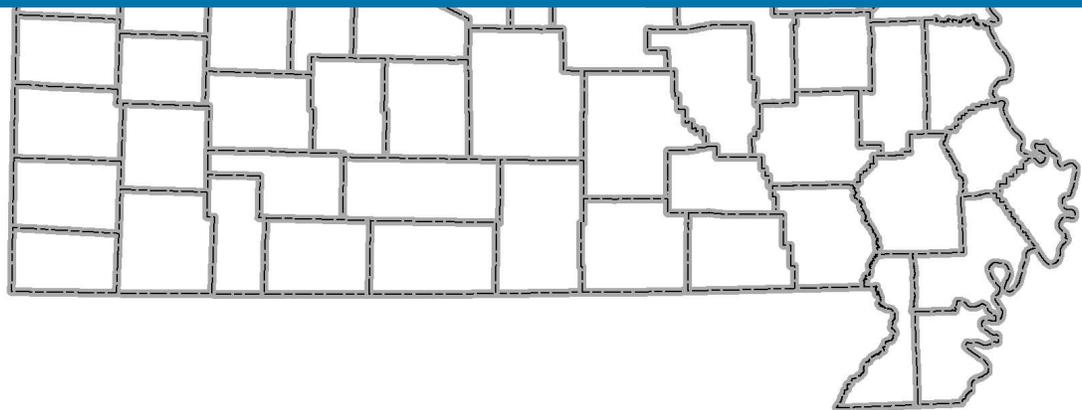


## The State of *Our Missouri Waters*

### South Fork Salt 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*.

# South Fork Salt 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 South Fork Salt River Watershed composes 42 percent of the Salt River Basin in north-east Missouri. It is one of three HUC 8 watersheds that drain into Mark Twain Lake, which is located in Monroe and Ralls counties. Mark Twain Lake was created when construction of the Clarence Cannon Dam was completed in 1984. Mark Twain Lake provides for multiple uses, including hydroelectric power, flood control, recreation, fish and wildlife conservation, water supply, and control of water levels for navigation downstream on the Mississippi River. At normal pool, the lake provides 18,600 acres of surface water and 285 miles of shoreline. The dam, which is 1,940 feet long, is capable of producing up to 58,000 kilowatts of power, enough energy to power a town of 20,000 people.

The geology and soils of the watershed restrict the infiltration of water to the subsurface; thus almost all water movement in the basin is through the surface stream network. There are no sizeable springs or losing streams documented in the basin, and stream baseflow is not well sustained in dry periods. Land use is dominated by cropland (39 percent), but grassland (35 percent) and forested land (16 percent) are also prevalent.

No surface water sources in the watershed provide public drinking water supply, however surface water is used for irrigation. Public drinking water systems either buy treated surface water from sources outside of the watershed, treat groundwater from local wells, or buy treated groundwater from other systems. In addition to providing drinking water, groundwater is also used for irrigation.

Documented water quality impairments include low dissolved oxygen in the Middle Fork Salt River, South Fork Salt River and a tributary to Coon Creek. A combination of point and non-point sources may affect oxygen levels in these streams. Due to low infiltration rates in the watershed, runoff of sediment, nutrients, and pesticides is also a concern in this watershed.

## 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>

# South Fork Salt 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.

## South Fork Salt River Basin Characteristics

- Drainage area of 1,214 mi<sup>2</sup>
- Includes portions of 7 counties
- Part of the Salt River system
- Largest population centers include Mexico, Centralia, Paris and Sturgeon.
- Est. pop. was 47,961 people in 2000 and 48,659 in 2010. Est. from 2000 to 2030, Macon, Randolph, Monroe, Audrain, Boone and Callaway counties are expected to increase by 3.0 to 50.8 percent.

## Recreational Resources

Union Covered Bridge State Historic Site is located on southeast of Madison. Mark Twain State Park and Historic Site, public land managed by the Army Corps at Mark Twain Lake and local Conservation Department areas provide thousands of acres for camping, hiking, fishing, picnicking, and hunting. Canoeing opportunities are available on the Middle and South Fork Salt.



## Water Resources

### Surface Water

There are two lakes ranging in size from 78 acres to 15,965 acres. There are 1,852 miles of major streams in the watershed. Some of the larger streams are South Fork Salt River, Middle Fork Salt River, Long Branch, Youngs Creek, Coon Creek, and Elk Fork Salt River. No surface water sources in the watershed provide public drinking water supply.

### Groundwater

Mississippian-, Ordovician-, and Cambrian-age strata in this area can supply from 10 to more than 1,000 gallons per minute of potable water, depending on depth. Modest quantities of marginally potable groundwater are locally available in some of the shallow Mississippian strata where it is not overlain by Pennsylvanian strata. The Pennsylvanian strata have an overall low permeability and generally yield small quantities of marginal to poor quality water. Groundwater resources in the watershed provide about 2.6 million gallons per day of water to 22,300 people, and have a capacity of about 6.9 million gallons per day.

### Springs

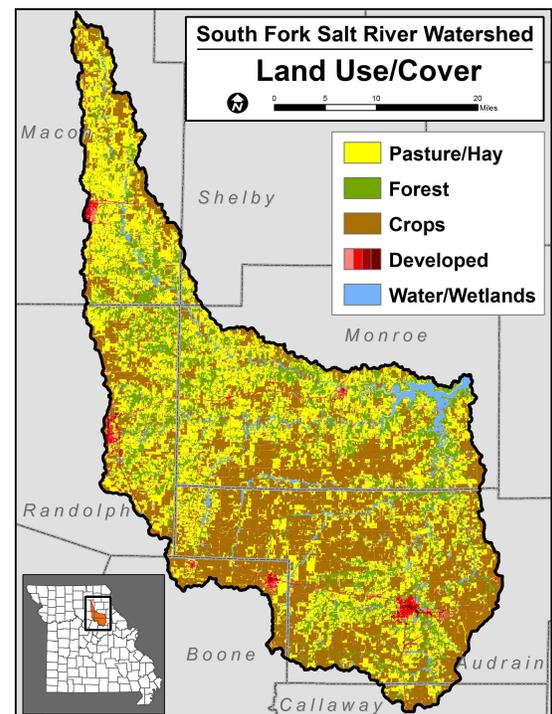
There are three mapped springs in the watershed, but none are named.

## Geology/Hydrology

Except for limited areas where streams have incised Pennsylvanian or Mississippian age rock, the surface of the basin is glacial till overlain by loess. Depth of the till is highly variable but generally less than 200 feet, and the loess deposits are usually 4 to 8 feet thick. The till is predominantly clay, with some rock and gravel intermixed with occasional sand lenses. The clayey nature of the till and the many shale and coal beds restrict the infiltration of water to the subsurface; thus almost all water movement in the basin is through the surface stream network. There are no sizeable springs or losing streams documented in the basin, and stream baseflow is not well sustained in dry periods. Five sinkholes have been identified in the basin, all of which are in Audrain County.

## Land Use

Land use is approximately 39 percent cropland, 35 percent grassland, 16 percent forest, 6 percent developed, 3 percent wetland, and 1 percent water. The northern part of the watershed is characterized by rolling hills and dominance of pasture, while the eastern portion has less steep terrain and is dominated more by row crop agriculture. Expected population growth may lead to greater percentage of developed area in the watershed.



# South Fork Salt River Watershed

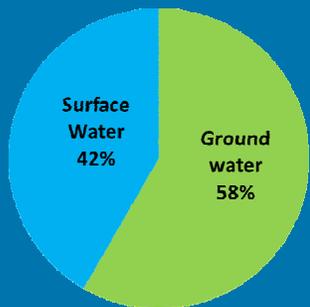
The State of Our Missouri Waters – Current Conditions and Trends

## Estimated Annual Major Water Use by Category



There are no surface water public water supplies in the watershed. 100 percent of water from the watershed that is used for municipal uses comes from groundwater wells. However, 84 percent of water used for irrigation comes from surface water sources in the watershed.

## Estimated Annual Major Water Use by Source

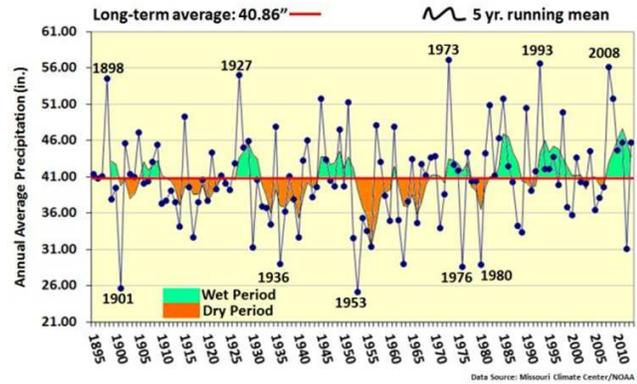


## Climate and Water Availability

### 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.

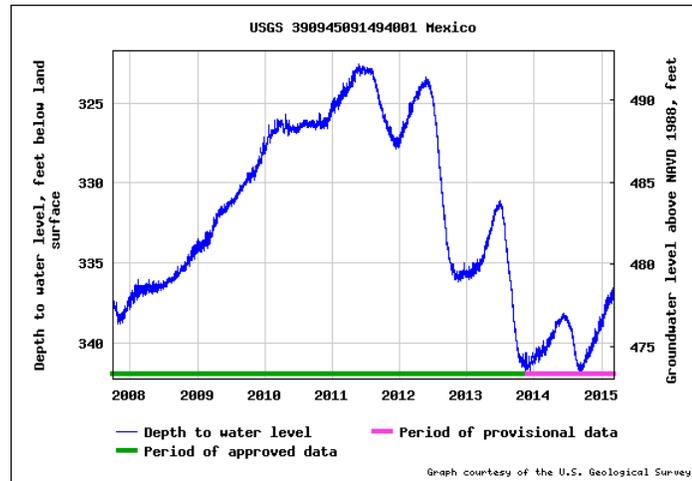
Missouri Annual Average Precipitation (1895-2013)



### Groundwater and Stream Monitoring

There are three groundwater monitoring wells, one near Middle Grove, one near Centralia and one near Mexico, as part of the Missouri Observation Well Network. The hydrograph, right, represents water levels at the Mexico monitoring well. This graph highlights how short periods of drought, such as the 2012 drought, can cause groundwater levels to quickly change. The graph also shows that water levels at this well haven't recovered to pre-2012 conditions. There are currently four stream gauges that measure average stream flow that varies from 31 to 78 million gallons per day.

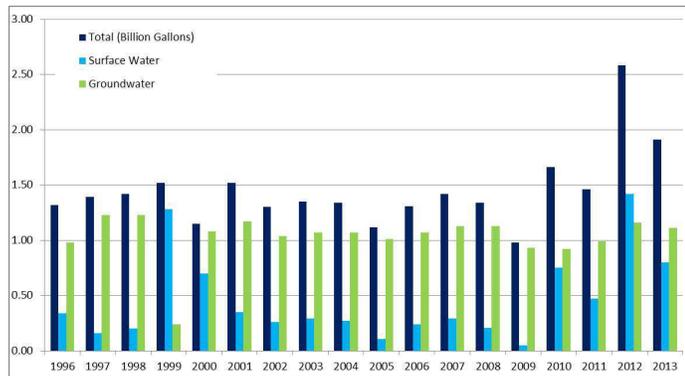
### USGS Mexico, MO Groundwater Monitoring Point



### Major Water Use Characteristics

Nineteen 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. Their estimated annual water use is 1.9 billion gallons, of which 58 percent is groundwater and 42 percent is surface water. Major water use categories are predominately irrigation (50 percent) and municipal (50 percent). There are 21 community public water systems.

### Historical Water Use South Fork Salt River Watershed



Three of these systems (Macon,

Moberly and Clarence Cannon Wholesale Water Commission), treat surface water from lakes outside of this watershed (Sugar Creek Lake, Long Branch Lake and North Fork Arm of Mark Twain Lake), eight systems purchase treated surface water from lakes outside of the watershed, six systems have their own groundwater wells, and four systems purchase treated groundwater from other systems. There are also an estimated 285 private domestic wells that provide an estimated 85,500 gallons of water annually for domestic uses.

# South Fork Salt 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](http://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.

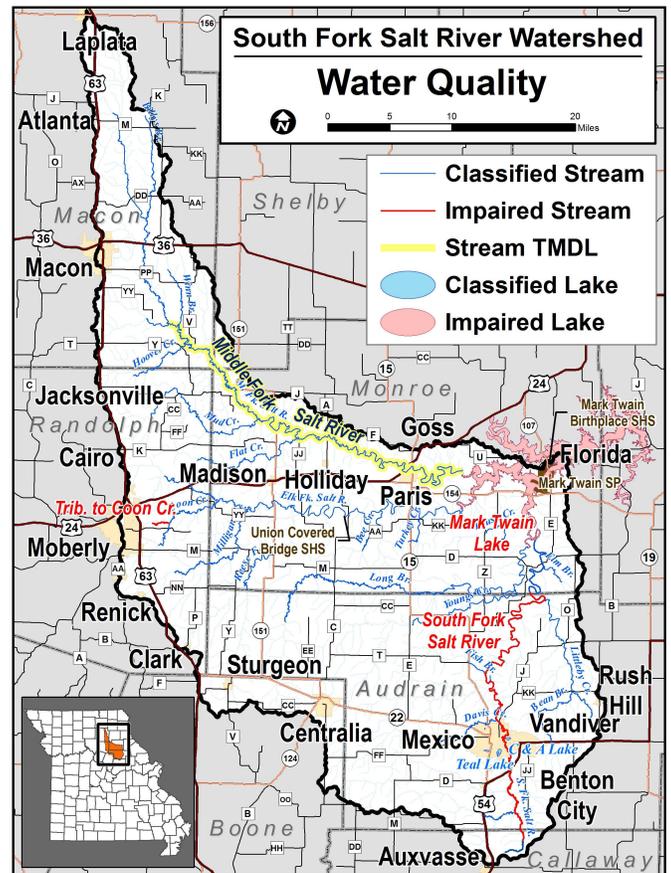
The following lake and streams within the watershed are listed on the State's 2014 list of impaired waterways and are presented on the adjacent map: Middle Fork Salt River (impaired for low dissolved oxygen), South Fork Salt River (impaired for low dissolved oxygen), tributary to Coon Creek (impaired for low dissolved oxygen.) A combination of point and nonpoint sources may affect oxygen levels in these streams. Mark Twain Lake is also listed on the state's list of impaired waters for mercury levels in fish tissue, so people consuming fish from the lake should follow the statewide fish advisory guide for eating Missouri fish.

Impairments can be caused by known sources like point or non-point 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.



# South Fork Salt River Watershed

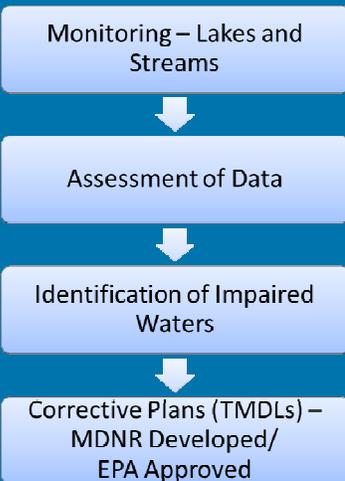
The State of Our Missouri Waters – Current Conditions and Trends

## 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)

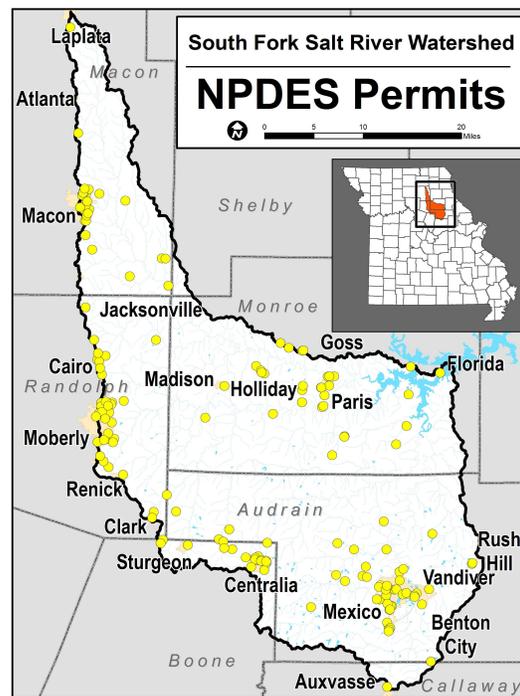
A TMDL is the mathematical calculation of the amount of a specific pollutant that a water body can absorb and still meet water quality standards. A TMDL study identifies the potential or suspected pollutant sources in the water and allocates the allowable pollutant load among these sources. It also includes 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 established for the Middle Fork Salt River to address an impairment to the protection of aquatic life caused by excess sedimentation. This TMDL establishes pollutant allocations and recommended load reductions for sediment for both point and nonpoint sources that should be implemented in order to protect and restore the aquatic life designated use within Middle Fork Salt River.

More information regarding this TMDL can be found online at <http://dnr.mo.gov/env/wpp/tmdl/wpc-tmdl-epa-appr.htm>

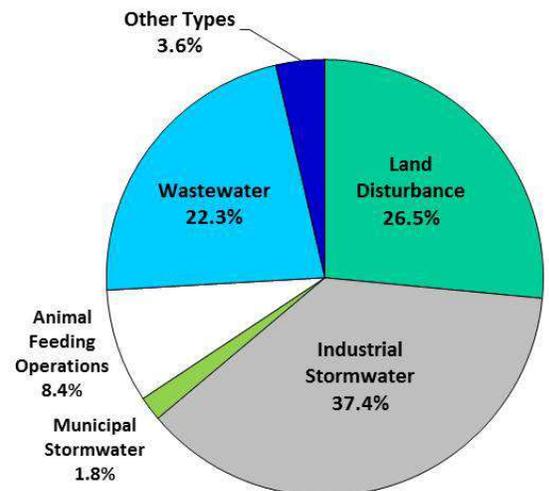
### Regulated Point Sources

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 South Fork Salt River Watershed.



Distribution of Permit Types in the Watershed



# South Fork Salt River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

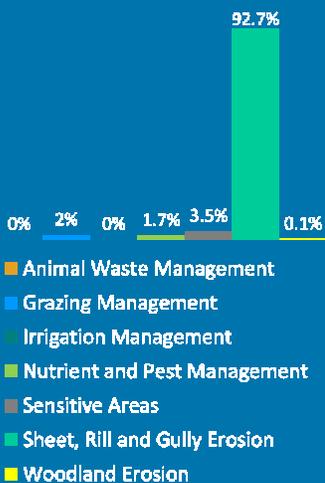
## Local Watershed Improvements

### 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 seven sites throughout the watershed.

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

Watershed project grants are provided by DNR to local communities to conduct outreach, implement and measure effectiveness of conservation practices, and conduct watershed planning. In recent years, several 319 project grants have been awarded in the Salt River basin, in both the North Fork Salt River HUC 8 and the Salt River HUC 8 watersheds. However, there have not been any 319 projects in the South Fork Salt River HUC 8.

### 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: Missouri American Water - Mexico and the City of Macon. Missouri American Water at Mexico has an active source water protection plan for their system's wells and the City of Macon has an active source water protection plan for Long Branch Lake. More information on the Source Water Protection Program and grants can be found on our website: <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. 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. 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. No irrigation management practices were implemented during this time. District funding requests for FY15 show that grazing management and sheet, rill and gully practices are most prevalent.

# South Fork Salt River Watershed

The State of Our Missouri Waters—Current Conditions and Trends

## Contact Information for this Watershed

Missouri Department of Natural Resources  
Northeast Region  
Watershed Coordinator  
Mary Culler  
1709 Prospect Drive  
Macon, MO 63552  
660-385-8000

Or visit the Web at  
[dnr.mo.gov/omw](http://dnr.mo.gov/omw)

## Resources

### Education and Outreach Resources include:

Missouri Department of Natural Resources' Our Missouri Waters [dnr.mo.gov/omw](http://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](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/](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

2010 Census data (<http://www.census.gov/>)

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

Department of Natural Resources' Groundwater Level Observation Well Network Page (<http://dnr.mo.gov/env/wrc/groundwater/gwnetwork.htm>)

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>)

Missouri Climate Center, (<http://climate.missouri.edu/modata.php>)

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

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