



Sac River  
Watershed

## The State of Our Waters



*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.*

# Sac River Watershed

The State of Our 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

In the northern portion of the watershed, dissolved oxygen levels and their negative impacts to aquatic life create challenges for the watershed. In some cases low dissolved oxygen can be a result of excess organic materials, which can consume oxygen, and may be discharged from wastewater treatment systems less effective in removing organics. However, as this watershed is in a transition area between Ozarks streams and Plains streams, more information is often needed to understand why undesirable dissolved oxygen levels are present.

In the southern portion of the watershed, there are challenges regarding bacteria levels in water bodies, which can cause serious public health and recreational safety issues. Non-point sources of contamination, such as animal waste and contaminants carried by stormwater runoff, can have a serious cumulative impact on surface waters in a largely rural watershed; however, agricultural best management practices can significantly reduce non-point source impacts. Pollution prevention is also critical in this portion of the watershed due to connectivity of surface water and groundwater. Point and non-point sources of pollution in water bodies or in and around karst features, such as sinkholes, can lead to regional contamination of groundwater wells and springs.

Groundwater quantity is also important to consider as groundwater levels in the Ozark aquifer are declining in some areas of high use. Water conservation efforts for groundwater and surface water users can be implemented to help mitigate impacts of increasing water needs in the area. Missouri shares water resources with many other states, some of which regulate water use and have already established their demand for water. It is important for Missouri to document our need for water and to protect our right to that water. Registering major water use, annually, establishes a users need for water and helps the department understand the water needs of Missouri citizens.

## Opportunities

### Community Involvement

- Implementation of practices to decrease bacteria levels in surface waters and public and recreational safety (exclusion of livestock from streams and sinkhole areas, riparian buffer strips, detention ponds, etc.)
- Implementation of practices to reduce soil erosion and sedimentation in the lower basin
- Stream Team activities

### Education and Outreach

- Technical assistance and training available for source water protection measures and planning
- Technical assistance and training available regarding calculation of municipal drinking water loss, I/I focused onsite assistance, drinking water main leak location, asset management, and water conservation planning and implementation
- Training available to livestock operations regarding the benefits of alternate watering sources for livestock
- Training available to owners of concentrated animal feeding operations (CAFO) to improve land application practices and to agricultural land owners to utilize various cost-share programs regarding best management practices

### Financial Assistance

#### **Point Source:**

- Clean water state revolving funds available for lagoon improvements to improve treatment processes for disinfection, ammonia, and biochemical oxygen demand
- Drinking water state revolving funds available for improvements to drinking water treatment, distribution and storage

#### **Nonpoint Source Pollution:**

- Financial assistance to CAFO owners to improve land application practices and to agricultural land owners to utilize various cost-share programs for best management practices

#### **Source Water Protection:**

- Grants available for proper Well Plugging and Abandonment and Source Water Protection Planning (additional opportunities presented at <http://dnr.mo.gov/pubs/financial-asst-brochure-2014.pdf>)

# Sac River Watershed

The State of Our 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.

## BASIC BASIN CHARACTERISTICS

- Drainage area of 1,981 mi<sup>2</sup>
- Includes portions of 10 counties
- Part of the Osage River system
- Population of 94,581
- Polk and Greene Counties have experienced approximately 15% population growth from 2006 to 2010, likely in their urban areas (Bolivar and City of Springfield, respectively).

## RECREATIONAL RESOURCES

Stockton Lake received approximately 300,000 visitors in 2013, while the Nathaniel Boone Homestead State Historic Site received approximately 10,000 visitors. These parks and attractions generate revenue for area businesses, support local jobs, and bring in state and local tax dollars.



## Water Supply

There are 3 major water supply lakes in the watershed: Follis Lake, McDaniel Lake and Stockton Lake. Stockton Lake is operated for purposes of flood control, hydroelectric power, drinking water supply and recreation.

A high quality source of groundwater in the area is located in the Ozark Aquifer, while the St. Francois, Springfield Plateau, Cambrian Ordovician and Pennsylvanian age bedrock aquifers also store accessible groundwater.

## Water Use

There are 18 community drinking water systems in the watershed, serving approximately 270,000 people. These systems use both surface and groundwater sources.

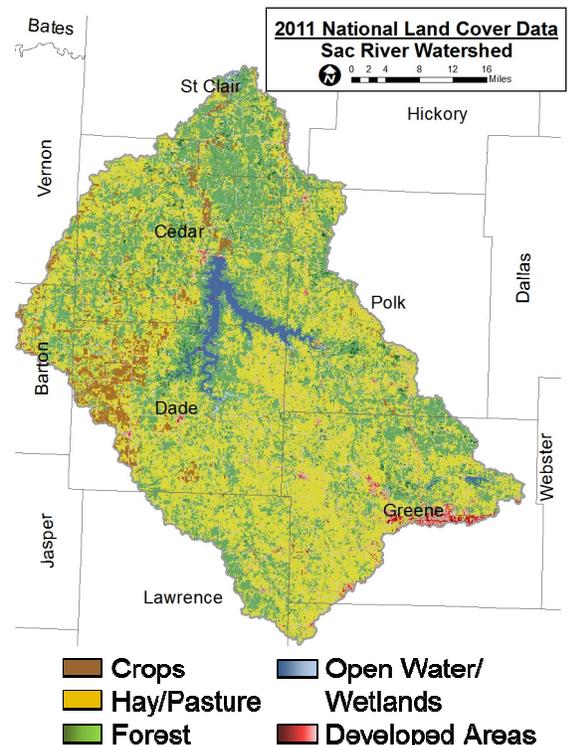
Eighty registered major water users are present in the basin with at least a 100,000 gallons per day withdrawal or diversion capacity. Sixty-eight of these are groundwater users with a total withdrawal capacity of approximately 1.7 billion gallons annually, while registered major surface water users have a withdrawal capacity of approximately 100 billion gallons annually. Major water use categories, for this watershed, were predominately municipal, followed by irrigation uses.

## Geology/Hydrology

Carbonate bedrock and associated karst topography (including abundant losing streams and sink areas) in the southern half of the basin make pollution prevention measures a priority. Within the basin, stream types transition, from typical clear, gravel bottom streams of the Ozark highlands to silt and sand bottomed prairie type streams more typical of the Osage Plains. Relatively low potential for surface to groundwater contamination exists in the northern reaches of the basin due to the restrictive permeability of bedrock.

## Land Use

Limited changes in land use have occurred from 2001 to 2011; however, this change comprised less than a 1% difference overall, while there was an increase of 0.1% of impervious surface area. As this watershed is largely rural, non-point source contributors are relevant to the overall health of the watershed. It should also be noted that the City of Springfield and the surrounding urban areas, in proximity to the headwaters of the Sac River, have a significant influence on stream conditions for the watershed and is making efforts to minimize effluents to the watershed.



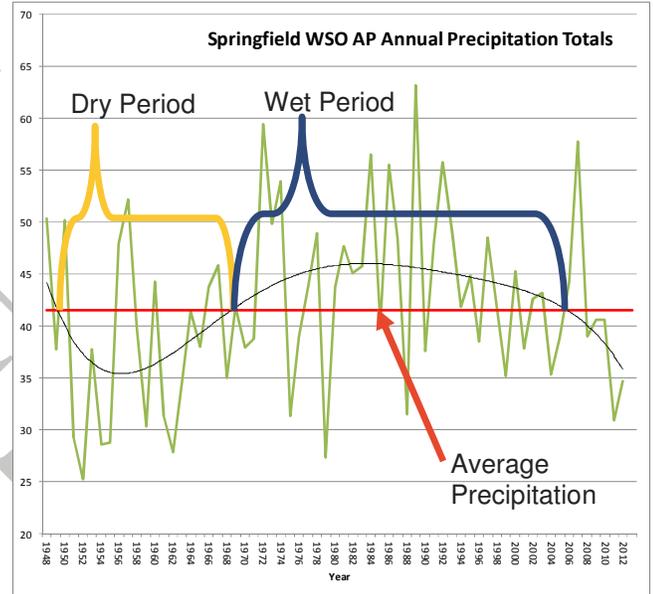
# Sac River Watershed

The State of Our Waters - Current Conditions and Trends

## Climate and Water Availability

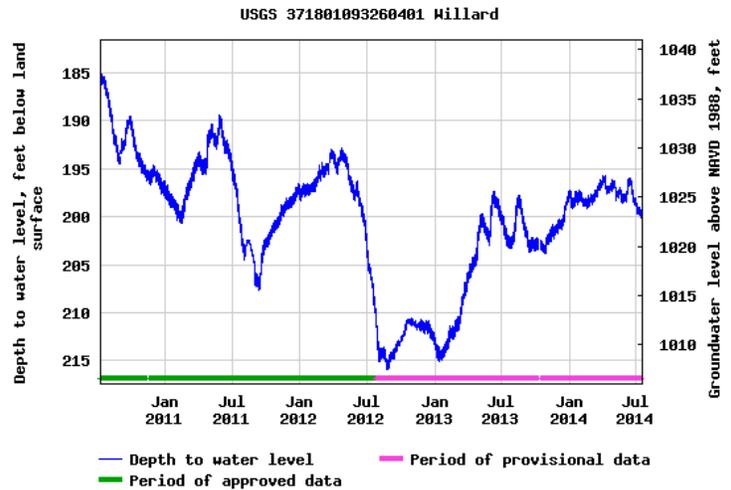
### Precipitation

Annual precipitation totals from the Missouri Climate Center are shown for the Springfield Weather Station Office Air Port (WSO AP), which appear to be trending downward since the late 1980's. Historic climate data for southwest Missouri indicates that 2012 had the 4th driest May through July period on record, and driest since 1953. The 2012 drought resulted in numerous impacts, affecting many sectors in Missouri. However, it was of limited duration when compared to other historic droughts, i.e. 1952-56. The 2006 through 2007 drought also had significant impacts.



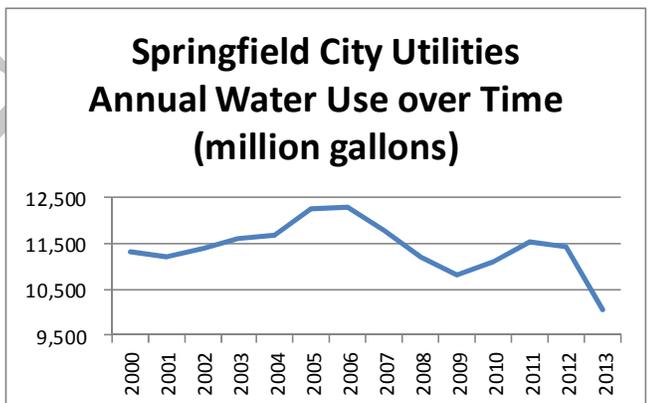
### Groundwater Levels

Through the use of the Missouri Observation Well Network, groundwater level declines have been observed in some localized areas. The hydrograph, shown to the right, represents water levels at the Willard North Elementary well. This graph highlights how short periods of drought can cause groundwater levels to quickly change. The graph also shows that water levels at this well have improved since 2012, but haven't recovered to pre-2012 conditions and appear to be trending downward since before 2011.

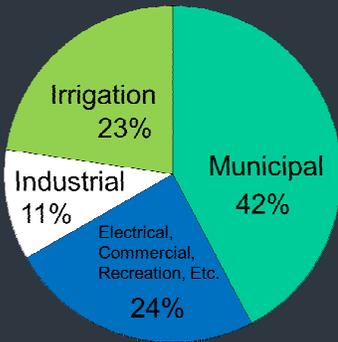


### Water Use Trends

Population trends directly affect water use trends. As indicated on the previous page, population in this area has increased by more than 10 percent in some counties. A 50-year water demand study for this area indicates that, with a medium growth scenario, several counties' public water supply needs will increase by over 10 million gallons per day by the year 2060. Southwest Missouri's projected demand is estimated to increase by almost 125 million gallons per day under the medium growth scenario for a total projected need of 464 million gallons per day. Springfield City Utilities annual water use data shows that demand increased by approximately half of a billion gallons in drought years. It also shows that 2012 impacts were not as severe as other drought years, for this system.

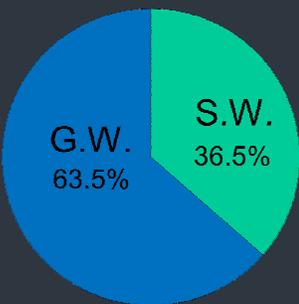


### ESTIMATED WATER USE BY SECTOR FOR SOUTHWEST MISSOURI



The City of Springfield's drinking water supply is provided by Stockton, Fellows and McDaniel Lakes, James River, Fulbright Spring, and 1 groundwater well.

### ESTIMATED WATER USE BY SOURCE FOR SOUTHWEST MISSOURI



# Sac River Watershed

The State of Our Waters - Current Conditions and Trends

## Watershed Protection

### THE DNR PROCESS:

Monitoring – Lakes and Streams



Assessment of Data



Identification of Impaired Waters



Corrective Plans (TMDLs) – MDNR Developed or Funded

When regulated sources of contamination are known or discovered, the department issues permits to limit the amount of certain substances that may be discharged into the water body. MDNR also has resources to help people proactively plan to protect drinking water sources (Source Water Protection Plans) as well as funding to put measureable actions on the ground to make a difference (319 projects and watershed planning, Soil and Water Conservation funding and the State Revolving Funds)

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

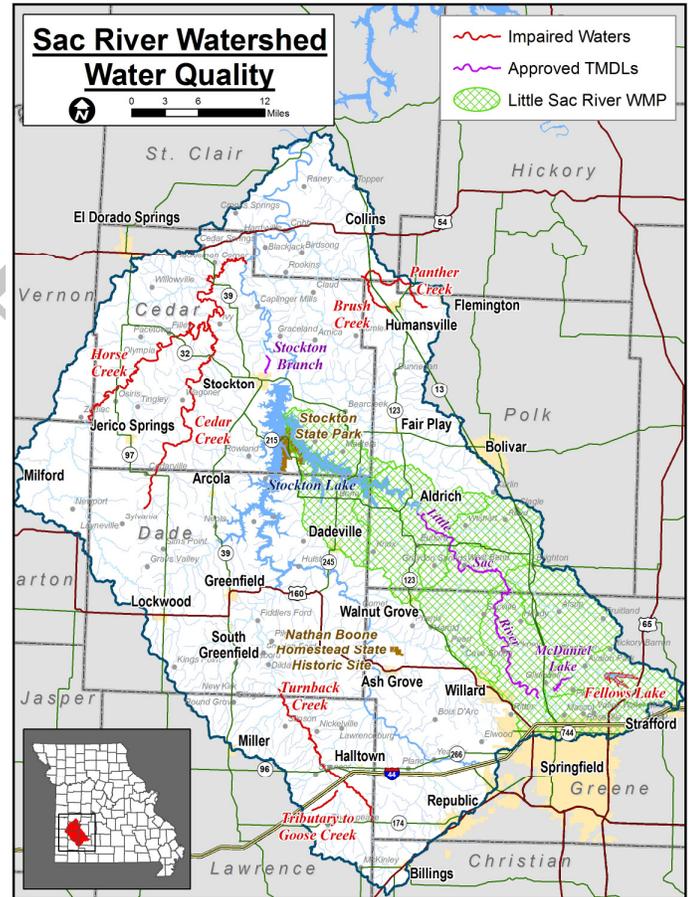
Section 303(d) of the federal Clean Water Act requires that each state identify waters not meeting water quality standards and for which, adequate water pollution controls have not been required. These identified waters are considered impaired. Water quality standards protect such beneficial uses of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

The following streams and lake are listed on the State's 2012 list of impaired waterways and are presented on the adjacent map: Turnback Creek, Tributary to Goose Creek, Horse Creek, Cedar Creek, Panther Creek, Brush Creek and Fellows Lake. Impairments can be caused by known sources like point or nonpoint source pollution, or may be unknown; however, 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 treated wastewater plant discharges, chemical spills or treated industrial wastewater discharges. Common challenges for wastewater treatment plants include the limited organic removal capacity of lagoons, as well as the limited ability of lagoons to meet federal ammonia standards. For these types of impairments, the department often works with facilities 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.

Non-point pollution sources refer to contaminants that do not come from specific conveyances and may come from multiple sources, such as failing septic systems, animal waste, land disturbance activities 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.

MDNR realizes that some impaired waters are also sources of drinking water and ensure that regulated facilities are permitted to treat these waters such that they are suitable for human consumption. As mentioned previously, MDNR also has regulatory authority over point sources; however, local voluntary action is needed to address nonpoint sources.



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## Watershed Protection

### Total Maximum Daily Loads (TMDL)

In this watershed, TMDL's have been developed for the Little Sac River and McDaniel Lake, which include pollutant reduction recommendations for fecal coliform and algae, respectively. Stockton Branch also has a permit-in-lieu-of-TMDL, which requires reduction of the pollutant (organic sediment) through NPDES permit limits. Impaired uses for these TMDL's include whole body contact, drinking water and protection of warm water aquatic life. The department has developed pollutant reduction recommendations and measures for all TMDL's, aside from the permit-in-lieu-of-TMDL which has an enforceable requirement. These recommendations are plans, for which actions still can and need to be taken to protect, preserve and enhance these watersheds.

For more information regarding these TMDL's, the department website provides further detail.

Little Sac River TMDL: <http://www.dnr.mo.gov/env/wpp/tmdl/1381-l-sac-r-record.htm>

McDaniel Lake TMDL: <http://www.dnr.mo.gov/env/wpp/tmdl/7236-mcdaniel-lk-record.htm>

Stockton Branch Permit-in-lieu-of-TMDL: <http://www.dnr.mo.gov/env/wpp/tmdl/1361-stockton-br-record.htm>

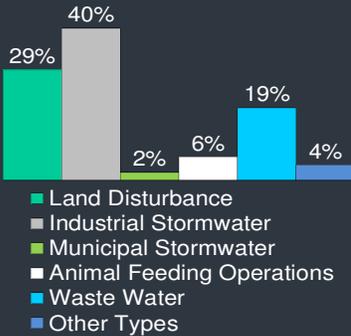
### GENERAL WATER QUALITY CRITERIA:

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.

### NPDES:

National Pollutant Discharge Elimination System

### NPDES PERMIT TYPES:



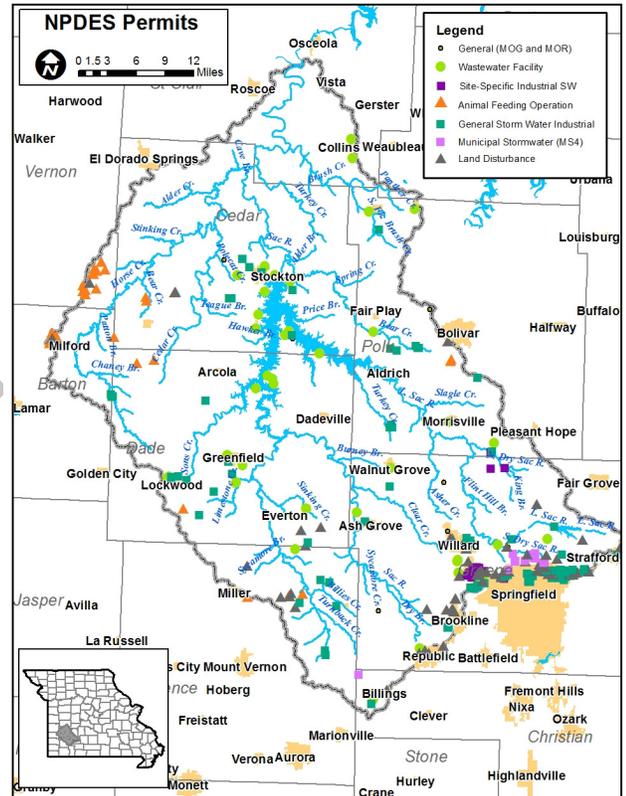
Missouri Stream Teams strive to gain and share knowledge regarding the state's stream systems and the problems and opportunities they face. Besides improving stream conditions, Stream Teams often provide useful data in targeting areas that should be monitored more closely for impairments. The Missouri Stream Team Watershed Coalition has compiled and reported monitoring data which clearly demonstrates the importance of watershed preservation, protection and improvement by local communities. (image from

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

### Regulated Point Sources

Regulated and non-regulated point sources of a significant density or number may indicate an opportunity for outreach regarding preservation, protection and improvement of the watershed. Opportunities may be identified for working with industries or locals regarding watershed interests and best management practices.

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



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## Local Watershed Improvements

### Volunteer Water Quality Monitoring

The Volunteer Water Quality Monitoring Program is one of the most popular activities of the Missouri Stream Team Program. The Missouri Stream Team Program is a partnership between the Department of Conservation, Department of Natural Resources, the Conservation Federation of Missouri and the citizens of Missouri. There are 108 Stream Teams in the Sac river basin that work to supply the department with water quality data.

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

Over the last five years, several watershed project grants have been provided 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 and recipients are presented below.

Type	Project Title	Recipient
SWC	Fellows/McDaniel/Fulbright Watershed Nutrient Reduction Project	The Greene County Soil and Water Conservation District
319	Little Sac Watershed Management Plan Project	Watershed Committee of the Ozarks
319	Springfield/Greene County Urban Watershed Stewardship Project	HUC # 10290106 and 11010002
319	Asher Creek 319 Project	HUC # 10290106
SWC	Little Sac Restoration and Improvement Project	Watershed Committee of the Ozarks

### Source Water Protection Projects & Grants

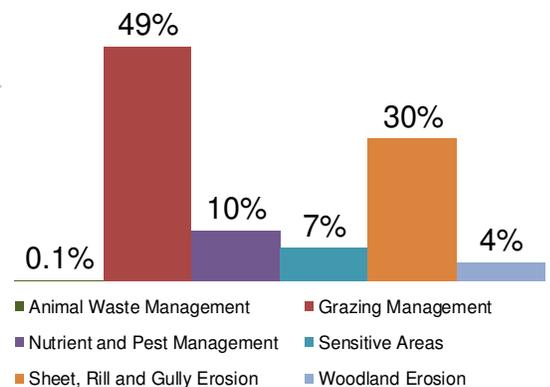
The program is designed to assist public water systems and the communities they serve with developing local voluntary source water protection plans to protect their source of drinking water from existing or additional contamination sources. Public water systems, in the watershed, that have participated in the source water protection program include: Willard (wells); Lamar (Lamar Lake and well); City of Springfield (Fellows, McDaniel and Stockton Lake, Fulbright Spring and wells), Barton, Dade, Cedar, and Jasper Counties Consolidated Public Water Supply District #1 (wells); Walnut Grove (wells). Lamar, Willard, Fair Play and Springfield have received source water protection/wellhead protection grants.

### Well Plugging Grants

Willard, MO has participated in the department's well plugging grant program and received two awards.

### Soil and Water Conservation Cost Share Programs

Soil and Water Conservation Districts set goals for each Resource Concern. Practices, specific to those areas, are funded and implemented to help districts meet their goals. These practices conserve soil, which consequently improves water quality by reducing sedimentation in our rivers and streams. The adjacent chart illustrates resource concerns addressed in the watershed, relative to its percentage of the total number of practices implemented from 2009 to 2014. No irrigation management practices were implemented during this time. Requests for FY15 show that grazing management and sheet, rill and gully practices are the most requested practices by conservation districts.



### LOCAL INVOLVEMENT AND OUR WATER:

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? During drought, how long will my family, school, cattle or crops have enough water?

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 and preserving local water supplies for generations to come.



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## Partners

### **Education and Outreach Partners include:**

National 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.mpu.org/Training.php>; [http://www.mpu.org/Untitled\\_Page\\_4.php](http://www.mpu.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 Partners include:**

National 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/>)

MDNR Groundwater Level Observation Well Network Page (<http://dnr.mo.gov/env/wrc/groundwater/gwnetwork.htm>)

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

MDNR Source Water Protection Program Page (<http://dnr.mo.gov/env/wpp/pdwb/swpp.htm>)

MDNR 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,

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))

