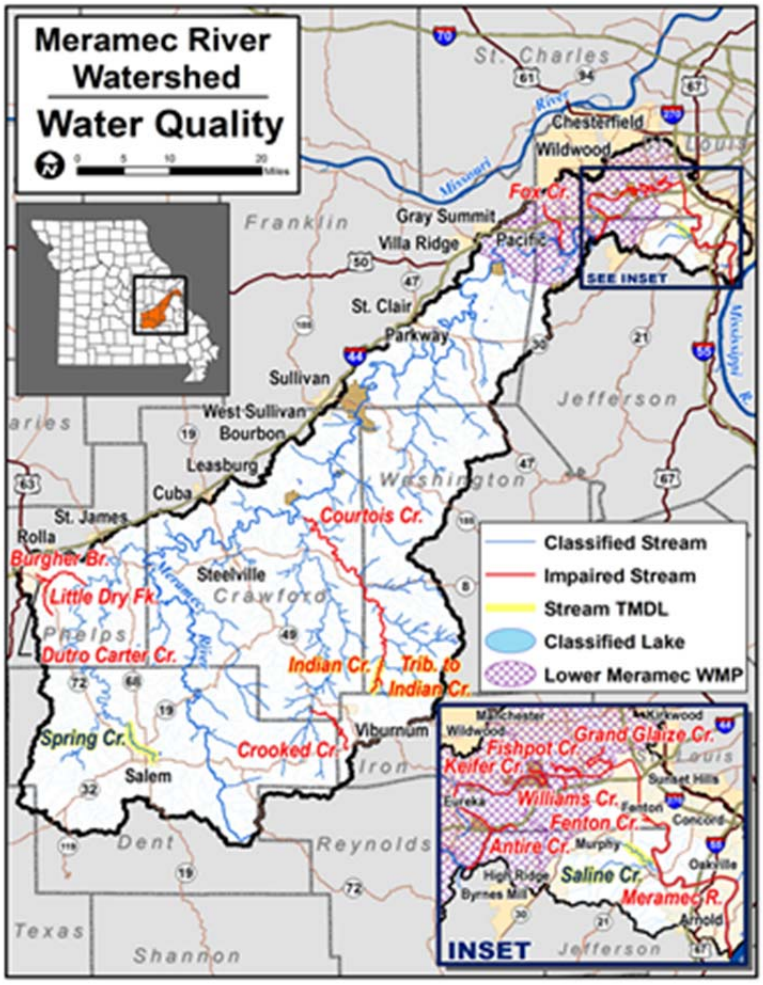
Meramec River Watershed

Water Quality Impairments

Section 303(d) of the federal Clean Water Act requires that each state identify waters that do not meet water quality standards and for which adequate water pollution controls are not in place. These identified waters are considered impaired. Water quality standards protect beneficial uses of water such as whole body contact (e.g. swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife.



The following lakes and streams within the watershed are listed on the State's 2014 List of impaired waterways and are presented on the adjacent map: Antire Creek (Bacteria & pH), Bee Tree Lake (Mercury in Fish Tissue), Burgher Branch (Low Dissolved Oxygen), Courtois Creek (Lead & Zinc), Crooked Creek (Cadmium, Copper, & Lead), Dutro Carter Creek (Low Dissolved Oxygen), Fenton Creek (Bacteria), Fishpot Creek (Bacteria & Chloride), Fox Creek (Unknown), Frisco Lake (Mercury in Fish Tissue), Grand Glaize Creek (Bacteria, Chloride, & Mercury in Fish Tissue), Indian Creek (Lead & Zinc), Keifer Creek (Bacteria & Chloride), Little Dry Fork (Low Dissolved Oxygen), Meramec River (Lead), Williams Creek (Bacteria).

Impairments can be caused by known sources like point or nonpoint source pollution, or may be unknown; however, identifying activities near impaired water bodies can provide key information in determining the sources of contamination as well as developing solutions for impaired waters.

Missouri Department of Natural Resources (DNR) is required to develop a Total Maximum Daily Load (TMDL) for all waters on the 303(d) list. The TMDL provides a framework for identifying and cleaning up impaired waters. The TMDL is a mathematical calculation of the amount of a specific pollutant a waterbody can absorb and still meet water quality standards. Each TMDL document will include allocations of the acceptable load for all sources of the pollutant. It will also include an implementation plan to identify how the load will be reduced to a level that will protect water quality. TMDLs go through a 45-day Public Notice period for public review and comment.

Total Maximum Daily Load Information Sheets are brief summaries of information related to waters listed as impaired. Information sheets will become available for each water body listed on the current 303(d) List.

Designated Beneficial Uses for Missouri Waterways	
Livestock and Wildlife Watering (LWW)	Protection of Human Health (Fish Consumption) HHP
Protection of Aquatic Life (AQL)	Whole Body Contact Recreation (WBCR)
Outstanding State Resource Water (OSRW)	Secondary Contact Recreation (SCR)
Drinking Water Supply (DWS)	Cool-water Fishery (CWF)
Industrial (IND)	

Waterbody	County	Pollutant	Impaired uses	Pollutant Source
Antire Creek	St. Louis	Bacteria	WBCR(B)	Urban Runoff/ storm sewers
		pH	AQL	Unknown
Bee Tree Lake		Mercury in fish tissue	HHP	Atmospheric Deposition
Burgher Branch	Phelps	Low Dissolved Oxygen	AQL	Rolla SE WWTP
Courtois Creek	Washington Crawford Iron	Lead Zinc Metals	AQL	Drainage from Viburnum division lead mine tailings piles and mining area
Crooked Creek	Iron Dent Crawford	Lead Cadmium	AQL General Uses	Buick Smelter
Dutro Carter Creek	Phelps	Low Dissolved Oxygen	AQL	Rolla SE WWTP
Fenton Creek	St. Louis	Bacteria	WBCR(B)	Urban Runoff/ storm sewers
Fishpot Creek	St. Louis	Bacteria	WBCR(B)	Urban Runoff/ storm sewers
		Chloride	AQL	Urban Runoff/ storm sewers
Fox Creek	St. Louis	Unknown	AQL	unknown
Grand Glaize Creek	St. Louis	Chloride	AQL	Urban Runoff/ storm sewers
		Low Dissolved Oxygen	AQL	unknown
		Mercury in fish tissue	HHP	Atmospheric Deposition
Indian Creek	Washington Crawford Iron	Lead Zinc Metals	AQL	Drainage from Viburnum division lead mine tailings piles and mining area
Kiefer Creek	St. Louis	Bacteria	WBCR(A)	Urban Runoff/ storm sewers
		Chloride	AQL	Urban Runoff/ storm sewers
Little Dry Fork	Phelps	Low Dissolved Oxygen	AQL	Rolla SE WWTP
Meramec River	St. Louis Jefferson	Lead in sediment	AQL	Abandoned mill tailings
		Bacteria	WBCR(A)	Point sources and urban/rural nonpoint sources
Williams Creek	St. Louis	Bacteria	WBCR(B)	Urban Runoff/ storm sewers
		pH	AQL	unknown

Bacteria Impairment

DNR judges a stream to be impaired by bacteria if the water quality criterion for E. coli is exceeded in any of the last three years for which there is adequate data (minimum of five samples taken during the recreational season).
High counts of E. coli are an indication of fecal contamination and an increased risk of pathogen-induced illness to humans. Infections due to pathogen-contaminated waters include gastrointestinal, respiratory, eye, ear, nose, throat and skin diseases. E. coli are bacteria found in the intestines of warm-blooded animals and are used as indicators of the risk of waterborne disease from pathogenic (disease causing) bacteria or viruses. Most E. coli strains are harmless, but some can cause serious illness in humans. Missouri's whole body contact bacteria criteria are based on specific levels of risk of acute gastrointestinal illness. The level of risk correlating to the category B criterion is no more than 10 illnesses per 1,000 swimmers in fresh water (1 percent). The level of risk correlating to the category A criterion is no more than 8 illnesses per 1,000 swimmers in fresh water (0.8 percent). (*Waters designated for the category A use are waters where there are established public swimming areas and existing whole body contact recreational uses. Waters designated for the category B applies to waters designated for whole body contact recreation not contained within category A.)*
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pH Impairment

The pH scale is used to measure the concentration of protons (H+) in a solution or in layman's terms the acidity or alkalinity of a solution. The "pH" value is an approximate number between 0 and 14 that indicates whether a solution is acidic (less than 7), basic (greater than 7) or neutral (pH = 7). For pH, a water body is assessed as impaired if more than 10 percent of available pH measurements violate the state's pH criteria. Very high (greater than 9.5) or very low (less than 4.5) pH values are unsuitable for most aquatic organisms. Young fish and immature stages of aquatic insects are extremely sensitive to pH levels below 5 and may die at these low pH values. High pH levels (9-14) can harm fish by denaturing cellular membranes. Changes in pH can also affect aquatic life indirectly by altering other aspects of water chemistry. Low pH levels accelerate the release of metals from rocks or sediments in the stream. These metals can affect a fish's metabolism and the fish's ability to take water in through the gills.
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Mercury in Fish Tissue

Mercury occurs in the environment through natural processes and human activity. Naturally occurring mercury is released to the environment by volcanoes, hot springs and the weathering of rock and soil. Substantial amounts of mercury can be released to the environment from human sources. Several industrial processes such as electroplating, coal combustion for production of electricity, pulp and paper manufacturing and the formulation of pesticides use mercury. Improper disposal of mercury-containing products such as thermometers and electrical switches increases the amount of mercury released to the environment. Because it can vaporize, a large amount of mercury enters the atmosphere and is deposited globally in precipitation.

Mercury affects the human central nervous system. It is considered a neurological and developmental toxicant, and it is a possible carcinogen. Mercury can accumulate to unsafe levels in commercially and recreationally important fish. Many chemical contaminants accumulate in bottom-feeding fish. However, unlike many of these other contaminants, mercury is magnified through the food chain. Therefore, predatory fish (bass, walleye and pike) have much higher levels of mercury. Of the mercury that accumulates in predatory fish, 90 to 100 percent is in the methyl mercury form, a form that is very soluble and assimilates easily into flesh. Preparing fish by skinning and trimming does not reduce the amount of mercury because it accumulates in fish muscle tissue (fillets). Cooking or drying fish can concentrate mercury levels to even higher levels. There is no clear demarcation of safe levels for mercury in fish tissue; however, mercury levels of 0.2 – 0.3 mg/kg or greater should be considered a general human health risk. The amount of human health risk depends on the amount of fish eaten and the levels of mercury in the fish being consumed.

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Dissolved Oxygen Impairment

A stream is designated as impaired for dissolved oxygen (DO), if more than 10 percent of measurements fail to meet the water quality criterion. Bluegill, Largemouth Bass, White Perch, and Yellow Perch are warm water fish that depend on dissolved oxygen levels above 5 mg/L. They will avoid areas where DO levels are below 3 mg/L, but generally do not begin to suffer fatalities due to oxygen depletion until levels fall below 2 mg/L. Average DO levels should remain near 5.5 mg/L for optimum growth and survival.

Factors that affect levels of oxygen in a stream are increased temperature, caused by the lack of shade (bare stream banks), low flows, and nutrients.

- Wastewater effluent that is high in biochemical oxygen demand (BOD_5), ammonia, phosphorus, and other nutrients will lower the dissolved oxygen in a stream and stress, or be lethal to, the aquatic organisms.

- Additional nutrients entering streams from nonpoint sources such as, fertilizers used on agriculture fields or lawns, or waste from humans and animals (livestock, pets and wildlife), can cause an excessive growth in algae and other aquatic plants. Algae produces oxygen during the day when photosynthesis is occurring but at night uses oxygen through respiration. During the night, when photosynthesis cannot counterbalance the loss of oxygen through respiration, oxygen concentrations decline. Excessive algae growth in a stream will further contribute to this loss of oxygen and when these plants die, the microorganism responsible for the breakdown of this material, will consume even more oxygen from the water. Dissolved oxygen, which aquatic organisms need just as humans need oxygen from the air, can be completely used up during the breakdown process. When this happens, aquatic organisms die from the lack of oxygen, which can result in extensive fish kills

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Metals Impairments

- **Indian Creek and Courtouis**
  This listing is a result of water quality data from the creeks that show exceedances of the dissolved lead and dissolved zinc chronic criteria. Additionally, these streams' aquatic invertebrate communities are exhibiting reduced species diversity and fewer individuals compared to reference streams. These reductions indicate these animals are being adversely affected by metals toxicity in their environment.
  It is believed lead is the primary pollutant resulting in metal toxicity for which the current metals impairment is based. It is common to find lead and zinc contamination in soil, groundwater, surface water and sediments surrounding lead and zinc mines. In excess quantities, both lead and zinc can be highly toxic to aquatic life.
  In addition, human consumption of fish containing sufficient quantities of lead can result in health problems, primarily affecting the nervous system, blood cells, and processes for the metabolism of Vitamin D and calcium.

- **Crooked Creek**
  A water body is considered impaired by metals if criteria are exceeded more than once during the last three years of data. These criteria are dependent on the hardness of the water.
  The sediment in the classified segment of **Crooked Creek** is contaminated by lead and cadmium. The department conducted sediment monitoring in 2004-2007. Based on the location of sediment sampling sites and known or suspected sources of metals, 3.5 miles of the creek were determined to be impaired by cadmium and lead in the sediment. Contamination of stream sediments has led to the contamination of fish and other aquatic life.
  New studies are showing that the lead and other metals in these tailings are toxic to mussels, crayfish and other small invertebrates that inhabit the bottom of the river. It is already known that lead accumulates in the bodies of aquatic creatures, which has been documented in the levels of lead in fish in Big River. Cadmium is a minor component in most lead ores and therefore is a by-product of lead production. With the exception of its use in nickel-cadmium batteries, the use of cadmium is generally decreasing in all other applications, such as pigments and corrosion resistant plating. This decrease is due to the high toxicity and carcinogenicity of cadmium. Excessive levels of cadmium have been shown to have adverse effects on human health, including kidney and bone damage.

- **Meramec River**
  The lead in sediment impairment starts where the Big River enters the **Meramec**, bringing contaminated lead mining tailings eroded from huge tailings piles in St. Francis County. Contamination of stream sediments has led to the contamination of fish and other aquatic life. New studies are showing that the lead and other metals in these tailings are toxic to mussels, crayfish and other small invertebrates that inhabit the bottom of the river. It is already known that lead accumulates in the bodies of aquatic creatures. This has been documented in the levels of lead in fish in Big River. The impairment is based on data collected by the department in 1998, 1999, 2006 and 2007.

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Chloride Impairment

The method used to assess a water body for chloride impairment, checks to see if the criterion is exceeded more than once in the last three years of data when the stream is at stable flow conditions.

- Data collected between July 2007 and July 2010 show three occurrences in which the chronic chloride criterion of 230 mg/L was exceeded. For this reason, **Fishpot Creek** was assessed as impaired by chloride.
- For **Grand Glaize Creek**, there were three occurrences between February 2007 and February 2010 where the chronic chloride criterion in rule at the time of assessment was exceeded during stable flow conditions.

High chloride concentrations in freshwater can hinder survival, growth, and reproduction of aquatic organisms by interfering with the biological processes that help the organisms maintain the proper concentration of salt and other solutes in their bodily fluids. Frogs and other amphibians lay their eggs in vernal pools, which are isolated from other water sources and do not have any process that flushes out chlorides. Amphibians such as these are especially vulnerable to high chloride levels as eggs and during metamorphosis.

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Unknown Impairment in Fox Creek

Aquatic macro invertebrate samples and fish community data were collected from **Fox Creek** in various years from 2001 to 2010. The available data suggests impaired aquatic communities for both fish and invertebrates. No additional chemistry data has been collected from **Fox Creek** to indicate if the impaired condition is due to habitat or instream toxicity. For this reason the stream was judge to be impaired due to unknown causes.

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