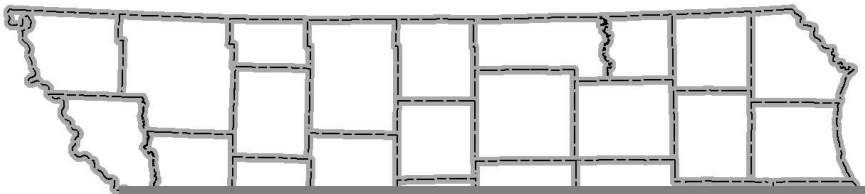
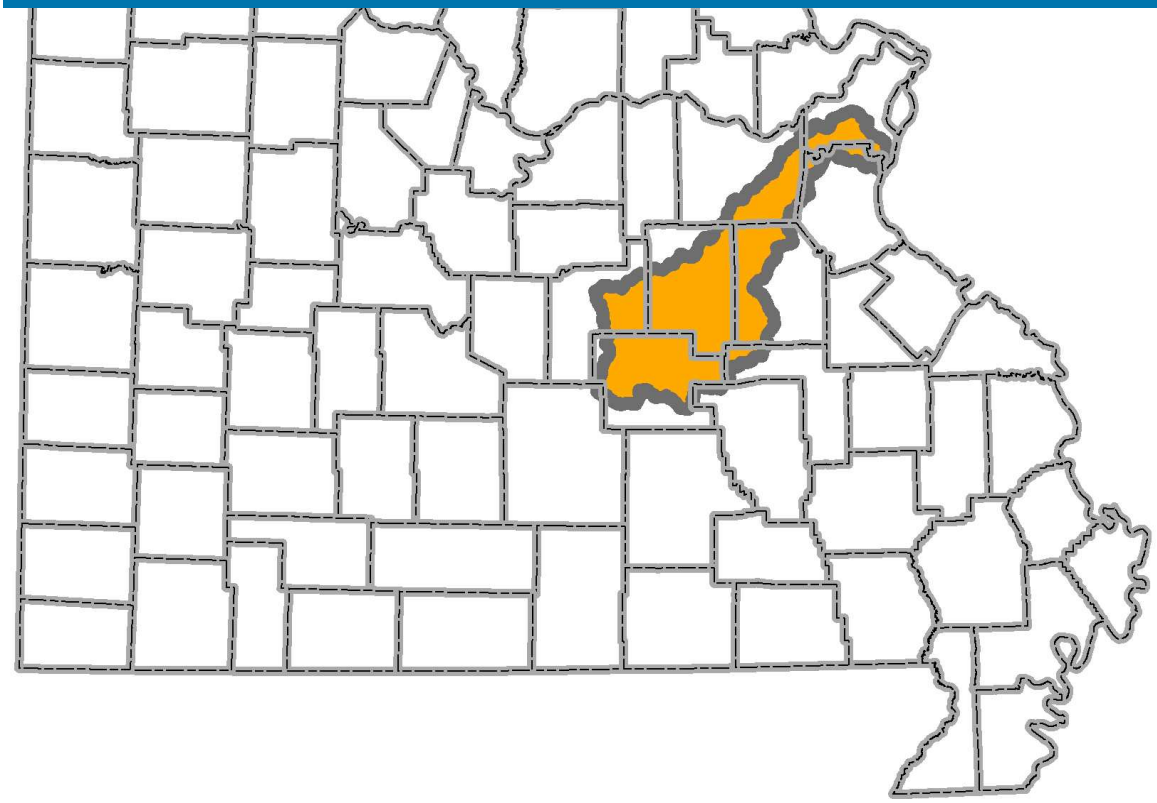


The State of *Our Missouri Waters*

Meramec River Watershed



The Missouri Department of Natural Resources seeks to improve the availability of water resource information to communities where impact to these water resources is felt most. The information presented in this summary is intended to increase awareness of how activities on land and in water have an influence on water resource quality and quantity. The department greatly values local input and engagement regarding the mission of ensuring safe and ample water resources, and will continue to seek local guidance to further focus department efforts and funding strategies for the betterment of *Our Missouri Waters.*

MISSOURI DEPARTMENT OF NATURAL RESOURCES

HUC-8: 07140102
June 2015

Meramec River Watershed

The State of Our Missouri Waters

Key Points

The Meramec River is one of the longest free-flowing waterways in Missouri. The rivers are used for recreational opportunities including hiking, fishing, canoeing and floating. At one time, the Meramec was considered one of the most polluted rivers in Missouri. Through tremendous efforts by local organizations along with state and federal agencies, strides have been made in cleaning it up. However, there are still impaired waters that need to be addressed.

In the **western portion**, low dissolved oxygen levels in water bodies often cause negative impacts to aquatic life and create challenges for the watershed. These low levels are often a result of excess organic materials, which consume oxygen, and may be discharged from wastewater treatment system types less effective in removing organics. Other sources of excess organics in water bodies may include excess animal waste, excess nutrient loads (fertilizer) and excess sedimentation from stream bank and sheet erosion.

In the **southeastern portion,** lead, zinc and other metals, due to drainage from Viburnum Division lead mine tailings piles and mining area, can cause negative impacts to aquatic life and create challenges for the watershed. In addition, human consumption of fish containing sufficient quantities of lead can result in health problems.

In the **northeastern portion** near St. Louis, streams have been identified as impaired due to bacteria, chloride and mercury, which is caused by urban runoff. The presence of fecal contamination is an indicator that a potential health risk exists. Fecal coliform bacteria may occur in streams as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste. Chloride in surface waters can be toxic to many forms of aquatic life and sources include the use and storage of deicing salt, septic systems, wastewater treatment facilities, water softening, animal waste, fertilizers, discharge from landfills, natural sources of salt and brine in geologic deposits, and from natural and human sources in precipitation. Mercury occurs in the environment through natural processes and human activity. A Fish Consumption Advisory has been issued for mercury in largemouth bass throughout the state.

Permeable bedrock and soils is present, particularly in the southern part and the northeast boundary contributing to the significant potential for contamination of groundwater from surface sources. Seventy-six percent of the stream miles have been classified as losing streams, there are approximately 650 identified sinkholes, 86 percent of water use is from surface water, with the major water use being from municipalities for drinking water. There are 122 public drinking water systems in the watershed.

Opportunities

Community Involvement, Education and Outreach

- Communities, groups and individuals promote watershed improvement activities through education, advocacy and hands-on projects. Examples include, watershed education for schools, litter control, tree planting, water quality monitoring and storm drain stenciling.
- Assistance is available for training and assistance regarding several topics such as source water protection, municipal drinking water loss, water main leak location, asset management, water conservation planning and implementation and I/I onsite assistance.
- Training is also available to livestock operations and landowners regarding the benefits of alternate watering sources for livestock, improvements to land application practices, best management practices and associated cost-share programs.

Financial Assistance

- **Clean Water and Drinking Water State Revolving Funds** are available to build or improve municipal wastewater and drinking water infrastructure and support agricultural and urban projects such as improvements to urban runoff, wet weather flow, stormwater and sewer overflow issues, water reuse and conservation and alternative treatment projects.
- **319 Nonpoint Source Funds** are available to assist organizations with implementation of on-the-ground practices that control, reduce or manage nonpoint source pollution such as riparian buffer strips, detention ponds, limitation of animal waste to stream and sinkholes.
- **Source Water Protection Grants** and **Well Plugging Grants** are available to public water systems to support safe well abandonment procedures and source water protection implementation and planning efforts.
- A full list of department funding sources is available at http://dnr.mo.gov/financial.htm

Importance of Water Quantity and Quality

Water shortages can have severe and expensive consequences. Adequate water supplies are vital not only to human health and safety, but also to the prosperity of our state. Whether it is for crop irrigation, industrial manufacturing or power generation, water is at the core of human existence and sustainability. A few decades ago, the supply of water in Missouri was considered virtually unlimited. As population and industry have increased, a need for statewide water planning has emerged.

Water quality impairments can also have severe impacts on human health and the environment and be extremely expensive. Unfortunately and more importantly, many water quality impairments are only discovered once the consequences of poor water quality have been realized. For this reason, it is important that locals are involved in the protection of their water quality and quantity so as to prevent irreversible consequences.

Our Missouri WATERS

Meramec River Watershed

The State of Our Missouri Waters—Background

What is a Watershed?

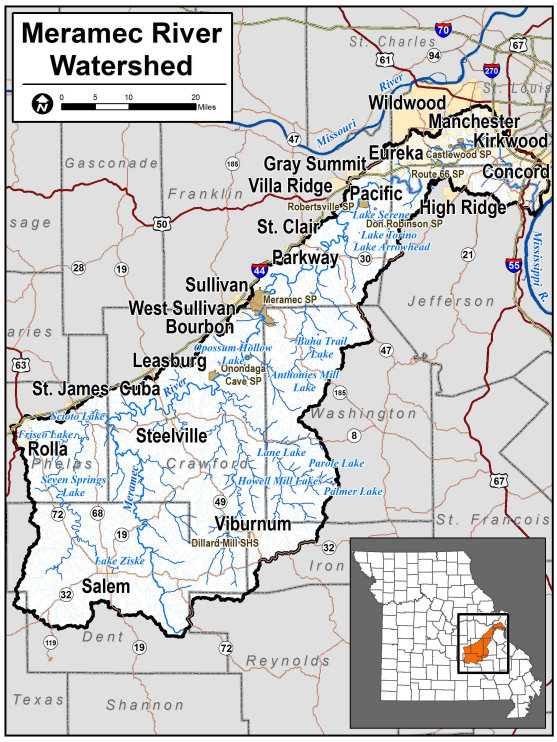
A watershed is an area of land defined by ridges, from which waters flow into a particular lake, river or wetland.

Meramec River Basin Characteristics

- Drainage area of 2,149.6 mi^2
- Includes portions of 10 counties
- Largest population centers in the watershed are on the northeast end near St. Louis.
- The Meramec River is the primary source of drinking water for more than 200,000 people.

Recreational Resources

State parks in the area include Castlewood, Route 66, Robertsville, Don Robinson, Meramac and Onondaga Cave state parks as well as Dillard Mill State Historic Site. These parks and attractions generate revenue for area businesses, support local jobs, and bring in state and local tax dollars.



Water Resources

Surface Water

There are 11 lakes from 50 acres to 195 acres, totaling 900 lake acres. There are approximately 3,650 miles of major streams. Some of the larger streams include: Little Indian Creek, Indian Creek, Huzzah Creek, Dry Fork, Dry Creek, Crooked Creek, Courtois Creek and the Meramec River.

Groundwater

There are two major aquifers, the St. Francois aquifer and the Ozark aquifer. The aquifer ranges in thickness from less than 200 feet to locally more than 700 feet thick, and averages about 500 feet in thickness. Most wells that are deep enough to produce from the St. Francois aquifer produce from the shallower and more prolific Ozark aquifer.

Springs

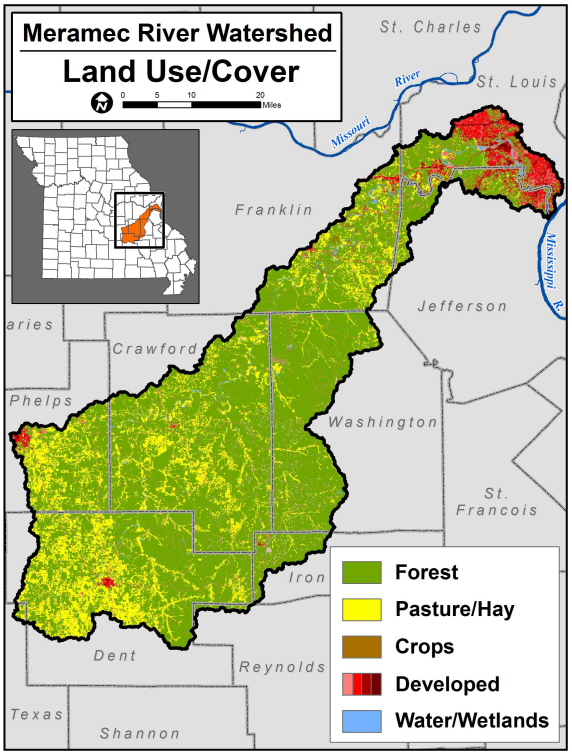
There are 401 springs, 123 named springs and 278 unnamed springs. There are 66 springs that have estimated or measured flow information.

Geology/Hydrology

The bedrock units within the basin are karst in nature, exhibiting sinkholes, losing streams, springs and caves. Of stream miles evaluated for discharging systems, 75.97% received a stream classification of "losing." There are approximately 650 identified sinkholes within the basin. Permeable bedrock and soils is present over much of the basin (carbonate bedrock), particularly in the southern part and the northeast boundary, contributing to the significant potential for contamination of groundwater from surface sources. The surface recharge area of Meramec Spring, the fifth largest spring in Missouri, is approximately 310 mi^2. The basin experiences development stress along the I-44 corridor and around the greater St. Louis metropolitan area.

Land Use

Land use in the watershed is primarily forest, some pasture/hay, with some developed pockets primarily in the North Eastern portion of the watershed.



Our Missouri WATERS

Meramec River Watershed

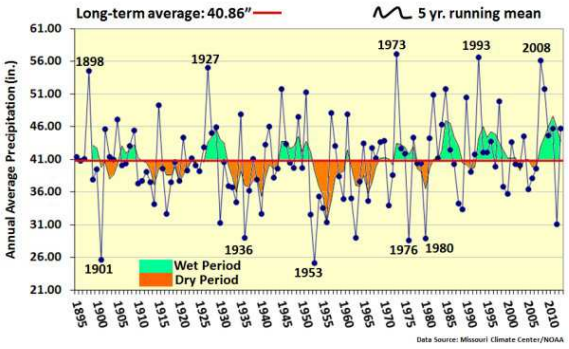
The State of Our Missouri Waters—Current Conditions and Trends

Climate and Water Availability

Precipitation

A 5-year trend line of the annual average statewide precipitation in Missouri reveals several wet periods have dominated since the early 1980s. This wet pattern has also been accompanied by an increasing trend of heavy precipitation events. Severe drought occurred during 2012, but this drought was brief compared to major multi-year droughts that occurred in the 1930s and 1950s. Tree ring analyses conducted in Missouri and historic observation data show periods of multi-year severe droughts in Missouri's history, indicating that extended dry periods are likely to occur in the future.

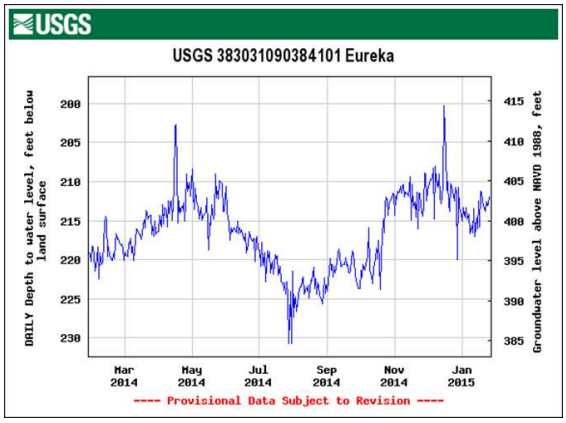
Missouri Annual Average Precipitation (1895-2013)



Groundwater and Surface Water Monitoring

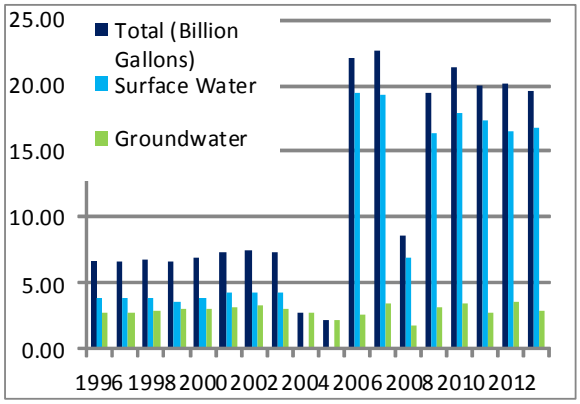
There are five groundwater monitoring wells in the area. These observation wells are located at Eureka, Bixby, Onondaga Cave State Park, Wildwood and Wofford Farm. Groundwater levels fluctuate several feet throughout the year, with groundwater lows typically occurring in summer and highest groundwater levels occurring in spring and winter. There are also 14 stream gauges that measure average stream flow.

USGS Eureka, MO Groundwater Monitoring Well



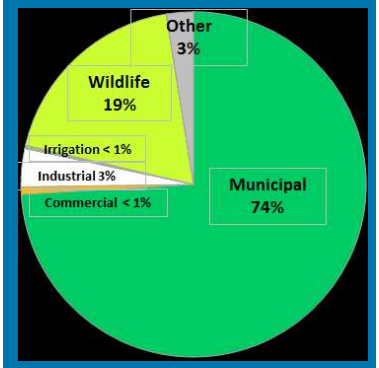
Water Use Characteristics

The estimated annual water use is 19.5 billion gallons, of which 86 percent is surface water and 14 percent is groundwater. There are 32 registered major water users, with at least a 100,000 gallons (70 gal per minute) per day withdrawal or diversion capacity, are present in the basin. Major water uses are shown in the chart on the top left column.

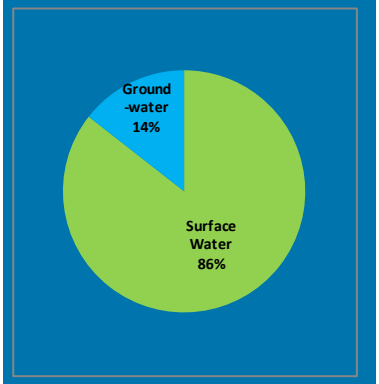


There are 91 public drinking water systems and 11 of these systems rely solely on surface water, and 80 systems use only groundwater. Estimates that rely on an inventory of privately owned wells combined with population estimates indicate 2,552,160 gallons are used annually for domestic water use.

WATER USE BY CATEGORY—2013



WATER USE BY SOURCE—2013



Our Missouri WATERS

Meramec River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

Watershed Protection

Protection of Our Natural Resources

The department exercises authority under Missouri's Clean Water Law to regulate point sources of pollution. When point sources are known or discovered, the department issues permits for these sources to limit the amount of certain water contaminants that may be discharged into the water body.

The department also has resources to help people proactively plan to protect water resources, such as:

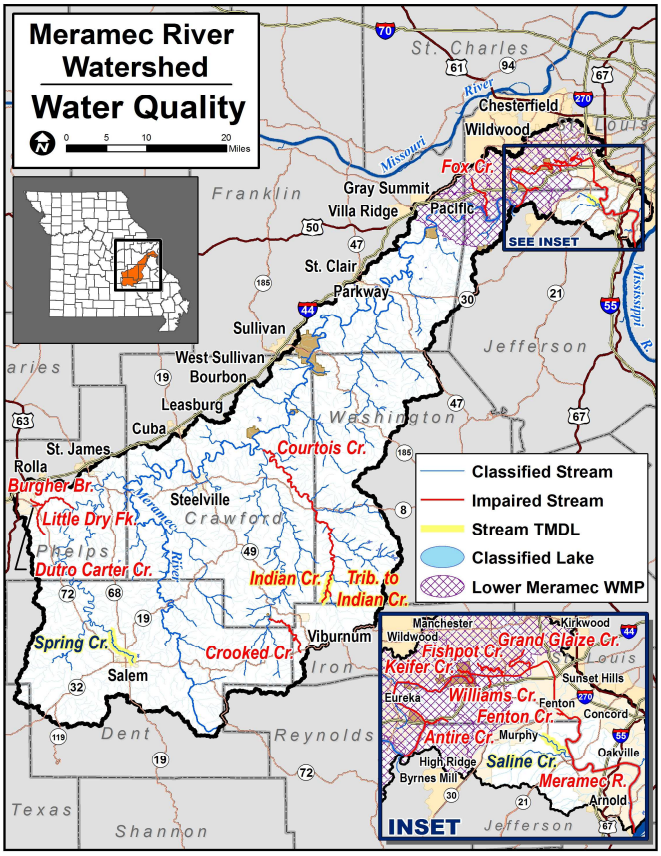
- Source Water Protection Plans for drinking water sources
- Section 319 funding for watershed planning and projects
- Funding to plan for source water protection
- Soil and Water Conservation funding
- State Revolving Fund grants and loans for community drinking water and wastewater improvements

A full list of department funding sources is available at dnr.mo.gov/financial.htm

It is important to note that resources are limited and local involvement, in determining most critical and effective focus areas, is invaluable.

Water Quality Impairments

Section 303(d) of the federal Clean Water Act requires 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.

Examples of **point sources** of pollution include municipal wastewater treatment plants, land disturbance sites, large confined animal operations, and treated industrial wastewater discharges. Common challenges for wastewater treatment include the limited contaminant removal capacity of certain types of treatment. When facilities experiences difficulty in providing the proper level of treatment and contaminant removal, the department often works with them to improve the treatment process and quality of the discharge. In the case that point source emitters are unwilling to improve the quality of their discharge, the department has regulatory authority to ensure that inappropriate discharges are discontinued in a timely manner.

Nonpoint pollution sources refer to contaminants that do not come from specific conveyances and may come from multiple sources, such as failing septic systems and contaminants carried in stormwater runoff from rural, urban and agriculture lands. Other causes of water body impairments include natural causes like precipitation, climate and drought which can alter stream flow and channel characteristics leading to changes in water quality.

Our Missouri WATERS

Meramec River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

General Water Quality Criteria

A water body is considered impaired if it does not meet water quality standards that specifically protect its beneficial uses, such as drinking water, recreational uses and fish or other aquatic life health.

Missouri's Process to Improve Water Quality

Monitoring – Lakes and Streams

↓

Assessment of Data

↓

Identification of Impaired Waters

↓

Corrective Plans (TMDLs) – MDNR Developed/ EPA Approved

NPDES:

National Pollutant Discharge Elimination System. In Missouri, NPDES permits are also known as Missouri State Operating (MSOP) permits.

Our Missouri WATERS

Watershed Protection

Total Maximum Daily Loads (TMDL)

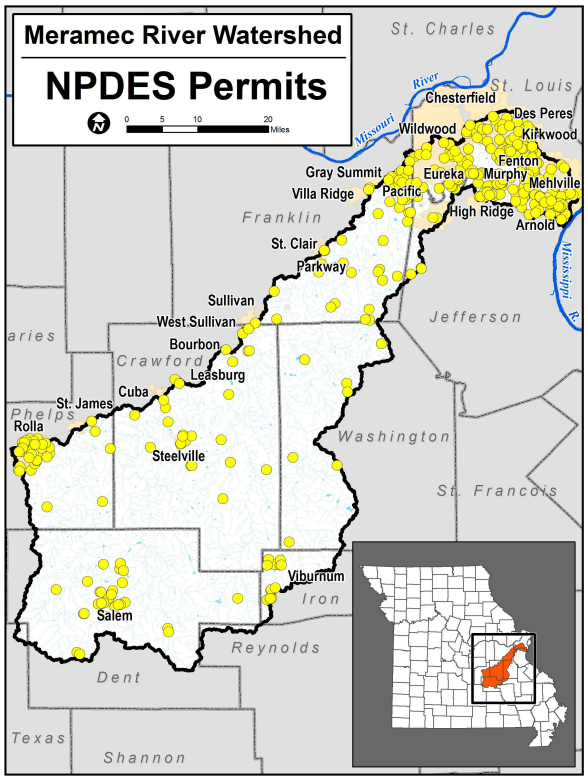
A TMDL is a mathematical calculation of the maximum amount of a pollutant that a water body can absorb and still meet water quality standards. A TMDL study identifies the potential or suspected pollutant sources in the watershed and allocates the allowable pollutant load among these sources. It also includes an implementation plan to identify how the load will be reduced to a level that will protect water quality. In this watershed, TMDLs have been developed for three rivers and streams to address impairments to the protection of aquatic life caused by heavy metals in the stream attributed to past mining activities. TMDLs were also written for several other streams to address aquatic life impairments caused by some combination of ammonia, biochemical oxygen demand, organic sediment or low dissolved oxygen. Pollutant reductions and implementation plans vary by water body, however, all are intended to restore these waters to a level that attains water quality standards and protects beneficial uses. In addition, a TMDL has been completed for the entire length of the Mississippi River bordering Missouri that addresses water quality impairments caused by chlordane and PCBs in fish tissue, a human health concern associated with fish consumption. This watershed drains to a segment of the Mississippi River that is subject to this TMDL. Since these chemicals have long been banned and are no longer manufactured, no specific implementation plans have been established, other than continued collection and proper disposal of existing chemicals. The TMDL does, however, call for continued monitoring and for the development of a consistent protocol for measurement of the pollutants in fish tissue. Pollutant reductions leading to improved water quality and attainment of beneficial uses are expected to occur naturally over time.

More information regarding these TMDLs can be found online at dnr.mo.gov/env/wpp/tmdl/wpc-tmdl-EPA-Appr.htm

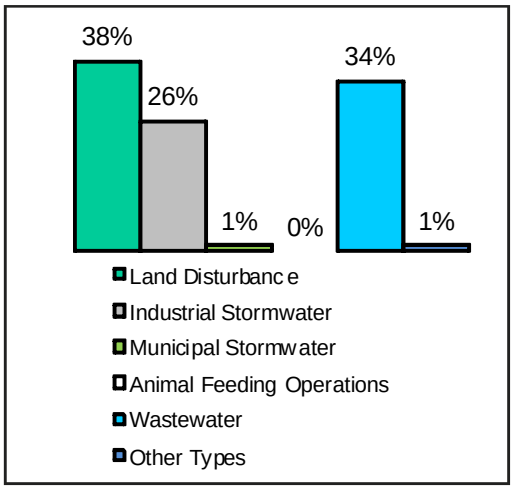
Regulated Point Sources

The department regulates point sources by issuing permits that prescribe conditions of operating the point discharge and limit the discharge of water contaminants. In addition, the department inspects regulated facilities and analyzes water samples to ensure the facilities are not polluting waters.

The following graphics illustrate the type and distribution of permitted sites in the Meramec River Watershed.



NPDES Permit Types



Meramec River Watershed

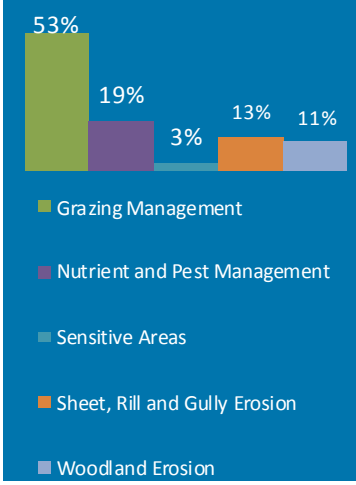
The State of Our Missouri Waters—Current Conditions and Trends

Local Awareness

Is it safe to fish or swim in the nearby stream? Does the stream provide habitat suitable for fish? What does it cost to make this water potable? Will I have enough water during a drought?

Impacts to water quality and quantity are most critical to local communities; however, impacts are often not realized until a dire situation arises as a result of poor water quality or quantity. Local awareness and involvement can lead to pollution prevention and reduction, water supply sustainability and can give communities the upper hand in protecting, preserving and enhancing local water supplies for generations to come.

2009-2014 Conservation Practices



Local Watershed Improvements

Missouri Stream Team and Volunteer Water Quality Monitoring

Missouri Stream Teams strive to gain and share knowledge regarding the state's stream systems and the problems and opportunities they face. The Missouri Stream Team Program is a partnership between the departments of Natural Resources and Conservation as well as the Conservation Federation of Missouri and the citizens of Missouri. Besides improving stream conditions, Stream Teams often provide useful data in targeting areas that should be monitored more closely for impairments. The Missouri Stream Team Watershed Coalition has compiled and reported monitoring data which demonstrates the importance of watershed protection, preservation and enhancement by local communities.

The Volunteer Water Quality Monitoring Program is one of the most popular activities of the Missouri Stream Team Program. Stream teams volunteer monitors have provided the department with valuable water quality data from more than 400 sites throughout the watershed.

Soil and Water Conservation and Nonpoint Source Grants (319 Grants)

Missouri's nonpoint source grant program funds activities and practices that work to reduce nonpoint source pollution in our lakes, streams and rivers. Grants can be used for a variety of activities such education, outreach, planning, conservation, protection and restoration. The overall goal of this program is to restore the quality of impaired waters by providing citizens with the knowledge and tools to implement better land use practices– from urban to agriculture. Locally these grant projects include: Clean Water Education and Resources, Addressing Organic Waste Impact on Water Quality, Kiefer Creek Watershed Restoration, Storm Drain Markers, Kiefer Creek Water Management Plan.

Source Water Protection Projects and Grants

This voluntary program is designed to assist public water systems and the communities they serve with developing local voluntary source water protection plans to protect their source of drinking water from existing or additional contamination sources. Public water systems in the watershed that have participated in the source water protection program include: Cuba and Mirasol Subdivision.

Well Plugging Grants

As part of Source Water Protection, the department offers grants to plug abandoned wells. Inactive wells can act as a direct conduit for pollutants to enter our water sources. Safely closing these wells is another layer of protection for pollution prevention.

Soil and Water Conservation Cost Share Programs

Soil and Water Conservation districts set goals for conservation issue concerns. Practices specific to these concerns are funded and implemented to help districts meet their resource conservation goals. These practices conserve soil, which consequently improves water quality by reducing sedimentation in our rivers and streams. The chart to the left illustrates the percentage of practices implemented by concern in the watershed from 2009 to 2014. No irrigation management or animal waste management practices were implemented during this time. District funding requests for FY15 show that grazing management was most prevalent, followed by nutrient and pest management.

Our Missouri WATERS

Meramec River Watershed

The State of Our Missouri Waters

Resources

Education and Outreach Resources include:
Missouri Department of Natural Resources' Our Missouri Waters dnr.mo.gov/omw

Missouri Department of Natural Resources Financial Assistance Opportunities http://dnr.mo.gov/pubs/financial-asst-brochure-2014.pdf)

Natural Resources Conservation Service (NRCS) http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/

Missouri Rural Water Association (MRWA) http://www.moruralwater.org/training.php; http://www.moruralwater.org/tools.php; http://www.moruralwater.org/dlcenter/

Missouri Public Utilities Alliance (MPUA) http://www.mpua.org/Training.php; http://www.mpua.org/Untitled_Page_4.php

EPA Region 7 Environmental Finance Center (EFC) http://webs.wichita.edu/?u=HUGOWALL&p=/Centers___Research/Environmental_Finance_Center/

Funding Resources include:
Natural Resources Conservation Service (NRCS) http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/

United States Department of Agriculture Rural Development (USDA-RD) http://www.rurdev.usda.gov/ProgramsAndOpportunities.html

Missouri Department of Economic Development (DED) http://www.ded.mo.gov/BCS%20Programs/BCSProgramDetails.aspx?BCSProgramID=10; http://www.ded.mo.gov/Community/InfrastructureAssistance.aspx

References

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Center for Applied Research and Environmental Systems (http://www.cares.missouri.edu/)

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Department of Natural Resources' Missouri State Water Plan Series, Surface Water Resources of Missouri,1995, Groundwater Resources of Missouri, 1996. (http://dnr.mo.gov/env/wrc/statewaterplanMain.htm)

Department of Natural Resources' Source Water Protection Program Page (http://dnr.mo.gov/env/wpp/pdwb/swpp.htm)

Department of Natural Resources' Major Water Users Page (http://dnr.mo.gov/env/wrc/mwu-forms.htm)

Missouri Stream Team Program Website, (http://www.mostreamteam.org/aboutTeams.asp)

Missouri Stream Team Watershed Coalition Website, (http://mstwc.org/)

Multi-Resolution Land Characteristics Consortium, 2011 and 2001 National Land Cover Database, (http://www.mrlc.gov)

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U.S. Army Corps of Engineers, Southwest Missouri Water Resource Study—Phase I. Sept. 2012 (http://tristatewater.org/?page_id=12)

Guinan, Pat, State Climatologist, MU Extension, Missouri Climate Center, (http://climate.missouri.edu/modata.php)

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