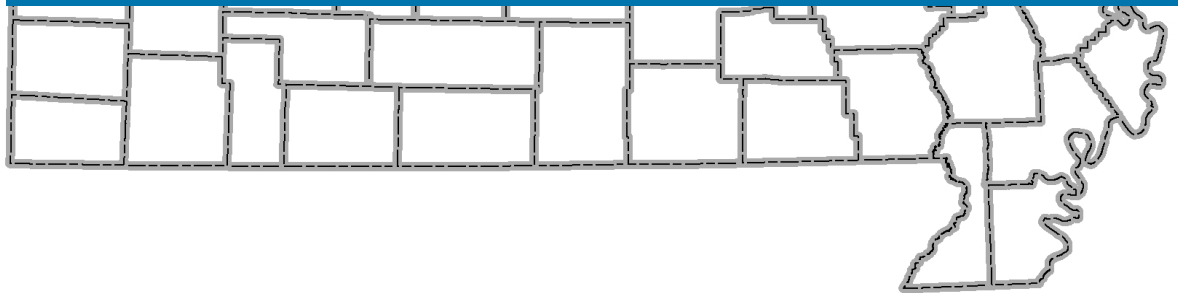


The State of *Our Missouri Waters*

Lower Missouri 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*.

Lower Missouri River Watershed

The State of Our Missouri Waters

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.



Key Points

The Missouri River is the longest river in North America, rising in Montana and flowing east and south and entering the Mississippi River just north of St. Louis. The Lower Missouri Watershed is the most eastern section of the watershed and joins the Mississippi on the border between Missouri and Illinois. Nearly half of this watershed is covered by forest. The eastern third is urban, where high intensity development has occurred. Missouri's wine country is within this watershed, and there are also opportunities to bike or hike along the Katy Trail and enjoy the views of many beautiful vistas.

The majority of the water use is from surface water, with the largest being electrical users. In the rural areas, there are more than 5,000 domestic wells collectively drawing over 1.5 million gallons per day from groundwater. In the eastern portion, a number of streams have been identified as impaired due to low dissolved oxygen levels, bacteria and chloride. The source of these impairments has been determined to be due to urban runoff. Low dissolved oxygen levels in water bodies often cause negative impacts to aquatic life and create challenges. These low dissolved oxygen 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. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. 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. Chloride in ground and surface waters comes from many sources including the use and storage of salt for deicing roads, 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. The Missouri River itself is also impaired due to bacteria.

Opportunities

Community Involvement

- Through education, advocacy and hands-on projects, communities, groups and individuals can be involved in and promote watershed improvement activities. Some examples include, watershed education for schools, litter control, tree planting, water quality monitoring and storm drain stenciling.

Education and Outreach

- Technical assistance providers are available for training and assistance regarding several topics such as source water protection, municipal drinking water loss, water main leak detection, asset management, water conservation planning and implementation, and I/I (inflow and infiltration) reduction.
- 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>

Lower Missouri River Watershed

The State of Our Missouri Waters—Background

What is a Watershed?

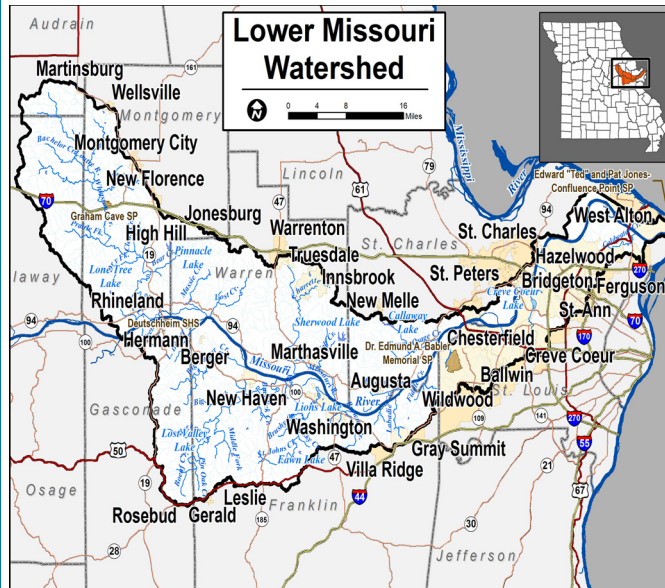
A watershed is an area of land defined by ridges, from which waters flow into a particular lake, river or wetland.

Lower Missouri River Characteristics

- Drainage area of 1,590 mi²
- Includes portions of 8 counties
- Part of the Missouri River system
- Largest population center is in the eastern half of the watershed.
- St. Charles and St. Louis counties combined population grew less than 1 percent from 2000 to 2010.

Recreational Resources

Opportunities for fun include exploring Graham Cave State Park, learning about German-American history in Missouri's wine country at Deutschheim State Historic Site, or viewing an urban oasis of a forest at Dr. Edmund A Babler State Park, plus the nation's longest rails-to-trails project, Katy Trail State Park, and finally a flyway used by roughly 60 percent of all North American bird species, Edward "Ted" and Pat Jones-Confluence Point State Park.



portion also contains the majority of sinkholes in the basin and creates a moderate potential for landslides and slope failures in developed areas. Geologic surveys have identified 23 percent of stream miles as losing in the eastern portion of the basin.

Land Use

Nearly half of the watershed is covered by deciduous or evergreen forest. In this watershed, high intensity development converges in the easternmost section. The largest percentage of cultivated crops are found clustered along the Missouri River floodplain while pasture is more dispersed. Wetlands are increasingly being recognized as providing valuable ecosystem services; they cover less than 5 percent of the watershed.

Water Resources

Surface Water

The watershed contains 11 lakes ranging in size from 52 acres to 307 acres. This amounts to 1,260 total acres of lakes and approximately 2,464 miles of streams in the watershed. Some of the larger streams are Missouri River, Tuque Creek, Saint Johns Creek, Bonhomme Creek, Creve Coeur Creek and Loutre River.

Springs

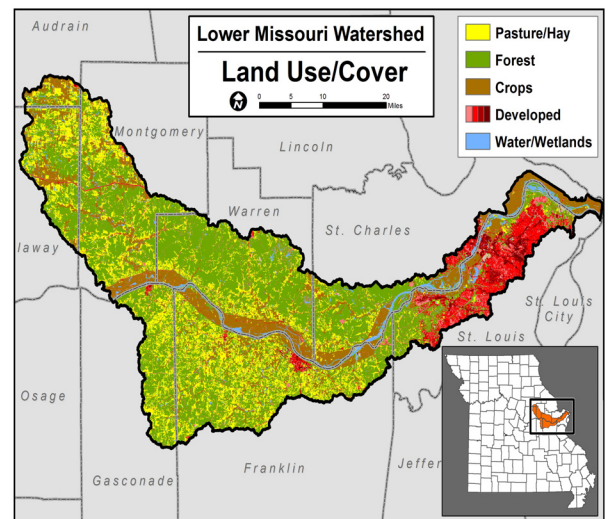
There are 73 mapped springs located in the watershed. Twenty one of the springs are named. Some of the named springs have documented flow which ranges from 0.02 mgd to 7.6 mgd.

Groundwater

There are four aquifers that provide groundwater resources. First is the combination of the St. Francois and Ozark aquifers which is called the Salem Plateau Groundwater Province located south of the Missouri River. There is an alluvial aquifer adjacent to the Missouri River. There is the Northeast Missouri Groundwater Province that is located north of the Missouri River, which includes Mississippian, Ordovician- and Cambrian-age strata, and can supply from 10 to more than 1,000 gallons per minute of potable water, depending on depth.

Geology/Hydrology

North of the Missouri River, the basins surface features are complex, with 15 formations of Ordovician, Silurian, Devonian and Pennsylvanian age rock present or absent in any given locality. South of the Missouri River, streams flow through Ordovician age dolomite, except on ridgetops and the far upstream end of the drainages in undifferentiated Pennsylvanian deposits. The majority of water movement in the basin is through the surface stream network because layers of clayey till, shale units and shaley limestone act as low hydraulic-conductivity confining units. An exception to low hydraulic-conductivity lies in the eastern portion of the basin in St. Louis County where three small springs exist. This eastern

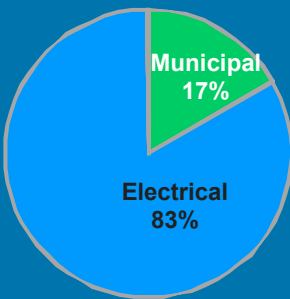


Lower Missouri River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

Climate and Water Availability

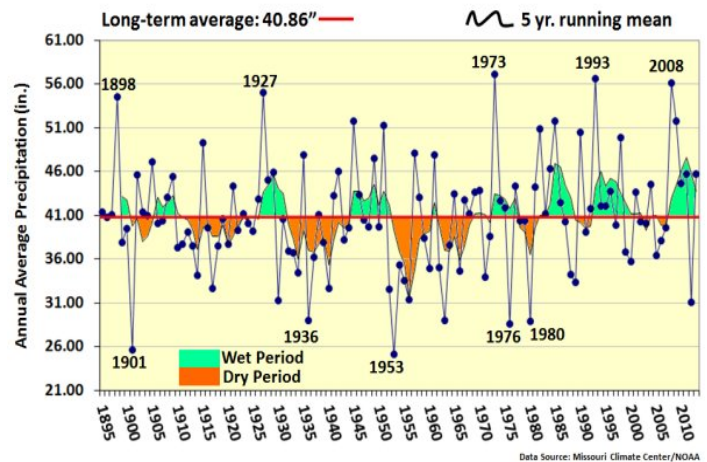
Water Use by Category (2013)



Precipitation

Annual precipitation totals 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)



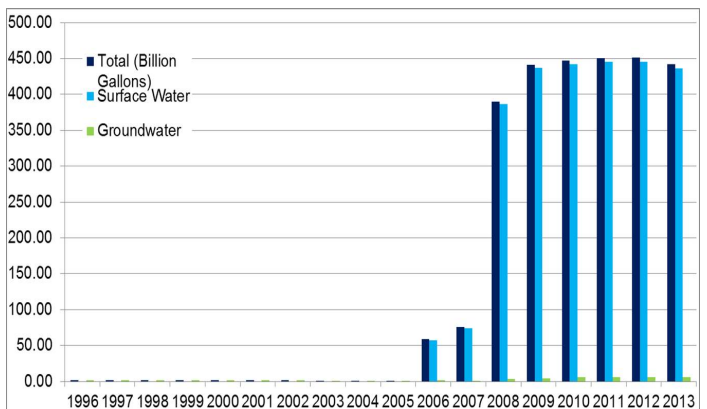
Groundwater and Stream Monitoring

There are four observation wells in the watershed found in Babler State Park, Hermann 4, Graham Cave State Park and New Haven. Two of these wells monitor Ozark aquifers while the other two monitor alluvium and Cambrian-Ordovician aquifers. Currently there are 13 surface water stream gages in operation in the watershed. Three are located on the Missouri River with the most downstream gage averaging 32,507 mgd. The 10 other gages are located on tributaries.



Major Water Use Characteristics

A major water user is defined as the capacity to withdraw more than 70 GPM (gallons per minute) or 100,000 GPD (gallons per day). There were 33 major water users in the watershed. The average household for Montgomery, Warren, Franklin and St. Louis counties is 2.46. There are 5,303 domestic wells. The estimated annual water use within the entire watershed is 1,565,445 gallons per day.



In total, there are 93 withdraw points divided between 89 groundwater (wells) and four surface water (intake, diversion). The above bar graph represents a dramatic change in water use beginning in 2006 because Missouri American Water began withdrawing from the Missouri River at two different surface intakes. Electrical users, however, remain the largest category of users within the watershed.

Water Use by Source (2013)

Groundwater 1%

Surface Water 99%



Lower Missouri 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.

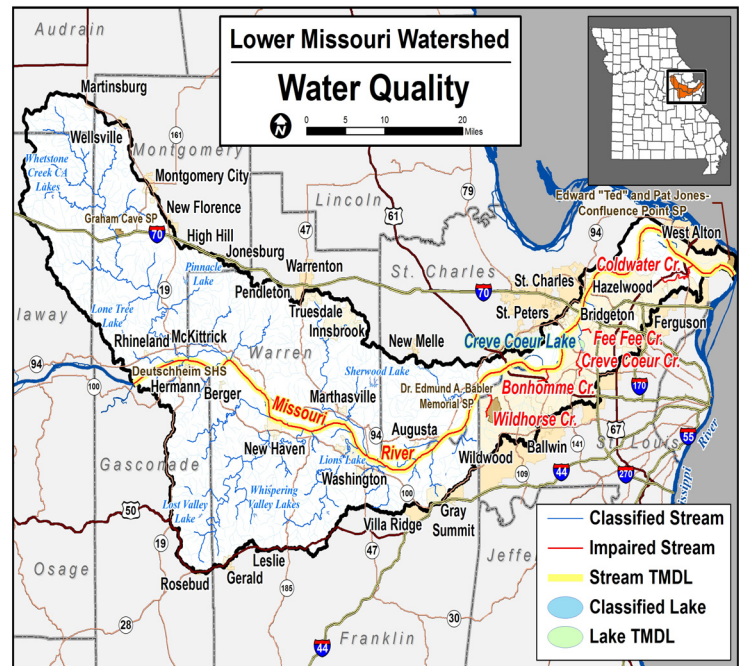
The following lakes and streams within the watershed are listed on the state's 2014 list of impaired waterways and are presented on the adjacent map: Bonnehomme Creek

(Bacteria & pH), Coldwater Creek (Bacteria & Chloride), Creve Coeur Creek (Chloride & Low Dissolved Oxygen), Fee Fee Creek (Bacteria & Chloride), Missouri River (Bacteria), Wildhorse 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.



Lower Missouri River Watershed

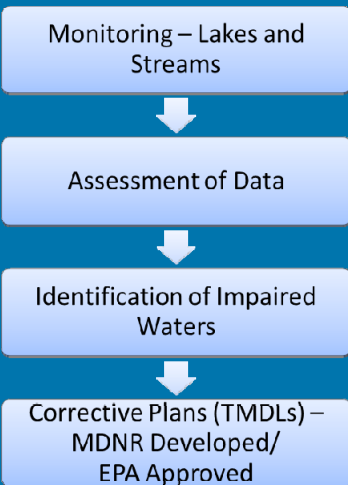
The State of Our Missouri Waters—Current Conditions and Trends

Watershed Protection

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



NPDES:

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

Total Maximum Daily Loads (TMDL)

A TMDL is the mathematical calculation of the amount of a specific 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 water 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, A TMDL has been completed for the entire length of the Missouri River in Missouri that addresses water quality impairments caused by chlordane and PCBs in fish tissue, a human health concern associated with fish consumption. This watershed encompasses a segment of the Missouri River that is subject to this TMDL. In addition, a TMDL was developed to address elevated chlordane levels found in fish tissue from fish collected in Creve Coeur Lake. Since chlordane and PCBs have been banned, and are no longer manufactured, no specific implementation plan has been established, other than continued collection and proper disposal of existing chemical stores. Pollutant reductions leading to improved water quality and attainment of beneficial uses are expected to occur naturally over time. In 2001, the Missouri Department of Health discontinued fish advisories related to chlordane in Creve Coeur Lake.

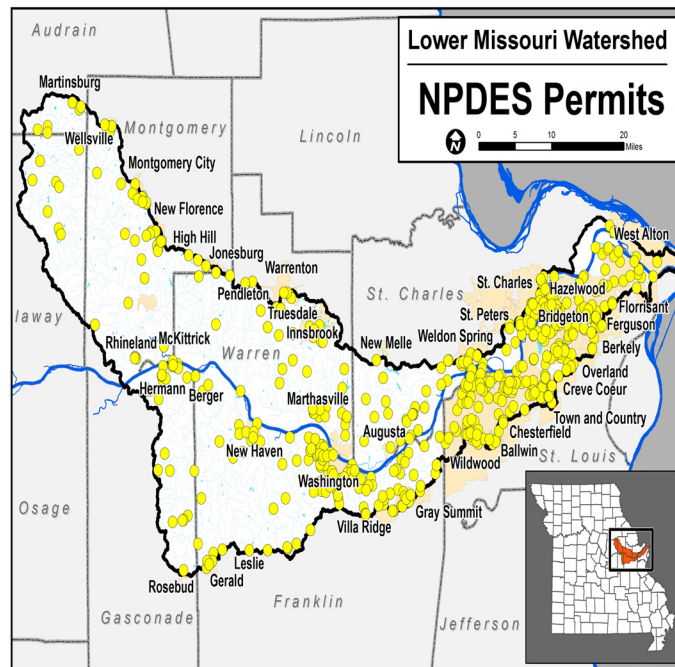
For more information regarding these TMDLs, please visit the links provided:

dnr.mo.gov/env/wpp/tmdl/wpc-tmdl-EPA-Appr.htm

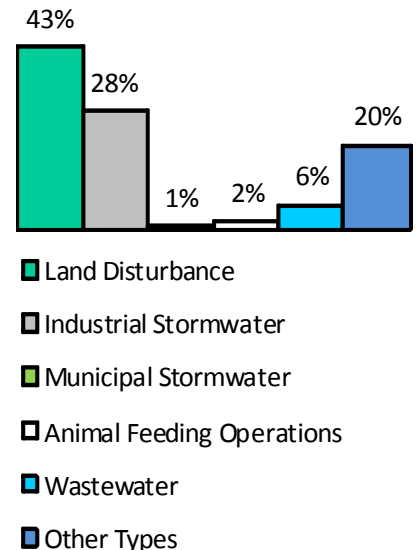
Regulated Point Sources

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. It's also important that communities look to the future for watershed planning in order to maintain awareness of wastewater treatment types, their impacts and upcoming regulations.

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



NPDES Permit Types



Lower Missouri River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

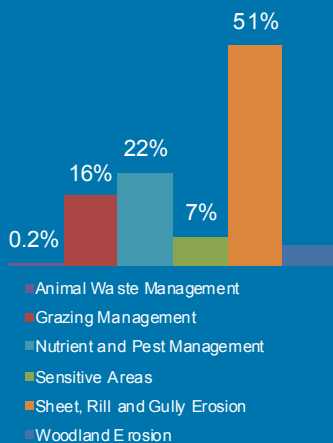
Local Watershed Improvements

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.

2014 Conservation Practices



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. (image from <http://mstwc.org/who-we-are/vision-mission-goals/>)



The Volunteer Water Quality Monitoring Program is one of the most popular activities of the Missouri Stream Team Program. Stream Team volunteer monitors have provided the department with valuable water quality data from 115 sites throughout the Lower Missouri River watershed.

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

Over the last five years, the department has provided several watershed project grants to local communities to improve water quality through reduction of nutrient and sediment loads and deposition, rehabilitation and removal of failing or neglected septic systems, watershed management planning, water quality monitoring, incentivized soil conservation practices, education/outreach efforts and other activities. These grant projects have included: Big River Stewardship and Education Initiative, Clean Water Education and Resources, and Watkins Creek Water Quality Demonstration.

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. Participating public water systems include: New Florence and St. Charles. Learn more at <http://dnr.mo.gov/env/wpp/pdwb/swpp.htm>.

Well Plugging Grants

As part of Source Water Protection, the department offers grants to plug abandoned wells. Lazy Day Campground in Danville received one of these grants in 2014.

Soil and Water Conservation Cost Share Programs

Soil and Water Conservation Districts set goals for conservation issue concerns. These practices are funded and implemented to help districts meet their resource conservation goals, which conserves soil and improves water quality by reducing sedimentation in our rivers and streams. The chart on the left illustrates the number of practices implemented for each concern in the watershed from 2009 to 2014, relative to the total number of practices for this watershed. District funding requests for FY15 show that grazing management and sheet, rill and gully practices are most prevalent.

Lower Missouri River Watershed

The State of Our Missouri Waters

Contact Information for this Watershed

Missouri Department of Natural Resources
St. Louis Region
Watershed Coordinator
Tracy Haag
7545 S. Lindbergh,
Ste 210
St. Louis, MO 63125
314-416-2960

Or visit the Web at
dnr.mo.gov/omw

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>

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