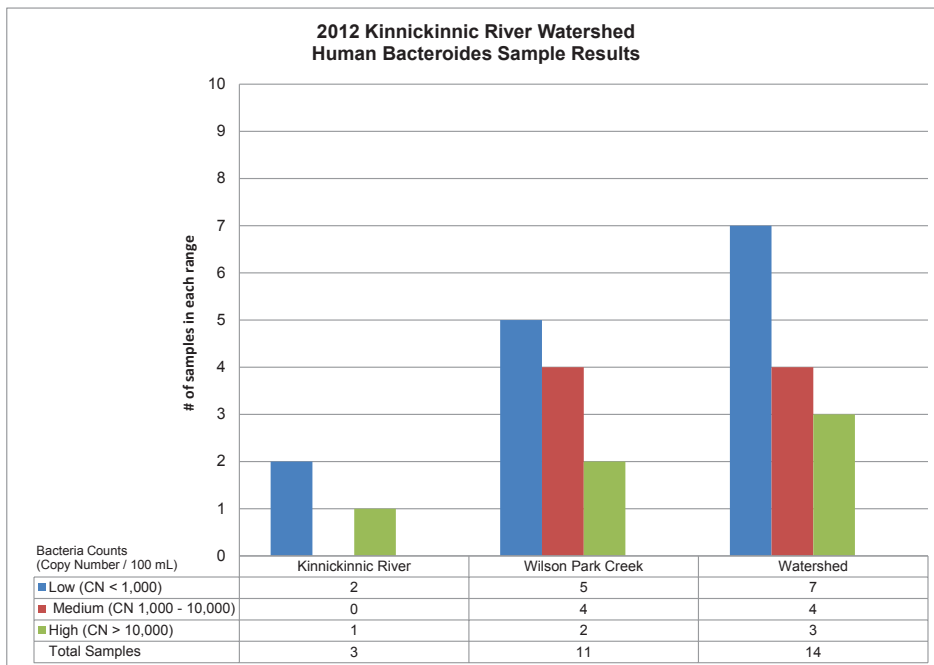


Fig. 7 Chart shows # of samples testing positive for human bacteroides in each range for streams in the Kinnickinnic River Watershed and for the watershed as a whole.

Since 2008, Milwaukee Riverkeeper has partnered with Sandra McLellan at UWM-SFS to identify unknown sources of human bacteria to area waterways. We completed our initial stormwater monitoring goals for the Menomonee River Watershed focus area in 2012 (Fig. 6), collecting up to 4 samples for each stormwater outfall on 10.5 miles of the Menomonee River, Honey Creek, and Underwood Creek. We collected 3 samples during rain events for each outfall and if flowing during dry weather, we collected a fourth. Why do stormwater outfalls flow when there is no rain? Unfortunately, a large portion of our sanitary and stormwater sewers are aging and in disrepair, hence leaks and cross-mixing occur. When stormwater outfalls flow during dry weather, it could be due to groundwater infiltration or permitted wastewater discharge from industry. However, a more serious explanation may be at play--cross-contamination from sanitary sewers.

We remain greatly concerned about the amount of human waste entering our streams through stormwater conveyance. More than 1/3 of our outfall samples (where the storm sewer dumps directly into the stream) contain medium to high amounts of human bacteria. It should be noted that the results for the Menomonee River samples are a bit skewed, as they include detailed investigations of an area with strongly suspected sanitary sewage contamination; needless to say, the results proved our suspicions that bacteria was entering our rivers through stormwater conveyance systems!

Milwaukee Riverkeeper staff also surveyed large portions of the Kinnickinnic River Watershed (Fig. 7), looking first for outfalls flowing during dry weather. Wilson Park Creek had several, with roughly

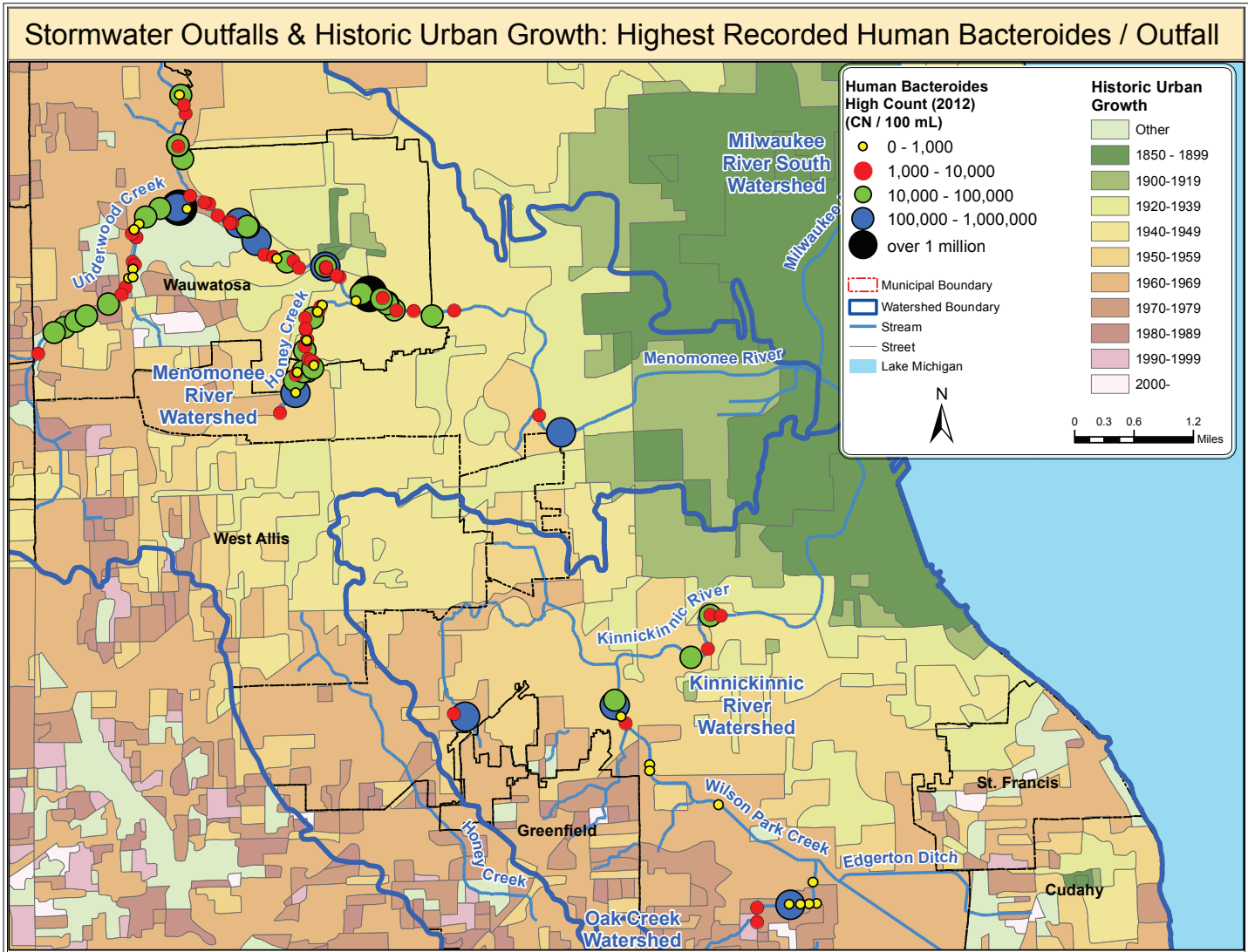


Fig. 8

half of them containing medium to high amounts of human bacteria. When considering “wet weather” samples from the Kinnickinnic River Watershed, 50% ranked in the medium or high range for human bacteria.

Milwaukee Riverkeeper will expand our bacteria monitoring efforts in the Kinnickinnic River Watershed for 2013 (weather and rain permitting) so as to gain a fuller picture of the sanitary sewage contamination in this watershed. We will employ the same regime of collecting 3 rain event samples and one dry weather sample

for each stormwater outfall.

The map above (Fig 8) depicts stormwater outfalls compared to historic urban growth. The growth layer helps us to determine how much aging infrastructure plays a role in sewer systems with high levels of human bacteria. While we do see a strong correlation, historic urban growth is not the only indicator.

Results depict samples collected from outfalls between 2008 and 2012, with the highest recorded bacteria levels for each outfall shown in graduated symbols. The larger and

darker the symbol, the greater the amount of human bacteroides found. Unfortunately, for 2012 data alone, we have found samples with over 100,000 counts of human bacteroides on four different stream reaches, two each for the Menomonee and Kinnickinnic River Watersheds.

MMSD tests for *E. coli* and fecal coliform, which can be either human or animal waste. When looking at all of their bacteria data, only 68.5%, 44.3%, and 49.6% met standards for the Milwaukee, Menomonee, and Kinnickinnic Rivers, respectively.

Turbidity/Transparency/Water Clarity:

No Matter What You Call It, It's a Problem for Our Basin!

Turbidity, transparency, and water clarity are all terms that describe the amount of suspended material in a body of water such as a stream. Increased turbidity not only indicates poor and degrading land use, it also leads to poorer conditions for both aquatic organisms and the stream itself.

Poor tilling practices on farmland, poor buffer management in riparian environments, dirty streets, and high levels of erosion all contribute to increased turbidity in our streams through erosion and stormwater runoff.

Generally, as turbidity increases, water temperature rises, which in turn leaves the stream less capable to store

dissolved oxygen essential for aquatic life. Turbid water also hinders the sunlight's ability to penetrate the water column, lessening the ability of aquatic vegetation to undergo photosynthesis, a process which contributes dissolved oxygen to the stream ecosystem. Eventually, the suspended sediment causing the turbidity will settle out on the stream bottom, covering small rocks and other spaces that house macroinvertebrates, the small organisms that compose an integral lower link of the aquatic food chain.

Turbidity also affects individual organisms directly. Sediments can irritate fish gills leading to respiratory distress and other difficulties. Sight predators, including certain fish

species, lose their advantage when visibility is impaired.

Milwaukee Riverkeeper volunteer monitors use a transparency tube to measure water quality. The tubes are clear plastic with a metric (cm) measuring tape running along the side and a black and white disc at the bottom, alternating colors in 4 quadrants. Monitors fill the tube completely with stream water, then slowly release the water through a valve and hose connected near the bottom of the tube. As the water drains from the tube, the monitor peers straight down into the tube and stops the release of water when they can see a distinction between black and white on the disk. MMSD uses more

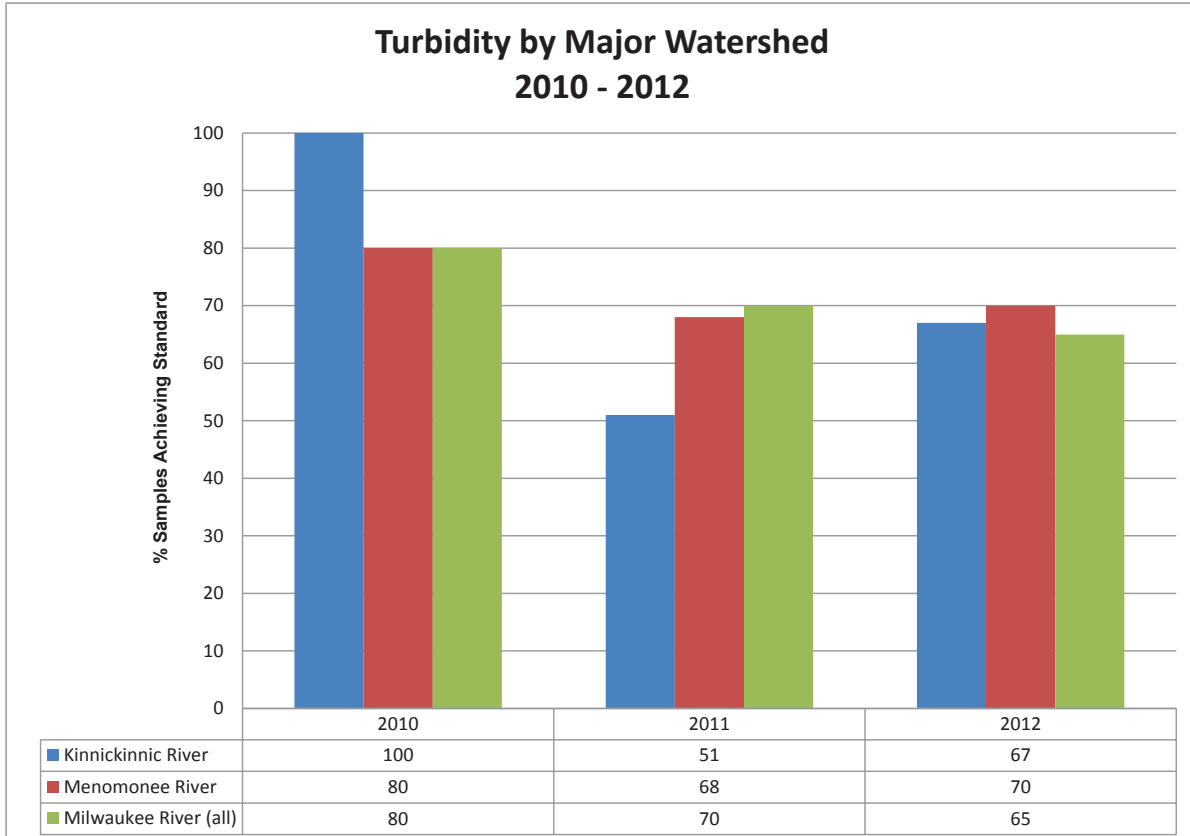


Fig. 9

2012 Turbidity Results by Watershed / Subwatershed % Samples Meeting Standard

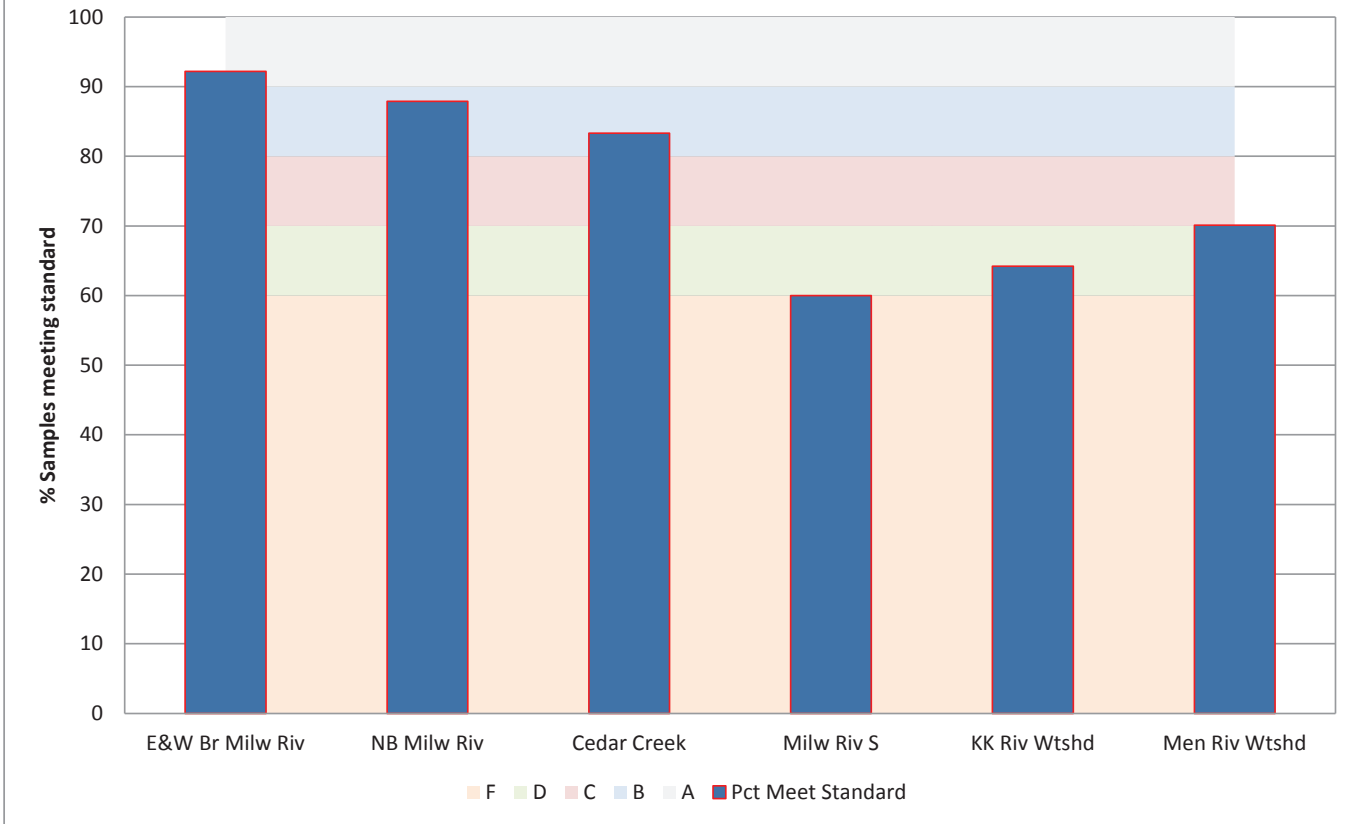


Fig. 10

sophisticated (and much more expensive) equipment to measure transparency in units of Nephelometric Turbidity (NTU). Volunteer monitors can do a simple conversion from their readings in cm to those of NTU's for a useful comparison.

The Milwaukee River Basin as a whole struggles with turbid waters (Figs. 9, 10, 11). The northern subwatersheds fare a bit better, with the North Branch improving from a C in 2010 to a B in 2011 to a B+ in 2012, and the East & West Branches maintaining an A/A- grade the past 3 years. Cedar Creek dropped from an A to a B from 2011 to 2012. The Milwaukee River South had the worst readings dropping from a D+ in 2011 to an F in 2012 with samples meeting the standard only 59.4% of the time. The Menomonee and Kinnickinnic Watersheds fared no better, though each improved from F's in 2011 to a C- and D, respectively in 2012. See the "What You Can Do" section for tips on helping address this major issue in our watershed!

Milwaukee River Turbidity by Subwatershed 2010 - 2012

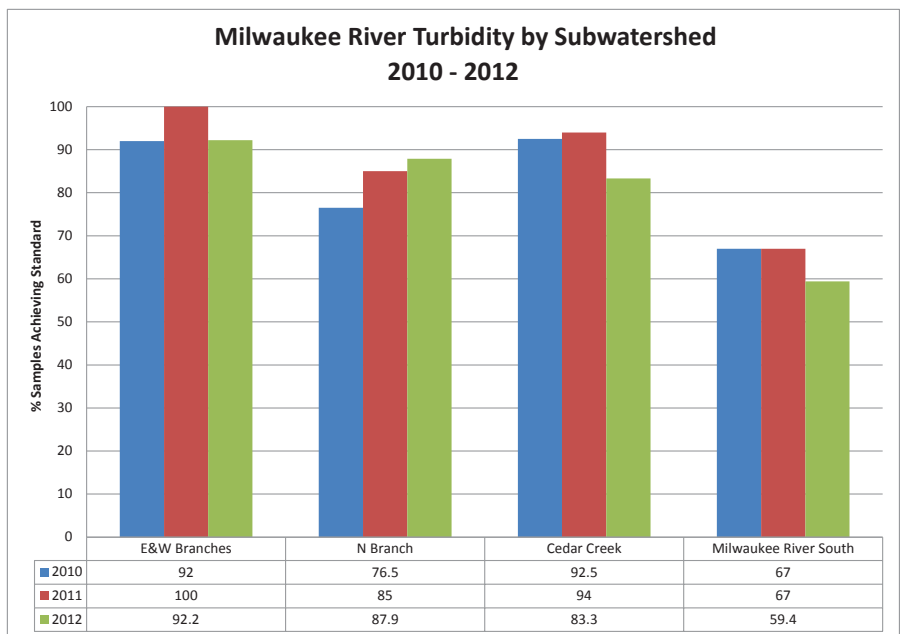


Fig. 11

Nutrients: Aren't They Supposed to Be Good For Us?

Phosphorus

While the ingestion of certain nutrients is critical for human health, overloading our local streams with excess nutrients is another matter.

As you may have noticed from our watershed grades for 2012, phosphorus once again did very poorly in our water quality analysis, with 5 F's and a D-. Phosphorus results for 2012 managed to be even worse than 2011, which actually saw 4 F's, a D, and a C (Figs. 12, 13).

Once again, the culprit is stormwater and increased alteration of natural environments. Urban stormwater loads local sewer systems with leaves and other phosphorus-containing plant debris, residual fertilizers, and animal waste. Rural areas supporting agriculture also contribute phosphorus runoff from poor management techniques and lack of riparian buffers, which can both

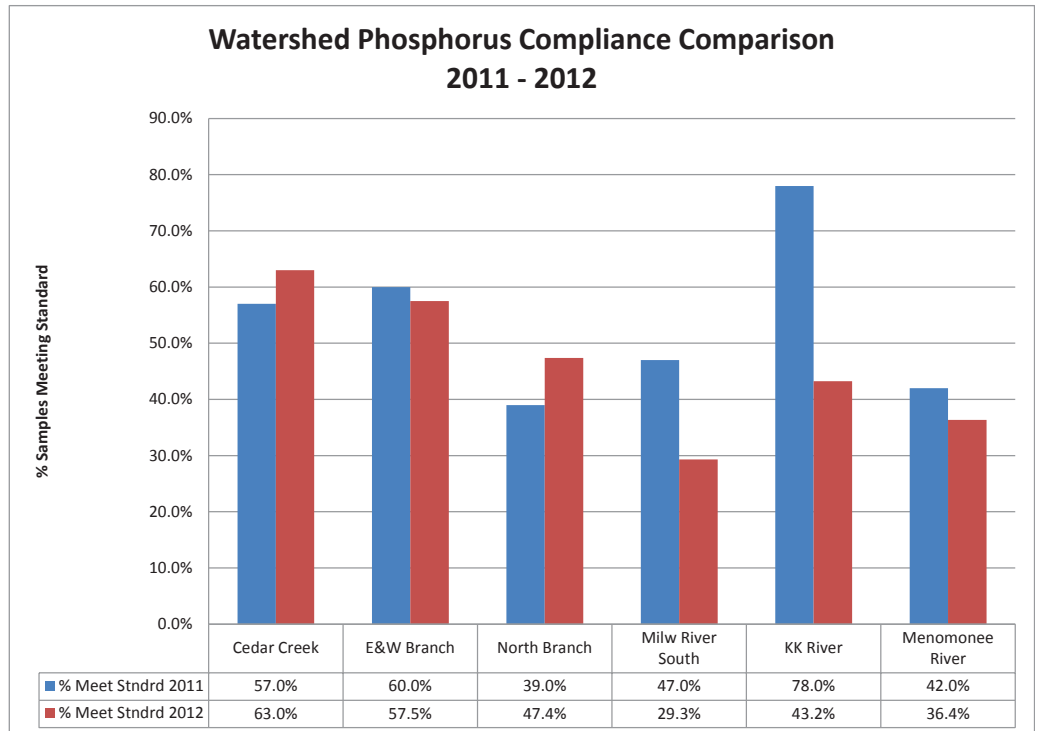


Fig. 12

contribute fertilizers, manure and soil itself to area streams. Other sources of phosphorus in our local waterways include detergents and

additives to our drinking water, which prevent corrosion of lead pipes.

As mentioned in previous report cards, excessive phosphorus leads to several problems for aquatic organisms, especially in streams with warmer waters, concrete bottoms, and low stream flows. Such stream conditions, with the addition of excess phosphorus, often accelerate and foster the growth of algae blooms, which are not only unsightly but can also contribute to fish kills and beach closings.

What can you do to help? Farmers can take more care in applying fertilizers and manure, and create and better manage buffers along streams and ditches. Homeowners can use non-phosphorus fertilizers, and remove leaves and other debris from street gutters and storm grates.

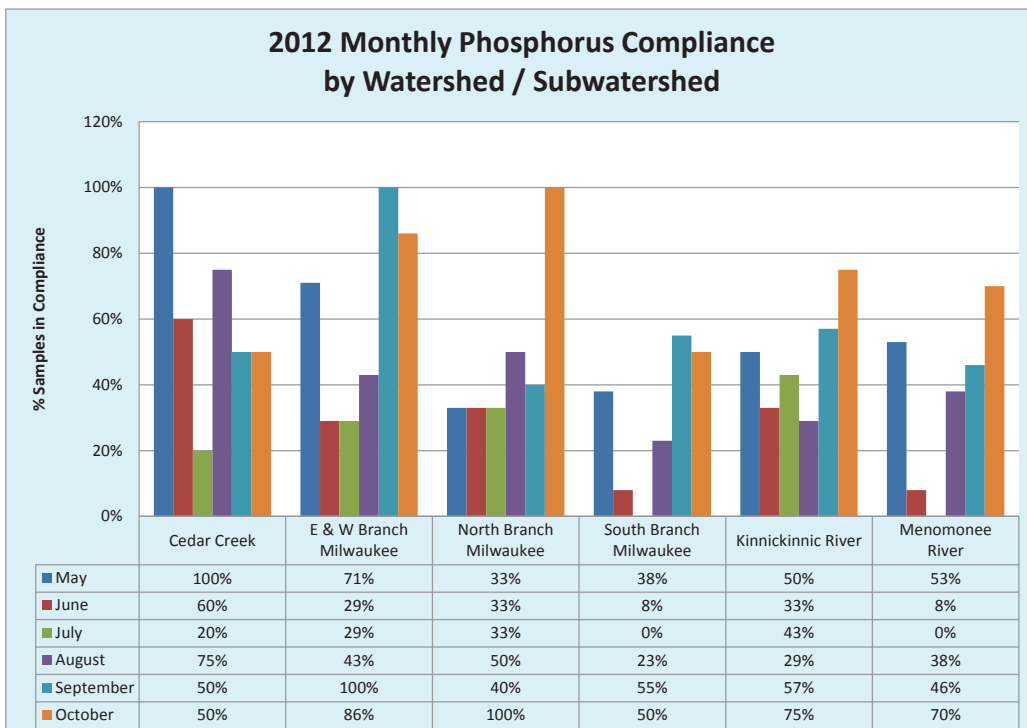


Fig. 13

Chlorides, aka salts, are another essential compound for human life. Too much salt in one's diet can lead to health issues. Likewise, too much salt in our waters can harm the health of our streams. The culprit? Road salt, and to a lesser extent the water softeners used to treat hard drinking water.

Chloride levels can impact aquatic life in two major ways, chronically and acutely. Acute levels of chloride have the potential to kill fish and aquatic organisms instantly, whereas chronic levels over a longer period of time can have the same effect.

For the third winter in a row, Milwaukee Riverkeeper monitored the effects of road salt at various locations in the metro Milwaukee area. Our monitoring consists of collecting samples to analyze for chloride, and measuring conductivity, which research has shown to correlate well to chloride levels when assessing the impact of road salt. This year, chloride samples were collected only at sites lacking an adequate number of samples to establish a correlation curve with conductivity. Conductivity was measured at all sites.

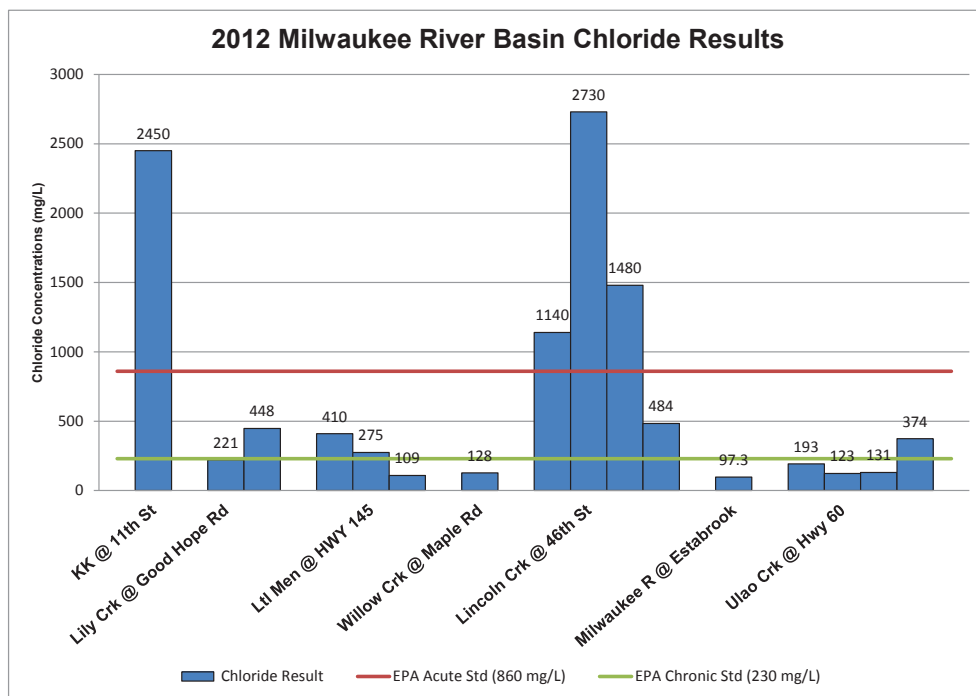


Fig. 14

Figure 14 includes samples taken in 2012, which includes two road salt application seasons, January - March and October - November. We can see that the more urban and smaller streams, the Kinnickinnic River and Lincoln Creek, have serious issues with chloride whereas the urban Milwaukee River location does not

have chloride issues, as concentrations are diluted due to a greater volume of water. The suburban streams (Lily, Willow, and Uiao Creeks and the Little Menomonee River), while less in chloride concentration, are vulnerable to chronic levels of salt.

Figure 15 depicts the urban, concrete-lined, Kinnickinnic River, with samples taken throughout the year, from 2011 - 2013. When observing the sample date and related chloride concentration, one notices the trend very easily; late spring, summer and early fall have fairly consistent concentrations (which usually exceed standards for chronic toxicity for wildlife), but as soon as road salt season arrives, the concentrations leap into acute levels of toxicity.

As we noted earlier in the report card, even though we may have average to excellent grades for dissolved oxygen, pH, and water temperature, having toxic chloride levels could negate these positive conditions for aquatic life, prohibiting healthy populations of aquatic life in our local streams.

So please, season lightly this winter!

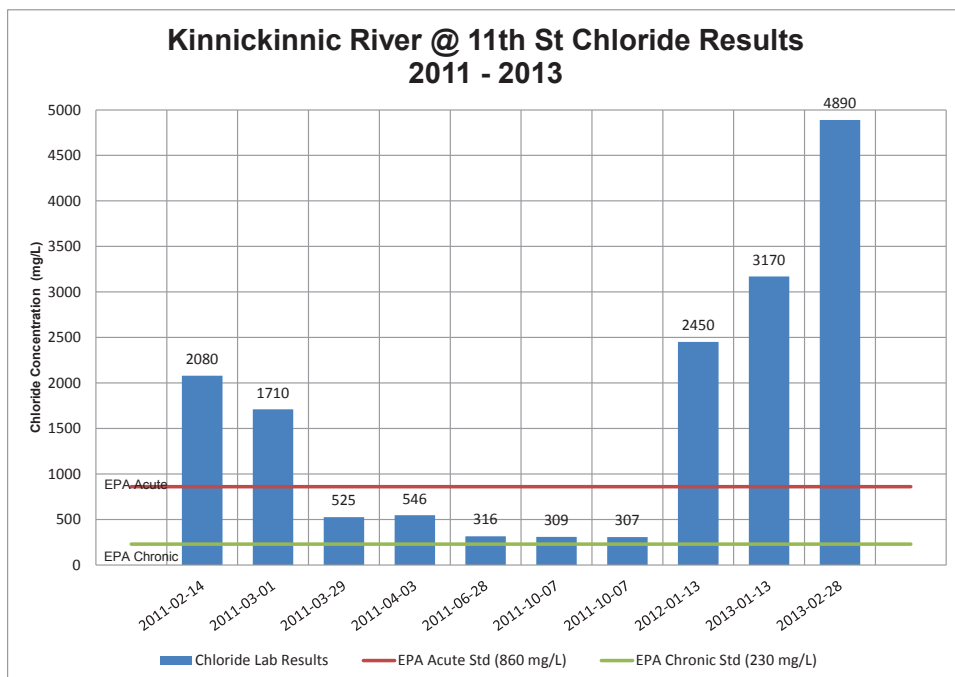


Fig. 15

Spotlight: Conductivity, It's Electric!

Conductivity measures the ability of water to conduct electricity. Many charged pollutants have this capability, and in our local streams it tends to be metals and salts, both naturally occurring as well as those contributed by humans.

Unfortunately, our local streams have a legacy of heavy metal pollution (no, not AC/DC or Led Zeppelin) that can be traced back to the industrial juggernaut that once was Milwaukee, whereas nutrient pollution in the form of phosphorus and chloride appear to be increasing each year.

Beginning in the winter of 2010-2011, Milwaukee Riverkeeper, in conjunction with UW-Extension, USGS and the WDNR, began monitoring chlorides and conductivity in Milwaukee metro area streams. One major outcome,

besides the realization that chlorides and conductivity are having a seriously deleterious impact on our local waterways, changing them from freshwater to quasi-marine environments for large portions of the winter, was that there is a strong correlation between chloride and conductivity in our streams. Hence, conductivity may be used as a dependable surrogate when measuring the impact of road salt on our local streams, and serves as a less expensive alternative.

Studies show that the optimal range for a healthy aquatic ecosystem is 150 - 500 uhmos/cm; none of our locations achieved that range, with values much higher. An average range for rivers in the US is 50 - 1500 uhmos/cm.

Milwaukee area streams tend to have conductivity readings on the

high side of average, with absolutely none of them falling in the optimal 150 - 500 uhmos/cm range.

Figure 16 compares monitoring locations for upstream and downstream locations on the mainstem Milwaukee River as well as for smaller tributary streams of the Milwaukee. As we saw in our chloride results, a few major trends exist. Tributary streams exhibit a more dynamic variation throughout the year and have overall higher readings of conductivity, most likely due to their lower baseflow volume. In addition, all three stream categories show three basic trends: spikes during the road salt season; a major dip during the spring when streams are swollen from rainfall; and increasing conductivity in the summer and early fall due to lower stream flows, leading into the next winter spike.

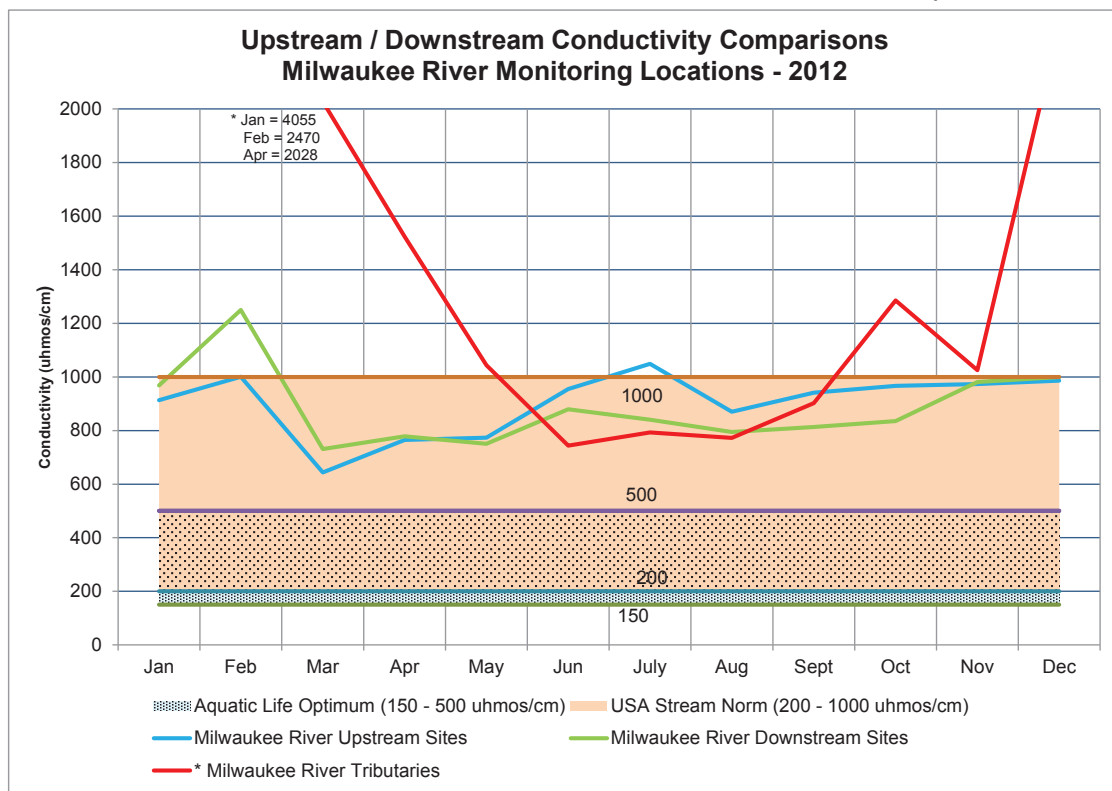


Fig. 16 Comparing monthly conductivity readings for three categories of monitoring locations: upstream and downstream locations on the Milwaukee River main stem and Milwaukee River tributary streams.

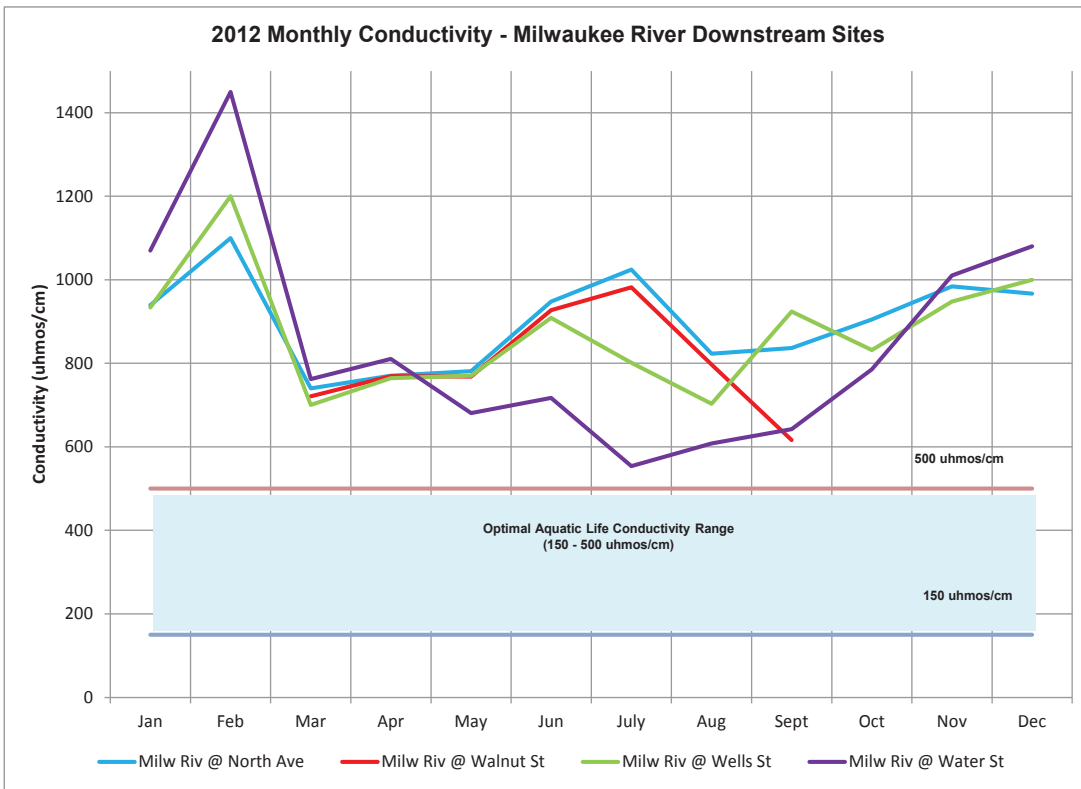
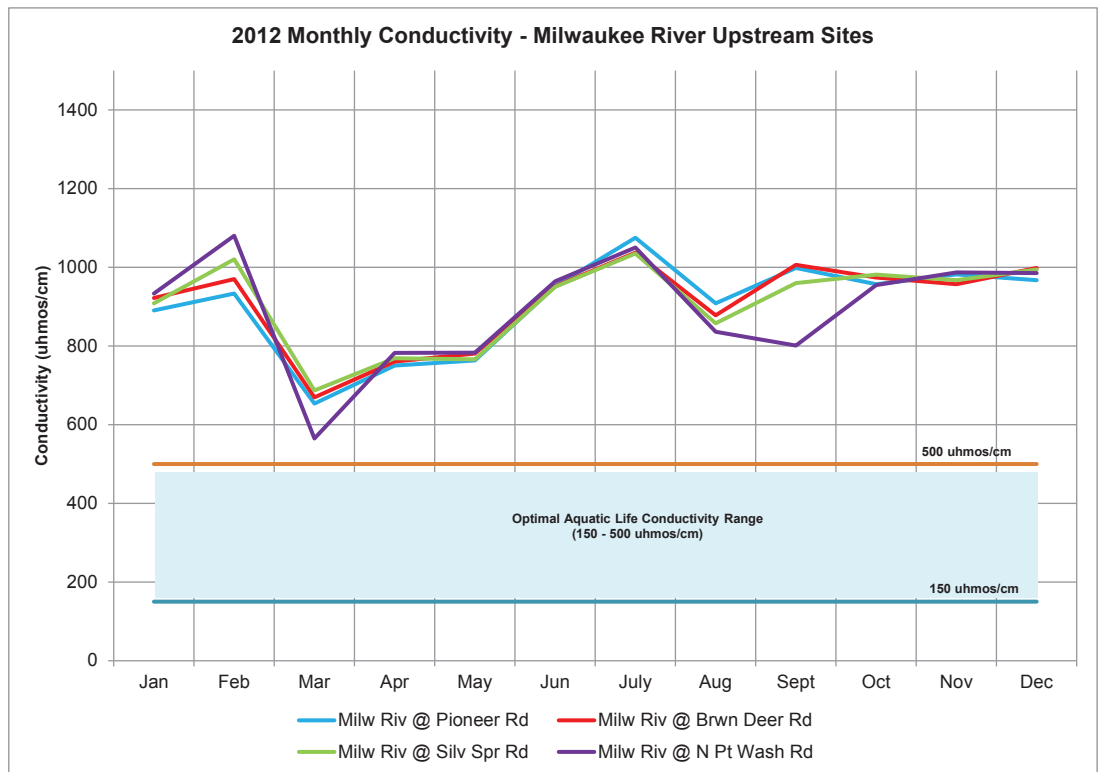


Fig. 17

Milwaukee River downstream conductivity monitoring locations. Downstream sites tend to have a higher flow and stream volume, which at times can dilute pollutant concentrations. In this case, conductivity readings followed a somewhat seasonal progression, with higher readings in the later winter - early spring, no doubt linked to road salting and melting spring runoff saturated with road salt. Late summer and early fall saw levels spike moderately, most likely due to lower water volumes increasing the concentration of contaminants. No recorded values for these sites met the optimal range for conductivity, with all values falling above the upper limit.

Fig. 18

Milwaukee River upstream conductivity monitoring sites show an even stronger relationship relating to seasonality and stream flow. We see the late winter/early spring spikes at the beginning of the year, followed by a dip mid-spring related to higher stream flows. A more gradual increase ensues as summer gives way to fall and water levels gradually recede. Interestingly, water volume may be the main factor affecting these sites with swollen spring streams diluting the conductivity temporarily before they return to their characteristic annual levels.



Volunteer Monitor Spotlight

Milwaukee Riverkeeper is grateful to the more than 250 citizens who have actively participated in our volunteer stream monitoring programs since 2006. Two groups of current monitors are highlighted below.

Matt & Angela

Matt & Angela Wolter began Level 1 stream monitoring in the spring of 2012. We set them up to monitor a pretty little creek earlier in the spring ... a week or so later we got a message that they could only find a muddy swamp area! While this didn't help Matt & Angela's data collection, it did teach us something new about that particular intermittent stream. Undeterred, Matt & Angela agreed to stray a bit further from home to take over a different monitoring location.

In 2013, they immediately jumped at the chance to move up to Level 2 monitoring, and even took on an additional monitoring site. Angela, a self-described novice regarding water quality said, "I prove that you don't have to be in a scientific field to become involved and help out our local

waterways." Angela initially became aware of the program through her husband Matt: "Matt was interested in pursuing stream monitoring and I thought it would be an activity we could share together without knowing what I was getting myself into."

Matt's passion for angling and his "itch to get outside on a monthly basis" (Matt's quite often in "the lab" conducting public health research at UWM School of Freshwater Sciences) led to his interest in volunteer stream monitoring. Matt also feels that "Not only is the volunteer work educational, but I get a sense of satisfaction when I see that I made a positive difference on the community."

In addition to volunteer stream monitoring, Matt & Angela have participated in several

river cleanups, staffed our educational table at local events, participated in a local morning tv shoot about water quality, and took some beautiful pictures at our annual bash this fall. They make a great team and a great contribution to our monitoring network!

Thanks Matt & Angela!



Team KK

Bill and Sheila Isakson, Christine Rundblad, and Brian Breider were four disparate strangers at our 2010 spring training (ok, there is one couple in the bunch and they all hail from Bayview, but they didn't know it at the time) who took it upon themselves to team up and monitor the difficult-to-access Kinnickinnic River Watershed. Four years later, they are still together and have become good friends; we call them "Team KK!"

Brian learned about stream monitoring training after attending a river cleanup. Christine found herself cheering on Milwaukee Riverkeeper from a newspaper story and then noticed the mention of stream monitoring training. Bill & Sheila just showed up to cause trouble (kidding, of course). Bill & Sheila both have strong backgrounds in the sciences and bring experience

and enthusiasm to the table.

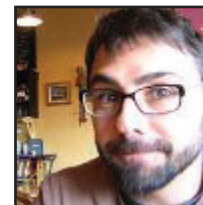
Brian hopes his efforts to improve water quality in his neighborhood will inform others about respecting "the unique environment we have here in the Great Lakes region and [inspire] work to improve and protect it."

Christine likewise strives to improve her surroundings, "I love the message that [Milwaukee] Riverkeeper is about making rivers swimmable and fishable. It makes me nuts to be on water that I can't jump into." She goes on to note, "I like that it [Milwaukee Riverkeeper] looks at the water up-close and scientifically, is a source of direct evidence, and is willing to both cooperate (and sue if necessary) to achieve results. Go Riverkeeper!"

Sheila and Bill, both trained biologists, began monitoring upon retirement, realizing "we have done

a lot of talking about water issues, it is now time for us to DO something!" Their interactions with the river stretch back to their kids youth, "Our children used to catch crayfish in Wilson Creek. We know that the streams that flow into the KK River are now very polluted... Our monitoring can provide data to help." We obviously concur.

Thanks Team KK!



If you are interested in joining Team KK & the Wolters as volunteer water quality monitors, please contact Milwaukee Riverkeeper. We hold trainings for Level 1 and Level 2 monitors each spring in late April or early May. For more information, see our website at www.milwaukeeriverkeeper.org, or contact Joe Rath at joe_rath@milwaukeeriverkeeper.org or call 414-287-0209.

Below are some easy things you can do to help restore the health of the Milwaukee River Basin. Thank you for your help and support!



Reduce erosion and sediment entering the rivers

- 1) Adopt a River -- keep an eye on a section of river near you. Contact us to learn how.
- 2) Educate and participate in land stewardship activities such as tree planting and invasive species removal.
- 3) Report potential sources of pollution from construction sites or stormwater outfalls, eroding areas, and other problems to Milwaukee Riverkeeper at [414-287-0207](tel:414-287-0207) or to the WDNR at [1-800-TIP-WDNR](tel:1-800-TIP-WDNR).



Reduce nutrients and polluted runoff

- 1) Prevent stormwater runoff by catching and encouraging slow infiltration of rain into soils with rain gardens, rain barrels, cisterns, and planting of native vegetation.
- 2) Pick up after pets -- pet waste is a major source of bacteria to our rivers.
- 3) Use water wisely both inside and outside the home. Minimize use of water during heavy rain storms to reduce stress on local sewers and protect rivers from sewage overflows.
- 4) Minimize or eliminate use of fertilizers and pesticides on your property.
- 5) Reduce or eliminate your use of salt on paved surfaces.



Stay engaged and help inform and educate others

- 1) Stay up-to-date on current issues affecting water quality and wildlife habitat. Sign up for Riverkeeper News.
- 2) Vote GREEN and advocate for fishable, swimmable, drinkable rivers and lakes. Contact elected officials and let them know that the health of the rivers and Lake Michigan is important to you.
- 3) Become involved in river cleanups, volunteer water quality monitoring, and other community events to protect our rivers and the land that drains to them.

Our Mission

Milwaukee Riverkeeper's mission is to protect water quality and wildlife habitat in the river corridors and to advocate for sound land use in the Milwaukee, Menomonee, and Kinnickinnic River Watersheds.

Milwaukee Riverkeeper serves as an advocate and voice for the Milwaukee, Menomonee, and Kinnickinnic Rivers. Our core programming involves patrolling, monitoring, and advocating on behalf of the rivers. We also coordinate hands-on river restoration projects and organize thousands of volunteers each year in river cleanups.

Milwaukee Riverkeeper is a licensed member of the Waterkeeper Alliance, an international coalition dedicated to clean water and healthy communities.



RETURN SERVICE REQUESTED

www.milwaukeeiverkeeper.org
info@milwaukeeiverkeeper.org

(414) 287-0207

1845 N. Farwell Ave., Suite 100
Milwaukee, WI 53202



Nonprofit
Organization
U.S. Postage
PAID
Milwaukee, WI
Permit # 3679